#### **5G is key to 6G – it’s an extension**

Akhtar et al 20 [([Muhammad Waseem Akhtar](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#auth-Muhammad_Waseem-Akhtar), School of Electrical Engineering and Computer Science (SEECS), National University of Sciences and Technology (NUST), Islamabad, Pakistan) “The shift to 6G communications: vision and requirements” Springer Open, December 21, 2020] MCM

Next-generation communication systems aim to achieve high spectral and energy efficiency, low latency, and massive connectivity because of extensive growth in the number of Internet-of-Things (IoT) devices. These IoT devices will realize advanced services such as smart traffic, environment monitoring, and control, virtual reality (VR)/virtual navigation, telemedicine, digital sensing, high definition (HD), and full HD video transmission in connected drones and robots. IoT devices are predicted to reach 25 billion by the year 2025 [[1](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR1)], and therefore, it is very challenging for the existing multiple access techniques to accommodate such a massive number of devices. Even fifth generation (5G) communication systems, which are being rolled out in the world at the moment, cannot support such a high number of IoT devices. Third generation partnership project (3GPP) is already working on the development of 5G standard and has identified massive machine type communication (mMTC), ultra-reliable and low latency communication (URLLC), and enhanced mobile broad band (eMBB) as three main use cases for 5G in its Release 13 (R13) [[2](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR2)].

At the same time, algorithms for the next generation communication systems, which will have the performance higher than that of existing 5G networks, are being developed [[3](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR3)]. A typical 5G communication system has the capability to support at most 50,000 IoTs and/or narrowband IoT (NB-IoT) devices per cell [[2](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR2)]. Specifically, a more robust network must be designed to realize the massive access in beyond 5G (B5G)/6G communication systems. We now discuss comprehensive literature that has appeared on various dimensions of 6G networks.

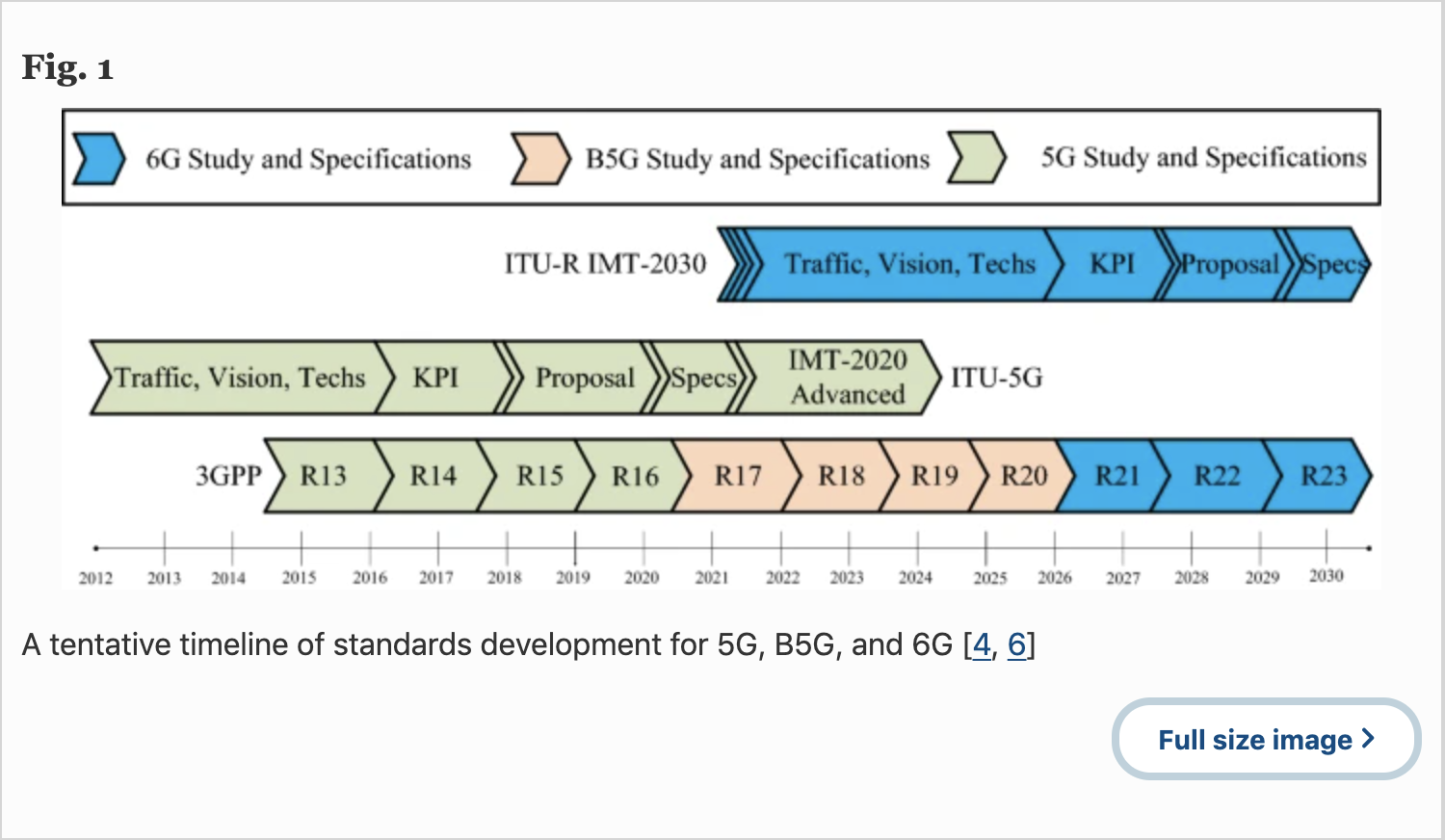
Vision and literature survey

Currently, there is little information about the standards of 6G. However, it is estimated that the international standardization bodies will sort out the standards for 6G by the year 2030 [[4](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR4)]. The work at some of the research centers has shown that 6G will be capable of transmitting a signal at a human computational capability by the year 2035 [[5](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR5)]. While the rollout of 5G is still underway, the researchers across the world have started working to bring a new generation of wireless networks. A tentative timeline for the implementation of 5G, B5G, and 6G standards by international standardisation bodies is shown in Fig. [1](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#Fig1) with respect to the vision of 6G wireless networks. International Telecommunication Union Radiocommunication sector  (ITU-R) issued the requirements of International Mobile Telecommunications-2020 (IMT-2020 Standard) in 2015 for the 5G network standards. At the same time, 3GPP issued R13 for 5G standards. It is predicted that ITU will complete the standardization of 6G (ITU-R IMT-2030) by the end of the year 2030, whereas 3GPP will finalize its standardization of 6G in R23 [[5](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR5)]. ITU has established a focus workgroup for exploring the system technologies for B5G/6G systems in July 2018 [[7](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR7)]. The Academy of Finland has founded, 6Genesis, a flagship program focusing on 6G technologies, in 2018 [[8](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR8)]. Similarly, China, the United States of America, South Korea, Japan, Russia have also started the research for B5G/6G communication technologies [[4](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR4), [5](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR5), [9](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR9),[10](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR10),[11](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR11)].

The vision of 5G technologies is extended for the 6G networks by speculating the visionary technologies for next-generation wireless systems in [[5](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR5)]. Different networking scenarios are presented in [[12](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR12),[13](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR13),[14](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR14),[15](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR15)]. The authors in [[12](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR12)] and [[13](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR13)] give a predictive technical framework for industries in future generations of communication systems mainly focusing on the specifications of future generations of the communication system. Cell-less architecture, decentralized networking, and resource allocation, and three-dimensional radio connectivity including the vertical direction are expected in next-generation communication systems. The evolution of wireless systems from 1G to 6G is outlined in [[14](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR14)]. The authors in [[15](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#ref-CR15)] presented the role of intelligent surfaces in the architecture of 6G networks.

#### **Here’s a timeline**

Akhtar et al 20 [([Muhammad Waseem Akhtar](https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2#auth-Muhammad_Waseem-Akhtar), School of Electrical Engineering and Computer Science (SEECS), National University of Sciences and Technology (NUST), Islamabad, Pakistan) “The shift to 6G communications: vision and requirements” Springer Open, December 21, 2020] MCM



## 1NC

#### Our interpretation is that the resolution should define the division of affirmative and negative ground and offense. It was *negotiated* and *announced in advance*, providing both sides with a reasonable opportunity to prepare to engage one another’s arguments.

#### ‘Resolved’ preceding a colon indicates a legislative forum.

Blanche Ellsworth 81, English professor at SFSU and M.A. in English from UC Berkeley, 1/1/1981, *English Simplified*, 4th Edition, cc

A colon is also used to separate 3. THE SALUTATION OF A BUSINESS LETTER FROM THE BODY, Dear Sir Dear Ms. Weiner NOTE: In an informal letter, a comma follows the salutation: Dear Mary, Dear Uncle Jack 4. PARTS OF TITLES, REFERENCES, AND NUMERALS. TITLE: Principles of Mathematics: An Introduction REFERENCE: Luke 3:4—13 NUMERALS: 8:15 PM 5. PLACE OF PUBLICATION FROM PUBLISHER Indianapolis: Bobbs-Merrill 6. THE WORD RESOLVED FROM THE STATEMENT OF THE RESOLUTION. Resolved: That this committee go on record as favoring new legislation.

#### Ought means should

Merriam Webster, No Date – Merriam Webster’s Learner’s Dictionary, “ought”, <http://www.learnersdictionary.com/definition/ought>  
ought /ˈɑːt/ verb  
Learner's definition of OUGHT [modal verb] 1 ◊ Ought is almost always followed by to and the infinitive form of a verb. The phrase ought to has the same meaning as should and is used in the same ways, but it is less common and somewhat more formal. The negative forms ought not and oughtn't are often used without a following to. — used to indicate what is expected They ought to be here by now. You ought to be able to read this book. There ought to be a gas station on the way. 2 — used to say or suggest what should be done You ought to get some rest. That leak ought to be fixed. You ought to do your homework.

#### Should requires legal effect

Summers 94 (Justice – Oklahoma Supreme Court, “Kelsey v. Dollarsaver Food Warehouse of Durant”, 1994 OK 123, 11-8, http://www.oscn.net/applications/oscn/DeliverDocument.asp?CiteID=20287#marker3fn13)

¶4 The legal question to be resolved by the court is whether the word "should"[13](http://www.oscn.net/applications/oscn/DeliverDocument.asp?CiteID=20287#marker3fn13) in the May 18 order connotes futurity or may be deemed a ruling *in praesenti*.[14](http://www.oscn.net/applications/oscn/DeliverDocument.asp?CiteID=20287#marker3fn14) The answer to this query is not to be divined from rules of grammar;[15](http://www.oscn.net/applications/oscn/DeliverDocument.asp?CiteID=20287#marker3fn15) it must be governed by the age-old practice culture of legal professionals and its immemorial language usage. To determine if the omission (from the critical May 18 entry) of the turgid phrase, "and the same hereby is", (1) makes it an in futuro ruling - i.e., an expression of what the judge will or would do at a later stage - or (2) constitutes an in in praesenti resolution of a disputed law issue, the trial judge's intent must be garnered from the four corners of the entire record. [CONTINUES – TO FOOTNOTE] [13](http://www.oscn.net/applications/oscn/DeliverDocument.asp?CiteID=20287#marker2fn13) "*Should*" not only is used as a "present indicative" synonymous with *ought* but also is the past tense of "shall" with various shades of meaning not always easy to analyze. See 57 C.J. Shall § 9, Judgments § 121 (1932). O. JESPERSEN, GROWTH AND STRUCTURE OF THE ENGLISH LANGUAGE (1984); St. Louis & S.F.R. Co. v. Brown, 45 Okl. 143, 144 P. 1075, 1080-81 (1914). For a more detailed explanation, see the Partridge quotation infra note 15. Certain contexts mandate a construction of the term "should" as more than merely indicating preference or desirability. Brown, supra at 1080-81 (jury instructions stating that jurors "should" reduce the amount of damages in proportion to the amount of contributory negligence of the plaintiff was held to imply an *obligation* *and to be more than advisory*); Carrigan v. California Horse Racing Board, 60 Wash. App. 79, [802 P.2d 813](http://www.oscn.net/applications/oscn/deliverdocument.asp?box1=802&box2=P.2D&box3=813) (1990) (one of the Rules of Appellate Procedure requiring that a party "should devote a section of the brief to the request for the fee or expenses" was interpreted to mean that a party is under an *obligation* to include the requested segment); State v. Rack, 318 S.W.2d 211, 215 (Mo. 1958) ("should" would mean the same as "shall" or "must" when used in an instruction to the jury which tells the triers they "should disregard false testimony"). [14](http://www.oscn.net/applications/oscn/DeliverDocument.asp?CiteID=20287#marker2fn14) *In praesenti* means literally "at the present time." BLACK'S LAW DICTIONARY 792 (6th Ed. 1990). In legal parlance the phrase denotes that which in law is *presently* or *immediately effective*, as opposed to something that *will* or *would* become effective *in the future [in futurol*]. See Van Wyck v. Knevals, [106 U.S. 360](http://www.oscn.net/applications/oscn/deliverdocument.asp?box1=106&box2=U.S.&box3=360), 365, 1 S.Ct. 336, 337, 27 L.Ed. 201 (1882).

#### Appropriation of outer space” by private entities refers to the exercise of exclusive control of space.

TIMOTHY JUSTIN TRAPP, JD Candidate @ UIUC Law, ’13, TAKING UP SPACE BY ANY OTHER MEANS: COMING TO TERMS WITH THE NONAPPROPRIATION ARTICLE OF THE OUTER SPACE TREATY UNIVERSITY OF ILLINOIS LAW REVIEW [Vol. 2013 No. 4]

The issues presented in relation to the nonappropriation article of the Outer Space Treaty should be clear.214 The ITU has, quite blatantly, created something akin to “property interests in outer space.”215 It allows nations to exclude others from their orbital slots, even when the nation is not currently using that slot.216 This is directly in line with at least one definition of outer-space appropriation.217 [\*\*Start Footnote 217\*\*Id. at 236 (“Appropriation of outer space, therefore, is ‘the exercise of exclusive control or exclusive use’ with a sense of permanence, which limits other nations’ access to it.”) (quoting Milton L. Smith, The Role of the ITU in the Development of Space Law, 17 ANNALS AIR & SPACE L. 157, 165 (1992)). \*\*End Footnote 217\*\*]The ITU even allows nations with unused slots to devise them to other entities, creating a market for the property rights set up by this regulation.218 In some aspects, this seems to effect exactly what those signatory nations of the Bogotá Declaration were trying to accomplish, albeit through different means.219

#### Outer Space is considered anything that sits above the Earth’s atmosphere

Betz 21 [(Eric Betz, Science & tech writer for @Discovermag, @Astronomymag and others), “The Kármán Line: Where does space begin?”, Astronomy, https://astronomy.com/news/2021/03/the-krmn-line-where-does-space-begin, March 5, 2021] SS

These days, spacecraft are venturing into the final frontier at a record pace. And a deluge of paying space tourists should soon follow. But to earn their astronaut wings, high-flying civilians will have to make it past the so-called Kármán line. This boundary sits some 62 miles (100 kilometers) above Earth's surface, and it's generally accepted as the place where Earth ends and outer space begins.

#### Private entities are non-governmental corporations

UpCounsel ND [(UpCounsel is an interactive online service that makes it faster and easier for businesses to find and hire legal help solely based on their preferences. “Private Entity: Everything You Need to Know”, UpCounsel, https://www.upcounsel.com/private-entity#importance-of-private-entities, No Date] SS

A private entity can be a partnership, corporation, individual, nonprofit organization, company, or any other organized group that is not government-affiliated. Indian tribes and foreign public entities are not considered private entities.

Unlike publicly traded companies, private companies do not have public stock offerings on Nasdaq, American Stock Exchange, or the New York Stock Exchange. Instead, they offer shares privately to interested investors, who may trade among themselves.

#### Unjust means unfair or characterized by injustice

Merriam Webster ND [(Merriam-Webster, Merriam-Webster, Inc. is an American company that publishes reference books and is especially known for its dictionaries.),“unjust”, https://www.merriam-webster.com/dictionary/unjust, No Date] SS

Definition of unjust

1: characterized by injustice : UNFAIR

#### Vote negative to preserve limits and equitable division of ground – the resolution is the most predictable stasis point for debates, anything outside of that ruins prep and clash by allowing the affirmative to pick any grounds for debate. That greenlights a race away from the core topic controversies that allow for robust contestation, which favors the aff by making neg ground inapplicable, susceptible to the perm, and concessionary. Two additional impacts:

#### Accessibility – Cutting negs to every possible aff wrecks small schools, which has a disparate impact on under-resourced and minority debaters. Counter-interpretations are arbitrary, unpredictable, and don’t solve the world of neg prep because there’s no grounding in the resolution

#### Link turns their education offense – getting to the third and fourth level of tactical engagement is only possible with refined and well-researched positions connected to the resolutional mechanism. Repeated debates over core issues incentivize innovative argument production and improved advocacy based on feedback and nuanced responses from opponents.

#### Prefer our impact: they’ve skewed the game which necessarily comes first because it makes evaluating the aff impossible. The role of individual debate rounds on broader subject formation is white noise – *can you remember what happened in doubles of the Loyola tournament your junior year?* – individual rounds don’t affect our subjectivity, so fairness is the only impact your ballot can resolve. You should presume all their truth claims false because they have not been properly tested

#### They can’t get offense: we don’t exclude them, only persuade you that our methodology is best. Every debate requires a winner and loser, so voting negative doesn’t reject them from debate, it just says they should make a better argument next time.

## Case

#### All of your authors believe in January 6th— means that your aff would justify the same thing.

#### Honeybees kill the environment— turns the bioD

Charles 18 [(Dan, NPR's food and agriculture correspondent.) “Honeybees Help Farmers, But They Don't Help The Environment,” NPR, 1/27/18. <https://www.npr.org/sections/thesalt/2018/01/27/581007165/honeybees-help-farmers-but-they-dont-help-the-environment>] RR

Honeybees are amazing and adorable, and they suffer when people spray pesticides or mow down wildflowers. We've heard plenty in recent years about collapsing bee colonies.

So Jonas Geldmann, at the University of Cambridge, says he understands how the honeybee became a symbol of environmental conservation.

But he still doesn't like it.

"Lots of conservation organizations are promoting local honey, and even promoting sponsorships of honeybees and that kind of stuff, and that increasingly annoyed me," he says.

It annoyed him because the honeybee is perhaps the one type of bee that we should worry about the least. Honeybee hives aren't natural, and they don't help the environment. In fact, they may harm it.

There are thousands of bee species. Almost all of them live in the wild, hiding away in the ground or in odd cavities, like hollow plant stems. They play a vital role in the ecosystem, pollinating flowering plants. Many are in peril; some species have disappeared.

Researcher Nigel Raine has a whole array of wild bees impaled on pins in his laboratory at the University of Guelph, in Canada. Many are tiny. Raine says that gardeners often assume they're flies. "If you sit down and say, 'No, that's a small, solitary bee; that's a metallic green one' — when you show them a metallic green bee in their yard, they say, 'Wow! That's amazing!' "

And then there's the honeybee: originally imported from Europe, raised and managed by beekeepers in order to make honey or to pollinate crops like almonds. It's an agricultural animal, in the same way that sheep and cattle are.

When flowers are abundant, there is plenty of pollen for both honeybees and their wild cousins. But in many landscapes, or when an orchard stops blooming, farmed honeybees can compete with wild bees for food, making it harder for wild species to survive.

Basically, a healthy environment needs bees — but not honeybees, Geldmann says. This week, he published a commentary in the journal Science trying to spread the word to a wider audience. "The way we're managing honeybees, in these hives, has nothing to do with nature conservation," he says.

Scientists who study bees already understand this. But they struggle with how to talk to the public about it.

"We're on a learning curve, all of us," says Marla Spivak, at the University of Minnesota, one of the country's most prominent bee researchers. "It's like honeybees were the portal — the door to much larger issues, conservation issues in general."

Concern for honeybees helped more people understand why it's important to have more land covered with wildflowers and trees — and free from pesticides, Spivak says. Such a landscape is good for both honeybees and wild bees.

#### 5G health concerns are wrong and anti-scientific—new studies prove

Lee et al 2021 (Paul Lee, Cornelia Calugar-Pop, Kevin Westcott, Craig Wigginton, Deloitte research analysts, December 2020, “5G is not hazardous to your health: Busting the radiation risk myth,” <https://www2.deloitte.com/global/en/insights/industry/technology/technology-media-and-telecom-predictions/2021/5g-radiation-dangers-health-concerns.html>)

Concerns about 5G’s health risks are widespread, but they have no basis in fact. If education about 5G is to be effective in curbing popular fears, it needs to be compelling, consistent, and pervasive, and it needs to begin now. As 5G becomes more widespread, some have sounded alarm bells about its supposed health hazards. Two main concerns have been voiced, both related to the radiation associated with the technology. The most common perception is that 5G causes cancer. The second fear is that 5G-emitted radiation weakens the immune system, enabling COVID-19 to spread. Both of these fears, in our view, are grossly overblown. We predict that in 2021, it is very unlikely that the radiation from 5G mobile networks and 5G phones will affect the health of any single individual, be it a 5G user, a user of any other generation of mobile phones, or any individual in the vicinity of a mobile network but not actually using a mobile device. There is no link between the growth in COVID-19 infections and the roll-out of 5G networks Unfortunately, while extensive scientific evidence proves that mobile phone technologies have no adverse health impacts—not just for 5G but also earlier generations—we also predict that between 10% and 20% adults in many advanced economies will mistakenly equate 5G with possible harm to their health. A Deloitte consumer poll in May 2020 found a fifth or more adults in six out of 14 countries surveyed agreed with the statement “I believe there are health risks associated with 5G” (figure 1). What has led to this high level of concern about 5G’s health impacts? It may have its roots in a simple confusion of terminology. Radiation is commonly assumed to involve radioactivity, but this is not necessarily the case. The confusion arises because the words “radiation” and “radioactivity” have been conflated, a confusion that has persisted since the dropping of the Hiroshima and Nagasaki nuclear bombs in 1945. As a result of these events, as well as incidents at several nuclear power plants in the 75 years since, the term “radiation” has often mistakenly become associated with destruction on a massive scale. In a similar vein, “radiation”—in reality, radioactivity—is also associated with cancer, reinforcing the word’s connotation of mortal peril. The point here is that radiation is not inherently radioactive. The literal definition of radiation is merely any process by which an object (from a human to a radiator to a star) emits energy (whether heat, light, or radioactive particles), which then travels through a medium (such as the air or hot water) and is absorbed by another object (a human body, a frying pan, a steam engine, or anything else). Radiation thus spans multiple everyday processes to which most people do not give a moment’s consideration. In our daily lives, most of us are regularly exposed to multiple types of radiation, most commonly in the form of sunlight. By this definition, 5G does generate radiation, but at very safe levels, and none of it is radioactive radiation. 5G base stations and phones, and the frequency ranges within which 5G operates, are very likely to be operating well within safe parameters in 2021 and throughout 5G’s lifetime, which may extend to two decades. Radiation within these parameters does not significantly raise the risk of cancer. It also does not weaken the immune system, and thus has not contributed to the spread of COVID-19.

#### **Chinese 5G dominance is inevitable, peaceful, and key to Smart Cities**

Xiang 9/8 [(Nina, Founder of China Money Network, a media platform tracking China's venture and tech sectors has been published in Forbes and wrote previously for Bloomberg BusinessWeek, Euromoney Institutional Investor, China Business Network, and China Radio International) “How China winning the race to install 5G will be good for the world,” Nikkei Asia, 09/08/2020]  
It seems nothing can stop China from winning the global race to install 5G telecommunications technology. Not government bans, nor the debilitating COVID-19 pandemic.

Despite these grave challenges, when it comes to 5G China is actually extending its lead while other countries are plagued by delays.

By the end of July, China's 5G users had already surpassed 88 million, accounting for over 80% of users worldwide -- far ahead of the previously projected 70% share for the whole of 2020. By the end of this year, the number of 5G base stations in China is expected to reach nearly one million, by far the biggest tally globally.

And despite the U.S. cutting off the supply of crucial mobile chips, China's Huawei Technologies remains the top filer of standard-essential 5G patents, with the telecommunications giant set to remain a top global supplier of 5G equipment.

Compare this to some regions in the U.K., where delays of up to three years are expected for the rollout of 5G technology after the government decided to strip Huawei from its networks. Or elsewhere in Europe, where COVID-19 is expected to slow the 5G rollout by up to 18 months. Even the U.S. looks certain to lag far behind China in the 5G race, despite the Trump Administration trying to speed things up last month by making a crucial new chunk of spectrum available to telecom carriers.

Yes, the 5G rivalry is threatening to further divide the world's digital universe by accelerating the U.S.-China decoupling in multiple dimensions and further disrupting global supply chains. But if we look beyond these geopolitical complications, and focus instead on the certainty that China's 5G leadership provides, then the current period can also be seen in a more constructive and beneficial light.

The world does not have to suffer or break apart just because China leads in next-generation wireless technology. In the area of consumer internet innovation, all China's 5G lead will do is strengthen its emerging role as an innovator, just as it did during the 4G mobile internet age when China began to introduce new ideas in particular areas ahead of others.

Bike-sharing and super apps are two examples. These unique innovations soon spread to other corners of the world, enabling California surfers to rent electric scooters with their phones, and allowing young professionals in Indonesia to hail a motorcycle taxi, and order and pay for a meal all on the same app.

What China's advanced schedule in 5G deployment means is that China's entrepreneurs will be able to experiment with user applications on scale first. It's not inconceivable that successful applications tested in China -- be it augmented reality or new gaming experiences -- will later be introduced to other countries.

It's often argued that 5G's industrial applications will bring revolutionary change, such as smart factories where 5G's super fast speed and low latency will enable more flexible, efficient, and intelligent manufacturing. But China, currently the world's factory with 28.4% of global manufacturing output -- far greater than the second-place U.S. on 16.6% -- was already well-positioned to benefit the most from such changes. And as the biggest exporter accounting for 13.45% of global trade, China can keep improving the quality of the products it exports to the benefit of the world's consumers.

Elsewhere, in areas including smart cities, health care, and autonomous driving cars, China can serve as the testing ground for trial and error. What works, what doesn't, and how 5G can best facilitate these long-term revolutions will only be answered through real-life experiments.

Imagine an accident involving an autonomous driving bus on a public road in China that warns the rest of the world that such mixed traffic situations are not the best approach for self-driving tech. The more lead time China has to test and answer these questions in scale, the more valuable the lessons will be to other countries.

Of course, China's leadership in 5G will not be only positive. How to ensure security, protect data privacy, and control risks will be pressing concerns that many international companies and legislators will need to urgently address.

Still, while the surveillance tech that forms a key part of any smart city project is clearly a thorny subject, the fear that Beijing can export authoritarianism around the world through the sale of surveillance tech is about as credible as the idea that the U.S. can export democracy by selling more Big Macs and getting more people to watch Hollywood films.

To be sure, there are troubling ethical questions around the use of surveillance tech. But the best solution is to have a global regulatory framework to address them, such as the EU's General Data Protection Regulation. But when it comes to seeing more technological innovations coming out of China, the rest of the world should relax. As the mobile internet era showed, China can innovate on its own without inflicting much harm.

The 5G age may see China becoming an even bigger driving force for innovation. Some of these inventions will raise difficult questions, but some will be as good for the public as those brought about by many of the things that came out of Silicon Valley. Having dual -- or even multiple -- engines of innovation is not a bad thing.

#### Smart Cities prevent extinction – overpopulation and resource depletion **RAM 20** [(Research and Markets, Leading market research firm providing more than 30,000 companies with market research information) “Smart Cities - Global Market Trajectory & Analytics,” Research and Markets, September 2020] Lavish lifestyles in the developed **Western economies are** resulting in these economies **consuming more than their fair share of Earth`s already constrained resources, while haphazard urbanization, ill-planned cities and overcrowding in developing economies are resulting in enormous wastages of precious natural resources. Unchecked urban sprawl is driving modern cities to their limits. Public infrastructure and resources ranging from food, energy, water, security, digital communication to transportation are being stretched to the breaking point. Inequitable distribution of resources is resulting in high cost of living, rising levels of pollution, cultural clashes, increased crime rates, and shortages in housing accommodations, among others.** Restrictions on personal freedom is another key fallout of population explosion i. e. limits on water consumption, limits on driving, and limits on travel. **Impact on the ecosystem includes species extinction, habitat destruction, and habitat fragmentation.** In short, **population explosion, a common thread cutting across countries and continents,** **is nibbling away at the planet.** As countries, governments, and communities scramble to support this increase in population, coming to fore is the concept of **Smart Cities enabled by intelligent information and communication technologies** (ICT) technologies. Cities are becoming smart not just through the automation of day-to-day functions but also through the manner in which these functions **can be monitored and analyzed for optimizing resource utilization, reducing costs, enhancing operational efficiency and improving quality of life. Key benefits of smart cities** driving government investments in smart city technologies **include** higher and more productive citizen engagement in civic activities; **better utilization of infrastructure; enhanced public safety; better communication and improved ability of cities to respond to natural and manmade calamities; unrivalled social, economic and environmental benefits and higher quality of life; massive reduction in energy and water consumption and wastages, among others.** Other major trends in the market include growing integration of artificial intelligence (AI) in **smart cities to provide actionable insights for policy makers to improve operational efficiencies, reduce resource consumption, monitor security risks and contain costs; undivided focus on demand response for its ability to enable closer consumer engagement in competitive city energy markets; and surging penetration of smart water meters and smart gas solutions against the backdrop of the expanding reach of smart utility services.** Asia-Pacific ranks including **China** is a major market, driven by the growing pressure to improve quality of life in emerging markets; **increased focus on Smart Cities in political agendas for the technology`s ability to provide fair human outcomes, and efforts of local governments to achieve international recognition for smart digitalization and sustainable economic development.**

#### 5G is not bad for bees—written by bee experts

McAfee 19 (Alison McAfee, bee expert, October 1, 2019, “Why We Shouldn’t Fear 5G,” *American Bee Journal*)

Adoption of 5G cell phone networks will lead to more cell towers, but there’s no good reason to expect it to harm honey bees. The next generation of cell phone connectivity — the 5G network — has been launched. Most countries are projected to adopt the technology by 2020, and we should expect download speeds ten to twenty times faster than 4G as well as higher network capacity (i.e., more devices can be used on a network simultaneously), feeding our existing data addictions. For some people, the 5G launch has also renewed old concerns that cell phone-generated electromagnetic waves could be interfering with honey bee navigation. It all started in 2006, when Dr. Jochen Kuhn, a professor at Landau University, Germany, and his colleagues released the seminal study (which, to the best of my knowledge, was never peer reviewed).1 The researchers placed DECT docking stations — digital enhanced cordless telecommunications stations, the kind used for cordless landline telephones — inside two mini-hives and powered them up. The two other hives did not get docking stations. They then trapped 25 bees at the entrance of each hive, released them 800 meters away, and recorded how many made their way home. They also measured comb areas in the hives, after giving the mini-colonies a chance to build up. The bees from docking-station-hives, as the old story goes, built less comb and were worse at finding their way home. The next generation of cell phone connectivity — the 5G network — has been launched. Most countries are projected to adopt the technology by 2020, and we should expect download speeds ten to twenty times faster than 4G as well as higher network capacity (i.e., more devices can be used on a network simultaneously), feeding our existing data addictions. For some people, the 5G launch has also renewed old concerns that cell phone-generated electromagnetic waves could be interfering with honey bee navigation. Data from two hives is obviously not enough to make any solid conclusions, no matter how well an experiment is designed. And well-designed, this wasn’t. The authors recognized this, writing that “because of the explorative character of [the] study we refrain from a differentiated statistical analysis.” In other words, the data were too sparse to apply standard statistical tests that all credible scientists use. And it didn’t even involve cell phones. Even in the absence of stats, there were numerous design flaws. The researchers didn’t know if the bees they trapped had completed orientation flights or if they were going outside for the first time. Nor did they test wayfinding ability before and after powering up the DECT stations, to get baseline wayfinding aptitudes for each hive. Nor did they use controls with DECT stations that simply weren’t powered up (of course finicky bees in mini-hives will build less comb if there’s a giant object sticking up from the bottom of their hive). Sometimes, the authors describe using eight hives, but data from only four are reported. The flaws are infuriating, especially considering the hype this “research” garnered in the media. In their defense, Kuhn and his colleagues were actually interested in using honey bees as a model to study effects of electromagnetic waves on humans, not honey bees (though this rationale is questionable, too). They never claimed to have found the cause of colony collapse disorder (CCD), a mysterious phenomenon which was hitting beekeepers hard at the time. As Kuhn told the New York Times,2 “We cannot explain the CCD-phenomenon itself and want to keep from speculation in this case. Our studies cannot indicate that electromagnetic radiation is a cause of CCD.” But in most cases, nobody listened. I can understand why the story was so compelling. Honey bee biology is so alien, the idea that electromagnetic waves could cause honey bees to get lost doesn’t seem that far fetched. After all, honey bees do have ferromagnetic crystals, or magnetite, in their abdomens, which act as magnetic field sensors.3,4 There is some evidence that workers use this information to help navigate Earth’s geomagnetic fields, kind of like migrating birds and fish, although the relative importance of these cues for wayfinding is probably lower than their sense of smell and orientation with the sun. And there is not a shred of scientific evidence to suggest that honey bees build comb in specific orientations relative to geomagnetic fields and “ley lines,” either, as some people have suggested on popular fora. But to add to the sci-fi, honey bees also have other magnetoreceptors called cryptochromes in their brains5 (although there is not yet any indication that they are actually useful). When it comes to honey bee biology, the line between fact and fiction can be so blurry that it’s hard to know when it’s been crossed.

#### **Waking Times is a conspiracy website**

MBFC 20 [“Waking Times” Media Bias/Fact Check, October 17, 2020] MCM

Overall, we rate Waking Times a Strong Conspiracy and Quackery level pseudoscience website. We also rate them Low for factual reporting based on poor sourcing and numerous examples of false information.

Detailed Report

Factual Reporting: LOW  
Country: USA  
World Press Freedom Rank: USA 45/180

History

Founded in 2011 by Dylan Charles and Anna Hunt, Waking Times is a left-leaning news and opinion website that focuses on “alternative and natural health, activism, elevating consciousness and living sustainably and with awareness.”

According to their about page Waking Times “is funded through advertising, affiliate marketing, and, on a smaller part, donations from our readers.” The owners are Dylan Charles and Anna Hunt through Waking Media, Inc.

Analysis / Bias

In reviewing the content of Waking Times I found several articles that would fall under both the Pseudoscience and Conspiracy categories. For example, in this anti-vaccination article, they use fear to persuade people not to vaccinate their children. The article attempts to convince people that more children are vaccine damaged in the USA than children in Syria have been damaged by chemical weapons. This article provides zero evidence to support that more children are injured by vaccines. There is not a single statistic from a reliable source to support this claim. They do, however, claim that the Syrian bombing by the USA was a False flag operation. In fact, the article cites Natural News as the primary source of information. Natural News is a well-known purveyor of pseudoscience, conspiracies, and fake news. Within this same article they cite a source called CDC.news, which is meant to look like an official CDC page, but in fact, is owned by Natural News for the purpose of discrediting the CDC. At least they put a disclaimer on the CDC.news page that it is not affiliated with the credible Centers for Disease Control.

In another article, they claim that Cannabis Oil cured a girl’s Leukemia, even though she had already undergone Chemotherapy. Again, there is zero evidence to prove it was the cannabis oil that cured her. It is simply unproven. Virtually all known conspiracies are covered by this site: Chemtrails, New World Order, False Flag, Aliens, etc. This source also promotes Pseudosciences such as miracle cures with natural products and anti-GMO propaganda. On the bright side, they do appear to support the scientific consensus that climate change is human-influenced. (2/3/2017) Updated (D. Van Zandt 8/15/2017)

Review 2: Anti-Vaccine:  Article about anti-expert.

http://www.wakingtimes.com/2017/08/09/not-trust-medical-experts/

The article makes claims that are backed up only by linking to clearly biased sites that are also anti-vaccine. Claiming to not ask experts and to instead do the research yourself is fine if you research things objectively, which the article fails to do. Objectivity is the ability to change your currently held belief that something is X when presented with evidence that it is not.

“Vaccines, historically, were NEVER crucial in protecting ANY form of society, “developed” or otherwise.”  Taken directly from the article, this references nothing to back this claim up and then moves on to keep citing the same clearly biased site.  There’s ample historical evidence that Vaccines helped save people from several major diseases and are easily verifiable by reading any number of scientific and historical works online.  Polio is probably the biggest one followed by Measles and Small Pox.

#### No extinction from bees

Palmer 15

(Citing study conducted by the Department Head Chair of Nature Conservation and Landscape Ecology  
Brian, "Would a World Without Bees Be a World Without Us?" May 18, https://www.nrdc.org/onearth/would-world-without-bees-be-world-without-us)

The most thorough and informative study came back in 2007, when an international team of agricultural scholars reviewed the importance of animal pollinators, including bees, to farming. Their results could encourage both the alarmists and the minimizers in the world of bee observation. The group found that 87 crops worldwide employ animal pollinators, compared to only 28 that can survive without such assistance. Since honeybees are by consensus the most important animal pollinators, those are scary numbers. Look at the data differently, though, and it's clear why the misattributed Einstein quote is a bit of an exaggeration. Approximately 60 percent of the total volume of food grown worldwide does not require animal pollination. Many staple foods, such as wheat, rice, and corn, are among those 28 crops that require no help from bees. They either self-pollinate or get help from the wind. Those foods make up a tremendous proportion of human calorie intake worldwide. Even among the 87 crops that use animal pollinators, there are varying degrees of how much the plants need them. Only 13 absolutely require animal pollination, while 30 more are “highly dependent” on it. Production of the remaining crops would likely continue without bees with only slightly lower yields. So if honeybees did disappear for good, humans would probably not go extinct (at least not solely for that reason). But our diets would still suffer tremendously. The variety of foods available would diminish, and the cost of certain products would surge. The California Almond Board, for example, has been campaigning to save bees for years. Without bees and their ilk, the group says, almonds “simply wouldn’t exist.” We’d still have coffee without bees, but it would become expensive and rare. The coffee flower is only open for pollination for three or four days. If no insect happens by in that short window, the plant won’t be pollinated. There are plenty of other examples: apples, avocados, onions, and several types of berries rely heavily on bees for pollination. The disappearance of honeybees, or even a substantial drop in their population, would make those foods scarce. Humanity would survive—but our dinners would get a lot less interesting.

#### No extinction – robot pollinators solve – prefer our ev. on recency because it takes into account current technologies.

Shivali Best, 2-9-20**17**, "Insect-sized drones can artificially pollinate plants," Mail Online, http://www.dailymail.co.uk/sciencetech/article-4208624/Insect-sized-drones-artificially-pollinate-plants.html

**As bee number dwindle, researchers have come up with a solution to help the remaining insects do their job. A tiny insect-sized drone has been designed which can artificially pollinate plants.** Far from replacing bees, the researchers hope that the drones could help carry the burden that modern agriculture has placed on bees, and in turn benefit farmers. **The tiny insect-sized drone can fly between flowers and plants, picking up pollen on its underside and distributing it, just as bees would do** HOW DO THE DRONES WORK? **The underside of the drone is coated with a cgel that is just sticky enough to pick up pollen.** The researchers decide to house the gel on a small four-propeller drone, but found that simply placing the gel on the smooth surface wasn't enough for it to pick up pollen. Instead, they found that using horse hair to mimic the fuzzy exterior of the bee, created a higher surface area for pollen to stick to. The undersides of these artificial pollinators are coated with horse hairs and a gel that is just sticky enough to pick up pollen from one flower and deposit it onto another. Researchers from the National Institute of Advanced Industrial Science and Technology in Tokyo created the gel by accident, when working to make liquids that could be used as electrical conductors. One of the attempts generated a gel as sticky as hair wax, which the researchers considered a failure. But **after a decade of sitting in a storage cabinet in an uncapped bottle, it was rediscovered unchanged during a lab cleanup.** Dr Eijiro Miyako, a senior author of the study, said: 'This project is the result of serendipity. 'We were surprised that after eight years, the ionic gel didn't degrade and was still so viscous. 'Conventional gels are mainly made of water and can't be used for a long time, so we decided to use this material for research.' **To find out if the gel could grasp onto pollen, the researchers covered ants in the gel, and left them to roam around a box of tulips. Compared with ants that didn't have the material applied, the ants with the gel were more likely to have pollen attached to their bodies. In separate experiments using houseflies, the gel was also found to have a camouflage effect - changing color in response to different sources of light - which could help artificial pollinators avoid predators.** Last month, the rusty patched bumblebee became the first bee species in the continental US to be declared endangered after suffering a dramatic population decline over the past 20 years. The US Fish and Wildlife Service added the bee to the endangered list, and are developing a recovery plan encouraging people to provide more habitat and reduce pesticide usage. Many of the steps needed to rescue the rusty patched bumblebee might also help other struggling bees and monarch butterflies, which pollinate a wide variety of plants, including cultivated fruits and vegetables, officials said. The researchers decided to house the gel on a small four-propeller drone, but found that simply placing it on the smooth surface wasn't enough for it to pick up pollen. Instead, they found that using horse hair to mimic the fuzzy exterior of the bee, created a higher surface area for pollen to stick to. In their study, the researchers flew the remote-controlled drones over Japanese lilies, and found that the drones could absorb pollen on one petal, and then deliver it to a second. This artificially pollinated the plants and caused them to begin the process of producing seeds. Dr Miyako said: **'The findings, which will have applications for agriculture and robotics, among others, could lead to the development of artificial pollinators and help counter the problems caused by declining honeybee populations. 'We believe that robotic pollinators could be trained to learn pollination paths using global positioning systems and artificial intelligence.'**

#### Here’s more ev. on robot bees.

Crystal **Ponti**, 3-5-20**17**, "Rise Of The Robot Bees: Tiny Drones Turned Into Artificial Pollinators," Houston Public Media, https://www.houstonpublicmedia.org/articles/news/2017/03/05/190398/rise-of-the-robot-bees-tiny-drones-turned-into-artificial-pollinators/

**Bee deaths have been on the rise, with losses outpacing colonies’ ability to regenerate. Last year, the U.S. lost 44 percent of all honeybee colonies** — a species essential to commercial pollination in this country. Other species of bees have neared mass extinction, including the rusty patch bumble bee and seven species of Hawaiian yellow-faced bees. A world without bees may seem far-fetched, but **experts are looking for ways to help plants survive without them**. Eijiro Miyako, **a researcher at Japan’s National Institute of Advanced Industrial Science and Technology, has designed** what he believes could one day be **a** partial **solution: an insect-sized drone capable of artificial pollination.** Coated with a patch of horse hair bristles and an ionic liquid gel, these pint-sized robots can collect and transfer pollen from one plant to another. The project stems from a serendipitous moment. Miyako had previously experimented with using the specialized gel for electrochemical applications. When the gel performed poorly, he tucked the bottles away in a drawer and forgot about them — until he moved out of his lab two years ago. As soon as he rediscovered the gel, he thought about the pollination crisis and honeybee decline. Conventional gels, Miyako explains, are mainly made of water and lose their stickiness over time. But **his ionic liquid gel, by contrast, is a substance with a long-lasting “lift-and-stick-again” adhesive quality – ideal for moving pollen from one plant to the next. “The continued adhesiveness and non-volatility of the ionic liquid gel was exciting,” says Miyako. The team** first **tested the biocompatibility and eco-friendliness of the gel against ants (which are also pollinators)** and cells from mice, **and found** that it had **no harmful effects** after three days. And when a drop landed on the floor and attached to an ordinary piece of dust, he was sold. **Miyako performed additional tests on living samples**. In one experiment, he placed ants in a box of tulips. One subset of the insects had the gel applied to their backs, while the others remained untouched. **Those with the sticky residue collected pollen from the flowers.** **Another experiment**, involving houseflies (Musca domestica), **showed** that **the gel had a camouflage effect, changing color with different sources of light, which could help the pollinators avoid predators.** (Yep, houseflies are pollinators, too.) With the live-model tests deemed a success, Miyako turned his attention to drones. He settled on a bee-sized, four-propeller drone, commercially available for around $100 each. He and his colleagues found that the gel alone was not enough to hold the pollen, so they added horse hair to mimic the fuzzy exterior of bees and provide an electric charge to keep the grains attached. Using fluorescent microscopy, the team observed pollen glowing in test tubes – offering strong proof that fertilization was successful. Although **artificial pollination is already possible**, it’s a tedious, time-consuming process. When done by hand, using a brush to apply the pollen, a person can pollinate five to 10 trees a day, depending on the size of the trees. Tackling thousands of trees takes major manpower and a hefty budget.

#### South Korea is looking into 6G programs now but continued private sector investment is key.

Fletcher 7/1 [(Bevin, editor of FierceWireless. She previously served as senior reporter for Wireless Week and CED Magazine, covering the wireless industry on a variety of topics including regulation, technology, and business. She has also worked as a journalist at biotech and finance trade publications. Bevin has a bachelor's degree in journalism from West Virginia University.) “South Korea kickstarts 6G plans,” Fierce Wireless, 7/1/21. <https://www.fiercewireless.com/tech/south-korea-kickstarts-6g-plans>] RR

South Korea’s Ministry of Science and ICT this week established a 6G R&D implementation plan that calls for investing around $194 million by 2025 in six focus areas.

The plan targets government investment totaling KRW 17.9 billion ($15.78 million) in 2021 across 10 strategic technologies, including Low Earth Orbit (LEO) satellites, with KRW 220 billion within four years.

The technologies correlate with the focus areas, including performance, Terahertz bands, space communications, ultra-precision; artificial intelligence; and reliability.

Specifically MSIT outlined strategic technologies that include Tbps-capable wireless and optical communication for maximum 1 Tbps speeds; Terahertz RF components and spectrum model for bands between 100-300 GHz; space mobile and satellite communications to help expand support altitude to 10 km above ground; end-to-end ultra-precision networking for 1/10 latency compared to 5G; intelligent wireless access and network with a focus on applying AI to all sections of the network; and technology for constant network quality monitoring for 5G focused on embedded security.

This year the focus is on laying the groundwork for technologies and identifying technical requirements for key areas of the 6G network. The government is also establishing 6G research centers at three universities in 2021, including KAIST, Sungkyunkwan University and Korea University.

South Korea is also targeting leadership in international standards and patents, with an emphasis on active public-private cooperation in the early stages of 6G.

“As next-generation communications network lays foundation for digital innovation, the public and private sector should work together to take challenges in leading global market in 6G era based on our experiences and knowhow in network,” said Minister Lim Hyesook of Science and ICT. “Furthermore, as both countries have solid foundation for collaboration thanks to Korea-U.S. Summit, we will work together in the early stage of 6G deployment based on such cooperation. We will continue to closely cooperate with relevant ministries, large companies and small and medium-sized enterprises to secure competitiveness in the future and further strengthen Korea’s position as a digital powerhouse.”

In May U.S. and South Korea agreed to encourage joint R&D on emerging technology including 6G.

South Korea and the U.S. signed a Memorandum of Understanding (MoU) through the National Science Foundation (NSF) and the South Korean Institute of Information & Communications Technology Planning & Evaluation (IITP) for collaborative research opportunities, including 6G.

South Korea plans to promote joint studies on core 6G technologies and spectrum, including 11 studies with the U.S., one study with China and two studies with Finland. The country’s 5G Forum will sign MoUs for 6G collaboration with organizations in the private sector, like the Next G Alliance in the U.S.

While 5G deployments are still largely in early phases, industry and governments are turning an eye toward 6G. Europe started a flagship program called Hexa-X, targeting 6G leadership. Groups like ATIS’ Next G Alliance in North America are looking to form next steps and roadmaps for 6G. China has indicated the start of 6G efforts as well.

The U.S. and U.K. earlier this month announced plans to create a detailed science and technology partnership agreement, including collaboration on 6G.

Executives from Qualcomm and Ericsson testified on Wednesday before the U.S. House Committee on Energy and Commerce Subcommittee on Communications and Technology for a legislative hearing focused on securing U.S. wireless networks and supply chain.

Qualcomm SVP of Spectrum Strategy & Tech Policy Dean Brenner said at the hearing that 5G still has a long runway, but the company has started early work on 6G. He emphasized that there won’t be 6G without spectrum, allocated by the FCC, and that spectrum and technology interactions need to take place at a very early stage.

Jason Boswell, head of security and network product solutions for Ericsson North America, said before the subcommittee that if they had not already started on the race to 6G, “we would already be behind.”

In addition to the vendor’s own R&D, he noted it’s important to show collaborations including public-private partnerships. Boswell cited involvement with the NSF RINGS (Resilient & Intelligent NextG Systems) program, noting a focus on potentially significantly impactful technologies such as artificial intelligence, quantum computing, kilohertz spectrum. There will be many different things needed to take advantage of 6G – “not just make it go faster,” he added.

#### A strong South Korean space sector is key to launching 6G networks.

Clarke 10/24 [(Carrington, he ABC's Seoul Correspondent, covering East Asia for the network. He works across digital, television and radio) “Asia is in the midst of a space race, but it's not just about exploration. It's also a military flex,” ABC Net News, 10/24/21. <https://www.abc.net.au/news/carrington-clarke/8042208>] RR

South Korea may not yet have its own dedicated 'Space Force' like the US, but it has made clear that space is crucial to its defence.

However, there are also legitimate civilian and scientific motivations for its ambitions for a space industry.

South Korea's capacity to launch its own rockets is a critical step for reaching goals like a national 6G cellular network and a sovereign radio navigation system like the American GPS.

Lee Hyung-mok, who is a professor emeritus in physics and astronomy at Korea National University, said he and his fellow scientists were excited about the opportunity to use these rockets.

He said they will help transport observation equipment outside the earth's atmosphere, allowing them to better understand our universe.

#### South Korea is a global leader in 6G development— encourages other countries to adopt 6G networks.

Castro 20 [(Caio, Journalist since eight years old, when I would read the newspaper out loud and pretend it was a radio show. Based in São Paulo, I have worked for Brazilian websites as reporter and editor before joining 6GWorld) “Korea lays out plan to become the first country to launch 6G,” 6G World, 11/5/20. <https://www.6gworld.com/exclusives/korea-lays-out-plan-to-become-the-first-country-to-launch-6g/>] RR

Pushing for 6G at the United Nations

Patents and standardization are two other areas where Korea wants to become a leader. And the push for that has already begun.

On September 24 2020, Korea’s delegation at the International Telecommunication Union (ITU) – the UN body responsible, among others, for global communications standards – filed a proposal for ITU members to start developing a 6G vision.

This is part of an articulated attempt to put Korea at the centre of discussions on the next generation of networks before other well-established countries do the same.

According to the MSIT’s strategy, the effort comes as a “pre-emptive response to global hegemony battle,” and the two core actions in this field are “applying to 3GPP, ITU Standards of 6G core technology.”

Still, the plan also envisions mutual collaboration with other nations regarding research and training specialized workforce.

Setting the environment

Besides establishing the R&D committee, the provisional strategy also has an eye on network development’s educational aspect.

The idea includes building four Network Research Centres by 2022, plus an investment in a platform for knowledge exchange, featuring Massive Open Online Courses about 6G technology evolution and “real-time sharing of best ideas.”

Another effort planned by the MSIT regards how to combine the private sector and academia. The plan states that universities could support companies’ R&D while they act on retraining the workforce. On the other hand, it would be the industry’s role to ” support field training of university students and [offer] student mentoring.”

The document to which 6GWorld has had access envisions 6G commercialization starting in 2028. In August, the Korean government published a provisional timetable including details for each phase of the process:

#### 6G is key to cyber security – turns scenario 1

Ziegler et al. 10/14 [(Volker, (Senior Member, IEEE) received the Dipl.-Ing. (M.Sc.) and Dr.-Ing. (Ph.D.) degrees from the Department of Electrical Engineering, Universität (TH) Karlsruhe, Germany.) “Security and trust in the 6G era,” Nokia Bell Labs, 10/14/21. Graphs/Figures Omitted <https://d1p0gxnqcu0lvz.cloudfront.net/documents/Nokia_Security_and_trust_in_the_6G_era_White_Paper_EN.pdf>] RR

In our 6G security vision, we cluster security technology enablers into domains of cyber-resilience, privacy and trust, and their respective intersection as shown in Figure 3. Our approach emphasizes the need to extend cyber-resilience technologies by privacy-preserving technologies and on top of that, trust-creating technologies in order to achieve the ultimate goal of trustworthy 6G networks. We consider resilience against all kinds of cyber-attacks as the core element and indispensable foundation — a network that lacks these attributes of cyber-resilience will not be able to protect privacy and enable trust. While cyberresilience protects privacy against external attacks, end users may in addition want to reduce the amount of sensitive information that is revealed internally, i.e., to the multiple stakeholders involved in providing the communication services. Enabling technologies are needed beyond those in the area of cyberresilience. By adding specific technologies focusing on creating trust, we complete the overall picture of a resilient, privacy-preserving and trustworthy 6G network. In this paper, we have decomposed technology enablers into the following categories: pervasive AI/ML, automated SW creation, automated closed loop security operation, privacy preserving technologies, HW and cloud embedded anchors of trust, quantum safe mechanisms, physical layer security and distributed ledger.

Successful standardization has been the cornerstone of a unified technology landscape that has enabled the proliferation of the mobile communication generations to date. The ecosystem of standardization organizations that has been involved in the architecture and specification of 4G and 5G systems has its sights firmly set on the 6G future as well. Timing is of the essence for creating the optimal impact of standardization. Most SDOs start with studies on technology enablers first before moving into a normative phase of specification. While we expect normative 6G standardization work to start no earlier than 2024/25, we see the precursors of related studies in several technology fields, which we reference in the following.

Pervasive use of AI/ML can be considered a mega-trend of security relevance and driving force to help define the next generation of the Telecom Operation Map (eTOM) [20] and business process framework. In the section below on automated security operations, AI/ML is identified as one of the key drivers for a comprehensive vision of a Secure Telecom Operation Map (SecTOM) for the 6G era. AI/ML will enable and transform automation and analytics for e2e delivery of services to customers as well as for processes to design, create, deliver and support the entire software lifecycle. AI/ML-enabled 6G must include an AI/ ML-enabled 6G security architecture in both SW creation and network operations. Notwithstanding, the complexity and the challenge of continuous adaption requires practical implementations of such a concept, without detailed continuous logging and synchronization across the stacks and processes, but rather, based on smart and representative thread sampling. Mitigation of adversarial attacks will need dedicated research as part of a comprehensive “AIOps” paradigm (cf. “Automated security operations” below), which will include adversarial training to improve robustness, continual adaption of the algorithms that an ML model uses to classify data, and omni-present checks for consistency and integrity of the ML models.

In short, AI/ML will be used pervasively across 6G security architecture, process and technology domains. As discussed in Section III, along with its benefits, there will be new and emerging threats rooted in AI/ ML. ETSI Industry Specification Group (ISG) Securing Artificial Intelligence (SAI) is already working on these aspects and this domain will gain more significance with the proliferation of AI/ML use towards 6G.

With AI/ML-supported, automated SW creation and secure network operations, 6G will address two of the major root causes of unsatisfactory security in today’s information and communication technology systems: vulnerable software and unsecure operational practices. Beyond this, 6G cyber-resilience clearly requires quantum-safe cryptography, considering the progress in the area of quantum computing. Physical layer security, i.e., exploiting the 6G radio technology not only for higher data rates and lower latency, but also for improved security, complements the set of cyber-resilience enablers we consider most relevant for the 6G area. Clearly, on the way towards 6G, these technology enablers will need to be broken down into more granular security mechanisms and further refined and optimized. They will also be part of the expected 5G security evolution, as described in Section II. New requirements coming up in the future as well as yet unknown technologies may also call for enhancing this initial set of cyber-resilience technology enablers.

Building on cyber-resilience, it is commonly agreed that privacy-preserving technologies need to be enhanced in 6G.

In our high-level view, we group all these into a single technology enabler, but we discuss the relevant technologies one-by-one in the following section below on privacy-preserving technologies. To complete the picture, two technologies aiming at enhancing trust are essential for trustworthy 6G networks: First, HW trust anchors that are resistant against tampering via software, with the challenge to apply them in a highly dynamic cloud environment, where workloads are no longer tightly coupled to specific hardware platforms.