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BIMUN

2020 北京国际模拟联合国大会

Beijing International Model United Nations 2020

Background Guide

International Telecommunication Union

Topic A: From Digital Divide to Digital Opportunities
Topic B: 5G Technology in Building Smart Sustainable Cities

青年使命 和合共生 | Harmony and Coexistence Mission of the Youth

Content

Welcome Letter

Dear Delegates,

Welcome to the International Telecommunication Union (ITU) of Beijing International Model United Nations 2020. The Directors of ITU would like to express our sincerest welcome to all the delegates for your participation.

Information technology is reshaping our world. 5G technology, as the new tide of the revolution, has been given high expectations. Today, about half of the total population is connected to the internet, meaning that there still are about 3.5 billion people who have no clue of the internet. In the process of telecommunication development, many countries have encountered insurmountable problems caused by the unbalanced development of information technology. How to create a better environment and conditions for the inclusiveness and sustainable development has become particularly urgent and important while the digital divide continues to widen. However, the divide can be narrowed or even eliminated if people can grab the digital opportunities brought by information technology. With the 5G networks coming to transform our lives, the “Internet of Things" will provide better health care, network service, vastly more efficient manufacturing with an array of innovative solutions to power our modern economy. Most importantly, 5G technology is bounded to reshape the future landscape of our cities. As the process of urbanization continues, the 5G technology will surely have its place in constructing sustainable smart cities.

Here, as a participant of Model United Nations Conferences, you may make a change with your passion and commitment. Don't be afraid if you are a novice. Do what you can, with what you have, where you are, and in a gentle way, you can shake the world.

The Background Guide, aiming at offering guidance, only provides a limited amount of information about the topic. As regards your own research about the country's status quo and stands, as well as the current situation and possible solutions are necessary and important.

We are looking forward to your performance!

Best Regards,

Directors of the International Telecommunication Union

Beijing International Model United Nations 2020

Introduction to the Committee

Founded in 1865, the International Telecommunication Union (ITU) is a specialized agency aiming to connect people around the world, establish global standards, and bridge the digital divide. It has 193 member states, working closely with around 900 companies, universities, and international or regional organizations.

There are four major sectors in ITU: ITU Development Sector (ITU-D), ITU Radiocommunication Sector (ITU-R), ITU Standardization Sector (ITU-T), and General Secretariat. The General Secretariat of ITU works to support and coordinate ITU activities. ITU-R coordinates the radio-frequency spectrum and assigns orbital slots for satellites. For this topic, ITU-R is mainly responsible for coordinating the international harmonization of additional spectrum for 5G mobile systems development. ITU's Standardization Sector, as its name suggests, basically works for establishing global standards concerning telecommunication, and is playing an essential part in producing the standards for the technologies and architectures of the wireline elements of 5G systems. The major mission for ITU-D is to bridge the digital gap between member states and within them, with the focus of development.

With the vision and mission of growth, inclusiveness, sustainability, innovation, and partnership, more people will be connected, and more countries will be involved in ICTs. ITU acts importantly to enable mobile service delivery and information exchange around the globe. It also helps closing the gaps caused by an increasing digital divide. At the same time, it welcomes innovation and cooperation to make more social changes.

ITU has highlighted 5G and Artificial Intelligence as fields of innovation necessity for smarter societies. In order to provide 5G a better platform to play its role, ITU is developing “IMT for 2020 and beyond” to set the stage for 5G research activities around the world. In the process of commercializing 5G, IMT-2020 plays a key role in defining the framework and overall objectives of the 5G standardization process and setting out the roadmap to guide this process by 2020.

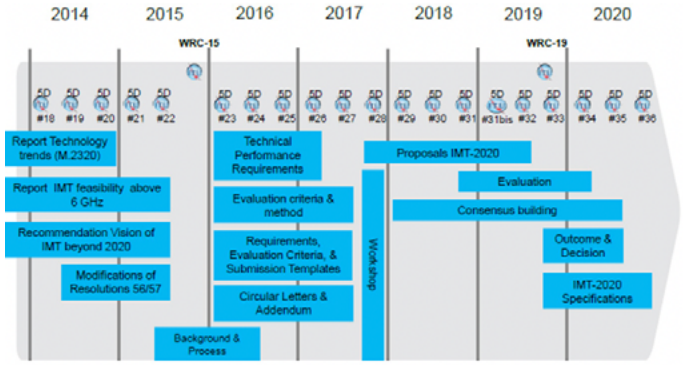

Figure 1: Detailed timeline and process for ITU-R IMT-2020 (ITU, Setting the Scene for 5G: Opportunities & Challenges 2018)

Key Terms

Digital Divide

The digital divide refers to the development gulf between demographics that have access to contemporary information technology and those who don't possess the access or only have restricted access. The digital divide exists not only between the developed countries and developing countries but also exists within society. Men, urban residents, and young people are more likely to be online than women, rural dwellers, and older people. (ITU 2019) The divides are generated most because of unbalanced development and insufficient connectivity. The problem is, therefore, heavily related to gender, age, culture, and other social or economic factors.

Fifth-Generation Mobile Communication Technology (5G)

Fifth-Generation Mobile Communication Technology (5G) is the latest generation of the mobile communication system being defined by the ITU. 5G is also called IMT-2020, the International Mobile Telecommunication 2020 standards. It is not an independent system but a converged network that completes further development based on the present mobile communication technology. Compared with the previous generations, 5G has outstanding advantages in its upgraded speed, high spectral efficiency, and broad bandwidth. It promises to improve the end-user experience by offering new applications and services with AI utilizing data, managing network resources, and providing intelligence.

Frequency Spectrum

The frequency spectrum is a scientific method of categorizing different electromagnetic waves. It possesses a similar function with the color spectrum, which classifies different colors of light. For telecom communication, it is all about choosing the right range of electromagnetic wave in the frequency spectrum. 4G technology uses 3GHz-6GHz as its frequency band. (Electronic Notes 2015) After years of development, this band is crowded with all kinds of terminals that are using 4G technology. Currently, the most promising frequency bands for 5G are Millimeter-wave and sub-6GHZ (also known as the 5G Wide and 5G Fast). The Chosen frequency bands vary between counties. In China, there are ongoing trials in the 3300 - 3600 MHz band with the possibility of the 4400 – 4500 MHz band and 4800 – 4990 MHz band also being used. At higher frequencies, China is considering using the 24.25 – 27.5 GHz band and the 37 – 43.5 GHz band. However, in

order to avoid using the same frequency band and the direct technological confrontation with Chinese companies, the United States is testing all frequency bands from the lower to the higher frequencies.

Smart Sustainable City (SSC)

A smart sustainable city is an innovative city which adopts information and communication technologies (ICTs) and other approaches to improve the quality of life, efficiency of city services and industrial operations while ensuring that the current development won't stand against the future generations with respect to economic, social, environmental as well as cultural aspects. (ITU 2019) The smart infrastructure of the city (the details of which are presented in Figure2) is considered as the nervous system of the smart sustainable city. Meanwhile, ITU plays a vital role in the implementation of the smart sustainable city. ITU is expected to provide a consolidated platform for global leaders to discuss policies and share experiences. The lack of global standards in carrying out plans of smart sustainable city remains one significant challenge.

Figure 2: The physical infrastructure components of a city (Úbeda 2018)

TOPIC A from Digital Divide to Digital Opportunities

Current Situation

I. Overview of the Topic

The rapid development of contemporary information technology has made the new type of imbalance, the international digital divide, which is a new problem in global governance. In recent years, discussions on the digital divide have received wide attention. Digital divide has become a major issue restricting global development and stability. In November 2001, former Secretary-General Kofi Annan announced the establishment of the United Nations ICT Task Force to bridge the digital divide. In June 2002, the 56th UN General Assembly held a special meeting to discuss the issue of bridging the digital divide. The World Summit was specifically convened in 2003, and further calls for practical actions to eliminate the digital divide. It's generally believed that narrowing the digital divide is an important step to achieve sustainable development goals. (Ying 2004)

Currently, digital divide has become an urgent issue. At the international level, it can be said that the users of digital information technology are mainly citizens of "rich countries" to a large extent. Many countries with low levels of economic development have become countries with "digital poverty," even "digital extreme poverty" in this digital information technology revolution. Lack of computers, shortage of telephones, low network transmission capacity, incomplete telecommunications infrastructure, the cost of new software, and Internet services are all obstacles to the development and use of digital information technology in developing countries. The emergence and intensification of the digital divide have become a major problem hindering world economic development and social stability.

Moreover, digital divide is not an issue only between countries but a problem existing at all levels, including social stratum, gender, and different cultures. Most scholars believe that the digital divide is the result of multiple factors, including gaps in information resources and information technology skills, differences in the level of economic development, relevant government policies, and social culture. Among them, the gap in information resources and skills in using information technology are the direct reasons for the formation of the regional digital divide. And the gap in the level of economic development, the differences in relevant government policies and social culture are the indirect reasons for the formation of the digital divide. (Xue and Liu 2011) These three

reasons will not directly lead to the regional digital divide, but indirectly lead to it through direct reasons. People have been managing to solve this problem since the proposal of digital divide, but there is still a long way to go.

II. Different Types of Digital Divide

Digital Divide Between Countries

The vast number of developing countries, especially in Africa, are facing the predicament of being marginalized by the information technology revolution. According to Facts and Figures published by ITU in 2019, in developed countries, most people are online, with close to 87 % of individuals using the Internet, compared with 19% in the least developing countries (LDCs). In addition, Europe becomes the region with the highest internet usage rates of 82.5%, while only 28.2% of people in Africa have access to the internet. (Measuring digital development Facts and figures 2019 2019) It can be seen that there is a huge gap in the use of the Internet between developed and developing countries.

However, judging from the current status of development, the level of ICT penetration in developed and developing markets is rising rapidly in the past decade. Further, the spread of ICT in developing countries and economically backward regions is even faster than that in developed and economically developed regions by a small margin, but the absolute gap in levels remains huge.

Digital Divide Between the Haves and Have-nots

In a period when almost everyone seems to have access to the internet, there are still a few demographic groups likely to be stuck in the digital dark ages. Minorities, low-income families, and residents of rural areas are among those who are historically lagged behind in the use of the internet. Compared with cities, the level of digitalization of rural information infrastructure and public services is far behind. In addition, there is a large gap with cities in terms of information consumption, information technology use, and information awareness and ability. Rural residents have weak Internet awareness. In contrast, they are more inclined to solve the problem of food and clothing.

Apart from these people, older adults are also among the have-nots. It's not surprising that young people know more about technology than elders. In the United States, half of the six million people who do not have internet access are individuals who are over 65 years old. (Caumont 2013) These people have suffered from the digital divide, which is shown when natural disasters occur. In 2012, when New York was hit by Hurricane Sandy, thousands of people turned to social media for the latest safety updates, but many elderly residents were unable to take advantage of such networks to seek help. (Roberts 2014)

Digital Divide in Gender

Compared with men, women are underrepresented in their use and ownership of computers. The reason behind this phenomenon is largely connected with the traditional stereotype against women which not only leads to women's less interest in digital devices, but also confines women to domestic affairs and constrains them from engaging in scientific researches. According to Facts and Figures published by ITU, it shows that the international gender gap is as high as 17% in 2019, while it was 13% in 2013, which means that the problem of digital divide in gender is worsening in recent years and effective measures have not been taken to tackle this serious issue. (Measuring digital development Facts and figures 2019 2019) In addition, women are also underrepresented in basic computer science education courses from a young age. In high school and college, females take fewer technology classes, are more difficult to graduate with degrees in IT field, and less likely to enroll in postgraduate technology fields, resulting that they are marginalized in the higher end of technology jobs. Gradually, the divide between male and female expands and forms a vicious cycle.

Transcultural Digital Divide

Due to the excessive concentration of information resources in certain countries, there is also a digital divide between different cultures. Till 2015, it's estimated that 55.5% of the website is in English, while only around 20% of the population in the world speaks English, and 5% are native speakers. (Wood 2015) Although the diversity of language on the Internet is increasing recently, for many netizens, there is still a little amount of content in their primary language. To get in-time information, they usually need translation or other tools, generating the digital divide between English-speaking and non-English-speaking countries. Besides, it may also cause cultural invasion for these non-English-speaking countries indirectly.

III. Past Efforts

Domestic Efforts

In many developing countries, telecommunication companies play an important role in bridging the domestic and regional digital divide. These companies usually choose to cooperate with some foreign corporations, together with local authorities. For instance, Nigerian telecommunications company MTN, cooperating with China's Huawei, has deployed RuralStar 2.0 in remote areas to create the first network connection in remote areas. Each RuralStar 2.0 relies on solar panels to operate and doesn't have to rely

on existing power sources, making low-cost, high-efficiency, high-quality network connections possible in remote areas of Nigeria.(Digital Inclusion 2018)

Apart from network connections, bridging digital divide in gender is also the concern of the public. In 2017, six “digital training buses" run by the Bangladeshi government and the second-largest local operator Robi went to 64 regions across the country to bring basic computer application skills and communication knowledge to rural women in remote areas of Bangladesh, including female students in junior high school and college. Due to Bangladeshi culture and traditional customs, most women are confined by their families after marriage, which has largely limited women's access to education and employment. The “Digital Training Bus" project aims to improve this situation, provide a platform for women to learn, and keep women up to date. At present, these “Digital Training Buses" have provided ICT training to about 50,000 women across Bangladesh.(Digital Inclusion 2018) This program shows that even small developments in digitalization can have a huge positive impact on women's lives, and will also promote gender equality, basic education and the healthy development of the country's economy at a macro level.

In developed countries, many of them strive to narrow the digital divide through the promotion of the public library. In the United States, public libraries can provide the public with equal opportunities, access to Internet information, and other services that enable the public to make full use of public libraries, from important projects such as learning skills and training to searching for information, communicating with family and friends, writing reports, doing homework and other matters that are closely related to citizens. To maintain and guarantee this important role of libraries, the U.S. government provides protection through various laws, ensuring that every public library will not be unable to access network information services due to financial problems.

Universal Progress

Digital divide has drawn wide attention globally. To tackle this issue, international organizations have taken necessary measures in the past decades. In 2005, ITU launched a new initiative called Connect the World with the purpose of bringing access to ICTs to the estimated 1 billion people worldwide for who making a simple telephone call remains out of reach. (Nations 2005) It puts great emphasis on the importance of relationships and cooperation between the public and private sectors, United Nations agencies, and civil society. Therefore, partners of this initiative include not only governments, national and international organizations, but also some leading corporate players such as Alcatel, Huawei, and Intel and a range of organizations from civil society.

During the World Radiocommunication Seminar in 2016, ITU has launched Network of Women (NOW) aiming to empower females in radiocommunication negotiations, which is built on the success of ‘We Lead’ mentoring program, sponsored by the US Federal Communications Commission. (International Telecommunication Union 2016) During the implementation of these initiatives, ITU will collect data accordingly, which includes

the probabilities for gender disaggregation for all indicators having a connection with accessing and using ICTs individually. These indicators can also be gender-disaggregated by age, education, labor force status, and occupation, contributing to the analysis and provides conclusive evidence of women's participation in the information society.

Regional Attempts

In tackling digital divide, the EU has taken many steps to address the challenges posed by the digital divide. One of them is a dedicated website to increase the transparency of policies and information. This website will publish some policies and information related to promoting broadband development, including laws, regulations, success stories, etc. The site will also post information on the scope of areas where broadband services are not available, needs assessments, plans to address the digital divide, and bidding information. In addition, the European Commission also uses this site to conduct demand surveys, promote information exchange among member states, and accelerate the speed of closing the digital divide.

Not only developed countries, but some developing regions have also deepened cooperation on this issue, such as China and Africa. China-Africa information technology cooperation can be summarized into three aspects: technology provision, financial assistance, and knowledge transfer. In technology provision, it encourages to reduce equipment and management costs through innovation, provide localized solutions to help local operators successfully operate in remote areas. For financial assistance, China helps local governments and operators lacking funds through government donations and preferential loans to develop telecommunications networks. As for knowledge transfer, China and Africa cooperate in cultivating local talents through joint teaching and the establishment of training centers, enhancing the ability of locals to participate in a digital society. However, the breadth and depth of China-Africa information technology cooperation need to be further improved. Trilateral and even multilateral cooperation with third parties needs to be promoted. (Yang 2013)

Problems to be Solved

I. Physical Barriers of the Individuals

Low Domestic Level of ICT Devices Ownership

Though the mobile coverage of some deprived areas could have reached more than 90% while 50% of the citizens in these countries possess the smart ICT devices, the current situation that there are still plenty of countries which are unable to reach 20% of the ICT coverage is leading to the result that they cannot achieve economic and welfare growth by the enhancement of the ICT devices ownership. (Gillwald 2017) Thus, the disparity of ICT devices ownership between countries is spectacular.

In some parts of the world, for example, like the countries in Africa, more than 75% of Africans are still beyond the penetration of the Internet, regardless to say to be affected by the benefits that ICT devices would bring to them. (ITU 2016) Indeed, with the fact that the output is almost equal to the input, the majority of the poor population does not necessarily need to use the ICT devices according to the current mode of technology and market. Since the low domestic level of ICT devices ownership exists in many countries, the people there are more possibly to be polarized inside the country, and countries themselves are more vulnerable to economic sanctions by countries with high ownership rates of ICT devices because the high holding class has more extensive communication opportunities to conclude the transactions and to own longstanding business relationships.

Lack of Institutional Access in Deprived Areas

Business like telecommunication services or metal business requires hundreds of millions of dollars in upfront reserve funds, and the only stakeholder that is able to serve up with such a large amount of funds is the government. It is necessary to investigate digital infrastructure and business, but it is definitely not enough only with these financial supports by the government.

As for the need for further development in the digital sectors, educational intervention shouldn't be ignored, but actually is proved to be left out in many deprived areas nowadays. For example, in China, where the nine-year compulsory education is basically available across the country, the IT courses and IT grade examinations have been put up in most middle schools. Moreover, in most campus and public educational facilities of big cities, like the libraries, digital reading room, and digital services are available, but this scenery didn't happen in the deprived areas of China, neither in the deprived areas around the world. In this case, though the students may have learned digital information in the

public schools, they cannot get enough practice and also cannot examine their curiosity through the Internet, so that some of the IT lessons in the schools are actually of no real utility, regardless to say the youth who even cannot afford to be educated.

Case Study: World Computer Exchange (WCE)

The mission of World Computer Exchange (WCE) is to help youth in reducing the side effect that global digital divide brings, to cultivate cultural recognizing between students from developed countries and least developed countries (LDCs), and to promote the role of industrialized and LDCs as partners and allies in education reform. The youth from LDCs can receive help from WCE to balance and understand the international gap in information exchange, communication technology, and information security. (WEF 2002) WCE uses abandoned computers in developed countries for a second time so that these computers can gain new souls in some deprived areas and then gave these computers to young people in developing countries in Africa, Asia, and Latin America to connect them with the Internet. There are also many computer and network equipment donated by companies and individuals from all over the world. (WEF 2002)

Though the assumption is rational, there are still many obstacles existing in this program. First of all, the amount of donated second-handed computers is not enough, and sometimes repairing these computers would even cost more than buying a new one. Furthermore, choosing a suitable position to build computer labs is also a formidable task because personnel has to go to the deprived areas and make an in-depth investigation of the geographical location, population density, education environment, network connection, and other issues. Additionally, since volunteers are the major component of the staff and donation is the main income of the financial resource of WCE, the educational support in the deprived areas is shown to be inadequate. Most volunteers are actually not professional IT teachers, and they haven't got proper training before they come to the schools in the deprived areas. Due to the limitation of schools' arrangement, many students are not available to use the computer labs or may have a long way to go to arrive at the lab.

II. Governmental Burdens

Lack of Basic Infrastructure

Local internet access, major domestic internet, and international network protocol are the main bodies of the ICT infrastructure. (ITU 2016)

For local internet access and major domestic internet infrastructure, most of the LDCs do not occupy such original connectivity systems to build up their domestic digital internet environment. Market-orienting, privatization of the local area network, and digital

information resource monopoly are the hardships for inviting domestic people to deploy Internet resources and experience sharing. Apart from that, there are special funds set up within the LDCs in order to solve the problems like the inadequacy of services and delivering services in the remote areas. These funds are generally mandatory donations from telecommunication operators, and the “donation” nature of the fund causes the uneven performances of the telecommunication operators. Some of the funds are overdue, and some of the funds are caught in the problem of power abuse. The supervisory body is unclear so that the funds are hard to be put in to practice to solve the problem of lack of basic infrastructure.

The international internet protocol and facilities have gained huge progress in the last decade, especially in the field of submarine cable among African countries. Before 2009, there were only three countries in the coastal African LDCs had the straightforward internet interfaces to the submarine cable, and when it turned to 2016, the number has steeply risen up to 18. (ITU, Achieving universal and affordable Internet in the least developed countries Executive summary 2018) The achievement was integrated, but most of the interior countries of LDCs are still remaining in the status of planning to get into the connectivity of the submarine cable, and these countries have to rely on the neighboring countries to access the international network protocol and facilities.

High Research Expenditure

Each country has its own investment expenditure in digital technology researches, but for different reasons. For most of the developed countries, their target is further developing digital science and technology in an all-round and in-depth way to achieve technology leadership. In the UK, for instance, when announcing the autumn budget report in November 2016, the Chancellor said that in the future, with the progress of science and technology and the increasingly fierce competition from other countries in the world, the UK must enhance the strength of science and technology innovation. To this end, the government will set up a total of 23 billion pounds “national productivity investment fund (NPIF)" in the next five years, which will make technological innovation and infrastructure become a priority investment area. (Digital technology industry will meet the outbreak period 2017) Generally speaking, permanent members of the United Nations have a solid foundation in human resources, material resources, and information technology, so many high-technologies are still in a state of monopoly by the big five. Many other developed countries still rely on the economic investment and technical assistance of large multinational companies because of the shortage of funds. The large electric vehicle center established by Tesla in Germany is an appropriate example. Despite the government's strong support, this issue has aroused much resentment among the masses for the environment and the protection of local industry reasons.

For the countries in the deprived areas, researches are often done for setting up the basic infrastructure as starters, and those countries have to pay extremely high extra patent

exposure to gain experiences and hire professionals from the original countries, which usually tends to be a huge expenditure. For example, Huawei's 5G technology is currently in the leading position in the world, but behind this remarkable achievement, Huawei has more than 80000 global researchers, and its research expenditure has reached 105 billion yuan. (Nkurikiyimfura 2019) Such a large amount of money is naturally beyond the reach of an enterprise, so the economic support of the Chinese government also plays an important role, but it's impossible for the countries in the deprived areas to build up such gigantic funds. By the time of 2017, Google and other enterprises have invested more than 500 million dollars in Africa, and France Telecom has invested 56 million dollars in Africa. (Nkurikiyimfura 2019) However, behind this seemingly benevolent act, Google has signed many tax-free and land lease free treaties with Africa, so that in the future, it will be inevitably difficult for Africa to take the initiative to own relevant digital information technology.

III. Education and Innovation Divide

Information Illiteracy in Deprived Areas

Despite the fact that by the time of 2017, the mobile broadband signal coverage has reached 61% of the population in the LDCs, and when it turns to 2020, LDCs are predicted to accomplish the Target 9 which is “Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.". The prediction for using the Internet extensively by 2020 is still made without certainty. (ITU, Achieving universal and affordable Internet in the least developed countries Executive summary 2018)

According to Figure 3, in 2020, the penetration of Internet use will be around 23% of LDCs' population, which means there will still be about 77% of the citizens in LDCs who have no access to use digital services. Ironically, in the same period of time, the 3G coverage will be around 97% in the LDCs. (ITU 2016) This gigantic gap is the best demonstration of the fact that the development of the Internet and the use of the Internet cannot achieve synchronous growth. More importantly, the increase of the gross secondary school enrollment in seven years is only about 3%, so that the youth who can be educated and acquire digital information is still remaining in the same place.

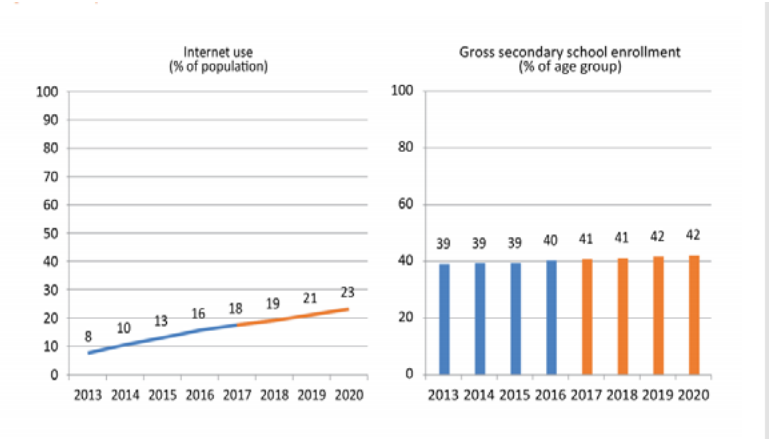

Figure 3 Predictions of Internet use and Gross secondary school enrollment (ITU 2016, UIS 2018)

Globally, the provision and application of ICT devices have shifted from the public to the private sector. (Frischmann 2004) The current policies are generally focusing on the penetration of digital devices and the Internet, but not aiming at the public and social value it would also produce. If resource management methods are to change, transforming from an immediate consumption perspective to one that includes production is essential, and it is also significant to switch from a policy of ensuring the spread of technology to one based on people's understanding of the function of the Internet.

Lack of Skilled Personnel

Since the stage of developing economy has transformed from efficiency-driven economy to innovation-driven economy, in those deprived areas, the development of their digital technology and digital industry has been hindered by various internal and external factors due to historical development and geographical factors. Thus the development is not ideal, and it leads to the gap with other countries, which results in what we called innovation divide. At present, they are unable to change this situation because they are short with the skilled personnel that is necessary for the development of innovation, which causes them to lag behind the world for a long time and thus leads to a vicious circle.

As a matter of fact, the lack of skilled personnel tends to be the most crucial-shortage, because without skilled personnel, there would be no researching panel. Furthermore, without the devotion of the experts and team members, there would be no innovation. This problem does not only matter in the deprived areas. In India, where is famous for digital outsourcing industry, the reason why there is no way to realize the transformation of service product paradigm through digital interface is that India is facing skills shortages and double-digit attrition.

IV. Other Social and Economic Barriers

The Monopolization of Information Technology

For a long time, the information technology companies in underdeveloped countries have been put in a really disadvantaged position due to digital monopoly. The rapid development of digital technology has strengthened the comprehensive national strength of developed countries headed by the United States in various aspects. With the help of the government, the information technology companies in developed countries are able to actively expand the scope of influence of their products and technologies in a large scale, so as to achieve monopoly in the international industry. However, countries in the deprived areas are unable to develop their own digital technology due to the long-term technological blockade and economic backwardness, and often endure the digital hegemony of digital power. Further, with high research expenditure and heavy industrial competitions, once the monopoly is forged and held by a country, or even one or two companies, it is very unlikely to be eliminated any time soon.

With the help of digital equipment, economic hegemony is mainly achieved by the monopoly of digital technology. Taking the software industry as an example, Microsoft is currently the number one leader in the world's software industry. Only dos and windows operating system software has basically monopolized the global operating system market, especially in rural areas, whose national software industry has been squeezed out by it. In order to obtain the right to use the digital technology and its hardware, the countries in the deprived areas have to endure the economic exploitation of the developed countries, which makes the fragile national economy even worse.

High Internet Charges and Connection Fee

For most of the potential users, the main reason why they cannot afford to get online is still that the cost of equipment is exorbitant for them, and the price of internet charges and connection fee is the dominant factor of whether or not the existing users would choose to use the internet services. When the users are no longer considering the price problems, they tend to take the network speed and quality of service into account. Therefore, generally speaking, the ICT devices ownerships are the precondition for the following obstacles.

The price of 500MB traffic packages is randomly different from country to country, and it ranges from $1 to 50$. If comparing the price of a traffic package with the monthly per capita income, the percentage also ranges from lower than 1% to more than 100%. (ITU, Achieving universal and affordable Internet in the least developed countries Executive summary 2018) For the purpose of solving such an excessive gap, the broadband commission has set a goal by 2015, which is to hold the price of Internet charges and

connection fees below 5% of per capita income. However, by the time of 2017, there are 36 countries of the LDCs still beyond that number. (ITU, Achieving universal and affordable Internet in the least developed countries Executive summary 2018) The telecommunication operators discovered such problems so that they have come up the relevant preferential policies, for example, like the special value-added hours at night and yearly or month data package. But as a matter of fact, it only helps in accelerate the charging frequency of the existing users. This situation reflects that the charges and connection fee is remaining unaffordable for a huge amount of people in the LDCs.

Case Study: CLOUD Act

On March 23, 2018, President of the United States signed the 2018 comprehensive appropriations bill, including the Clarifying Lawful Overseas Use of Data Act (CLOUD Act), which has been clear about that the United States law enforcement agencies of network operators have the right to obtain data with the extraterritorial effect and the corresponding international comity principle while setting up the mechanism of foreign government data to be obtained from the United States at the same time. (Wei 2018)

According to CLOUD Act, regardless of whether the data is stored in the United States, service providers are required by the Act to keep, backup, and disclose communications of all. The regulation breaks the framework of data location as the standard for judging data sovereignty, and reestablishes a new framework of network operator control, while the United States has the world's largest Internet tycoon with the widest range of global users and strong technical advantages in data collection, mining, and analysis. Taking the network operators under their jurisdiction as the standard for judging data sovereignty, first, it creates an advantageous position for the cross-border data retrieval of the United States. It not only provides maximum convenience for the United States to take law enforcement actions around the world, but also breaks the equality framework established by the original bilateral or multilateral judicial assistance mechanism, suppresses other countries' law enforcement power with the advantage of the American Internet industry, and increases the right of discourse and standard-setting in the field of cyberlaw enforcement cooperation. The second is to maintain its control over data resources by fighting against the data localization storage policy.

Regards data location as the judgmental standard of jurisdiction widely implement localization storage policy, makes Internet companies in the United States continuously transfer the data to other countries. In this case, The United States is likely to lose control of global data resources. And using network operators' control as a standard actually breaks the protection for local storage, prolonging “arm's length" to step up control. The third is to maintain its ability to monitor the world by strengthening its control over America's Internet giants. Prism monitoring plan has been made Internet companies in the United States facing a crisis of confidence, especially in foreign market access. If data location is still used as jurisdiction standards, the Internet companies would be more

likely to establish a data center outside the United States, and they may gradually get rid of the United States government control; thus, the United States will lose the global monitoring tools. And that's the reason why CLOUD Act has double-edged.

Towards Digital Opportunities

I. Introduction to the Term

To narrow the digital divide, grasping digital opportunities also plays an imperative role in addressing the issue. At present, society is gradually converting to one that is information-based. The development of digitalization has brought many new opportunities to all aspects of people's lives. For example, in terms of education, as more and more regions have access to broadband in recent years, it is possible to send high-quality education to rural children through online education, thereby promoting equality in education. In terms of daily practices like shopping, due to the further development of e-commerce and the improvement of the system, enterprises and consumers have gained convenience and benefits from it. In terms of communication between the government and the people, as many governments and local organizations have set up special online channels and mobile phone hotlines. E-governance helps shorten the distance between the government and the people and improve office efficiency. In addition, some artificial intelligence and systems have also emerged thanks to the development of digitalization. For example, in responding to natural disasters, there is a series of information systems that play a role in early prevention, collecting information and data, and post-remediation, helping relevant departments to minimize the damage. These are all the opportunities brought by digitalization, and organizations around the world are striving to grasp it.

II. International Collaboration

South-north Cooperation

Over the past few years, international society has realized that global cooperation is imperative to promote sustainable and inclusive development. South-north collaboration is one of the methods, which is extensive cooperation between developing and developed countries in the fields of economy and technology, including collaboration in bridging the digital divide and creating digital opportunities in developing countries.

The digital economy is a significant part of south-north cooperation, which not only draws considerable prospects into creating more jobs and data, but also provides the basis for recognizing human rights, stimulating access to quality basic services, and improving transparency and accountability of governments. For many developing countries, the use of the digital economy as a driving force of sustainable and inclusive growth and innovation to achieve its sustainable development goals through ICTs is feasible. However, if it fails to leverage these opportunities, its economies risk isolation, stagnation, and an increasing digital divide.

To grasp the digital opportunities, developing countries, especially the least developed countries, need assistance from developed countries. For Africa, whose leadership has a stated ambition to create a Single Digital market in the continent, the European Union (EU) is a suitable partner for this continent. The EU's digital single market is based on a comprehensive set of policies, plans, and regulations designed to remove national barriers and promote connectivity, digital skills, research, innovation, and entrepreneurship. The targets of both Africa and the EU are to cooperate in order to better connect the two markets and stimulation of the achievement of the Sustainable Development Goals on account of the digital partnership. Under this situation, the Digital Economy Task Force (DETF) appears, with the purpose of guiding the EU and the African Union when prioritizing actions for cooperation. Besides, DETF provides a platform of partnership for the private sector, donors, international organizations, financial institutions, and civil society based on the understanding of how African digital transformation can achieve cross-border integration, expedite sustainable development, and bring benefits to all citizens. (European Commission 2019)

South-south Cooperation

The burgeoning digital economy is based on digital infrastructure (DI), containing three closely intertwined aspects: communication networks, software packages, and related capabilities, and data platforms. (United Nations 2018) To keep the pace with other advanced economies, digital asymmetries and divisions need to be addressed. In addition, the appropriate investment will be needed to develop and apply new technologies that demand a sound and extensive digital infrastructure in turn. To meet the challenges, developing countries will also need assistance and collaboration not only from the traditional developed partners but also from regional neighbors. Therefore, south-south cooperation plays an imperative role in digital cooperation, which can boost the ability of the South to digitally industrialize and effectively gain from the new opportunities and avenues that digitization offers. It can also help countries mitigate the downside risks.

One of the most important steps towards building a digital economy within the region is the 'Big Data' technology and Artificial Intelligence (AI) in the manufacturing industry. For developing and least developed countries, this may be extremely difficult. To progress on digitization, countries will need to develop their ICT infrastructure (access, connectivity, and affordability) complemented with digital skills. In this process, countries need to own the data to build data infrastructure, among which data platforms is one of the most important components, providing methods to mine and analyze data. Data platforms collect, collate and combine layers of data to form Big Data and transforms it for commercial use such as AI by processing, analyzing and exploiting it, providing the basis for generating huge profit streams and potentially changing the relative positions of countries in terms of their shares in global production, consumption, investments, and international trade. (United Nations 2018)

III. Government Efforts

Digital Learning Program in Primary Education

Digital technologies have revolutionized our society. The education system is also influenced not only because technology can impact the way education is delivered, but because education plays a role in preparing young children for a tech-driven world. Recently, digital learning becomes more and more popular in many countries, which is also known as digital education. The application of digital in learning provides innovative and stimulating learning environments, facilitates individualized learning, and increase students' motivation. Besides, for children in rural areas and developing regions, digital learning also helps boost education equality and allow classes of high quality becoming accessible to them. Since the digital illiteracy gap and innovation divide have already existed in many under-developed regions, if these regions don't take necessary steps to tackle that, the gap will be more difficult to narrow with the further development of digitalization. Therefore, digital learning in primary education is a necessity to address the issues for these regions.

Concerning the pedagogical use of digital technologies, the prime factor of digital learning is teacher's digital competence, with emphasis on whether they view the use of technology as an added value to their teaching and to their students' learning experience. In Europe, there has been a specific competency framework for educators, which offers a consistent set of self-reflection tools at European level addressing citizens and learners, educators as well as schools respectively. In addition, Europe has top-level support for digital education except in the aspects of the curriculum, teachers, and assessment. To produce maximized effect, it also includes investment in IT infrastructure, requirements for digital school plans, digital leadership in schools, parental involvement, availability and quality of digital learning resources, and the place of digital education in external school evaluation frameworks. Not only Europe, but some developing countries have also taken steps toward digital learning. For instance, Kenya has launched the ICT Integration in Primary Education, which is one of the most critical programs emphasized in the Jubilee Manifesto, which is aimed to align integration of ICT into teaching and to learn for standard pupils in primary schools. This project is comprised of four main pillars, including the promotion of ICT infrastructure, development of digital content, capacity building of the teachers, and acquisition of ICT devices. From examples of Europe and Kenya, it's clear that among all the factors, the improvement of infrastructure and teachers' digital competence are crucial components in digital education. If digital education is implemented successfully in primary education in developing regions, it will have a great influence on the next generation who are expected to become more competitive in the digital world.

E-government Services

Electronic government (or e-government) is the application of ICTs to government functions and procedures with the purpose of increasing efficiency, transparency, and citizen participation. (Organization of American States 2010) If it's well implemented, E-government services will enable citizens, corporations, and organizations to proceed with their interactions with the government more conveniently, quickly, and costly. For instance, in Denmark, electronic invoicing saves taxpayers 150 million euros and businesses 50 million euros a year, which implies that the potential savings through e-government services are massive. (European Commission 2019) The Chinese government has also taken full use of the WeChat to facilitate the public, including the launch of a WeChat applet that integrates people's livelihood services. Through this mobile livelihood service platform, people can achieve “one-stop" handling and solve big problems online.

E-government services have great potential for governance, but there are many problems that are currently blocking the process of implementation. At an early stage, although most of the e-governance projects are citizen-centric, they failed to meet the expected impact. In India, it started e-governance initiatives in the mid-1990s. Since then, India has launched several projects, including railway computerization, land record computerization, which focused mainly on the development of information systems. (Digital India 2020) However, the result was not positive at the early stage due to the limited features of these projects. The less interactive and isolated systems prevented the successful adoption of e-government services along with the entire range of governance, resulting in a lack of integration amongst government applications and databases. Therefore, some issues related to interoperability need to be addressed before the implementation of e-government services, such as the improvement of collaboration within sectors to build a more connected government. In addition, there were other shortcomings, such as a low degree of government process reengineering.

Promoting Institutional Access to ICTs

Institutional access to ICTs encompasses a wide variety of venues in many countries. Both privately and publicly owned venues can seem as public access venues since their services are open to the general public. These include the public library, telecenters, and cybercafé. In some countries and regions, they lack the knowledge of the importance of public access and the ways to implement and sustain public facilities. Under this situation, online fora and training workshops can be taken to address this issue. Besides, to ensure the competitive, widespread and reliable provision of internet services, a conducive policy, and regulatory environment are also necessary for the implementation since one of the requirements for public facilities is low-cost and high-speed connectivity.

Information System in Managing Natural Disasters

When disasters like earthquakes, tsunamis, floods have happened, fast and accurate management of information and communication is of great importance. Coordinated and timely response, the collection of and access to necessary data are key to effective disaster management. The implementation of these activities is supported by the information system (IS), which involves geo-information systems (GIS) for providing spatial information, logistics systems to support the "humanitarian supply chains," and highly complex decision support systems.(Krumay and Brandtweiner 2015) The main tasks of IS include analyzing the collected data and guaranteeing the communication with stakeholders, such as the cooperation between virtual teams and online communities of experts and informing the public of the information. Therefore, the application of IS in disaster management increases the promptness of communication and effectiveness of problem-solving, avoiding unnecessary steps, and reduce the negative impacts to some extent.

According to different stages of disaster management, IS has relative systems to apply to it. For instance, the forecast systems are used to support the mitigation stage, such as systems aiming to store information and train for emergency situations. While in the stage of response, systems for communication and coordination will be utilized to communicate and provide information. Additionally, GIS also plays a vital role in this stage to restore the affected regions. However, to make the IS be used to its full extent, it needs to meet specific requirements regarding usability, availability, stability, and reliability. (Krumay and Brandtweiner 2015)

Case Study: The Hazard Management of Japan

As one of the most technologically advanced countries in the world, Japan is also one of the countries that are most exposed to natural disasters, such as earthquakes, tsunamis, volcanic eruptions, flooding. Having been facing with various disasters, Japan has gained significant experience in disaster management.

In the past few years, Japan has utilized ICTs in its disaster risk management (DRM) to enhance the resilience of existing infrastructure and systems in the face of risks and impacts. Current DRM strategies center around the four phases of the disaster management cycle, including prevention and mitigation, preparedness, response, and recovery. In these phases, the ways in which ICTs are utilized are increasing and expanding. To manage the aftermath of earthquakes, tools and systems for seismic monitoring (data gathering and analysis), communication (including underground sensors, cables) and prediction technology (modeling, including machine learning) are adopted to improve observation and collection of hazard information. Besides, in the response phase, to assess and analyze the damage and monitor secondary disasters, IS integrated real-time information from image monitoring tools, such as drones, satellite image assessments. It also uses social media and hardware, such as mobile phones

and radio, to keep the public updated. Notably, such disaster technology innovation has increased the economic productivity in the long run because of the in-time measures taken in the whole process of disaster management.

IV. Digital Opportunities for Establishing Digital Economy

E-commerce

With the development of e-commerce, the traditional methods of resource allocation have been changed. It brings about new opportunities for the development of corporations and governance. At the enterprise level, the most significant feature of e-commerce applications is that it can effectively reduce the enterprises' cost, reflecting in three aspects.

First, e-commerce can effectively reduce the cost of procurement cost of production of raw materials. Through e-commerce, enterprises can strengthen the effective combination with suppliers and of raw materials to form an integrated information system for the production and operation of raw materials, which helps improve transaction efficiency and reduce unnecessary costs in the transaction. Second, e-commerce can effectively reduce the marketing costs of enterprises. It reduces part of the production and sales process of the enterprise, thereby effectively reducing the transaction consumption costs in the production and sales process of the enterprise. Third, e-commerce can effectively reduce the inventory cost of enterprises. Via e-commerce, direct communication between enterprises and suppliers can be achieved, enabling enterprises to directly understand the sales of suppliers, which is conducive to making the fastest market based on market conditions. It not only effectively reduces the problem of enterprise inventory but also improves the supply speed of the enterprise. In addition to reducing costs, the e-commerce also provides direct communication channels for enterprises and consumers, so that enterprises do not need to understand the needs of consumers through intermediaries to meet consumer needs and improve consumer satisfaction. For consumers, it provides convenience for consumers' shopping, reducing the time and energy consumed by consumers.

The construction and development of e-commerce are mainly divided into two parts. The first part is the construction of the hard environment, that is, the network infrastructure, payment platform, logistics distribution terminal, and logistics warehousing facilities. The second part is to strengthen the soft environment, that is, to innovate the e-commerce investment policy system, improve e-commerce efficiency, promote services, and ensure the proper market environment. In addition, support from the government is also imperative. Since the 1990s, the US government has published relative policies to stimulate and normalize e-commerce development. At the end of 1996, President Clinton personally initiated the establishment of the US Government E-Commerce Working Group, a cross-sectoral e-commerce management coordination agency, which is responsible for formulating relevant electronic Business policies and measures, and coordinate and urge

related departments to implement. In 1997, President Clinton promulgated the Federal Government's "Global E-Commerce Framework" to promote and support the development of e-commerce, which establishes the basic framework of federal government policy and has had a positive impact on the development of e-commerce in the United States and around the world. Because of the previous preference policies published by the US government, US e-commerce has achieved significant progress in today's market.

In addition to the benefits to enterprises and consumers, e-commerce provides new chances to the government that dedicates to eliminating poverty. In some remote areas, enterprises and rural original product suppliers can be connected through information service platforms to promote the development of rural areas, which is a good channel to expand the market of local products at low cost.

Digitization in Work Places

In the past, the workplace was merely a physical space that employees occupied during regular office hours. Currently, because of the gradual digitalization in the workplace, the lines between the physical office and the place where work actually happens have been blurred. As a result, it's increasingly clear that traditional information approaches no longer meet employees' evolving needs. Therefore, companies and other sectors have begun to integrate technologies that employees use, including e-mail, instant messaging, virtual meeting tools into the workplace, in order to break down communication barriers and improve efficiency, innovation and flexibility.

In addition to the aforementioned benefits, studies have also shown that the digital workplace will also benefit enterprises from attracting talents, promoting employees' productivity and satisfaction. Realizing these advantages, more companies are committing their budget on supporting digital workplace strategies that promise to deliver measurable returns. However, when creating a digital workplace, sectors, and companies must also develop a governance model that supports connectivity and collaboration while mitigating risks and enabling compliance. For instance, besides technical training to the employees, it's also imperative to provide policy training on the type of information that should or should not share in the digital workplace. Stakeholders need to communicate policies on how to properly handle personal data and how to avoid damaging their companies' brands.

V. Future Trend

Digital transformation will continue for a better future. To better develop digitalization, some big telecommunications have taken steps towards 5G, including Huawei, Nokia, AT&T. The establishment and promotion of 5G across the world will provide new digital opportunities to stakeholders. In addition to faster broadband speeds and more reliable

mobile networks, 5G will also stimulate the advancements in smart manufacturing, smart vehicle, various IoT-intensive technologies that are eager for 5G. The value of 5G will not only be revealed in smartphones but every industry related to people's daily lives, including the establishment of smart sustainable city, which connects to the public and helps promote the efficiency of city operation. In addition to 5G, further development of AI will also be an essential focus, including the Robotic Process Automation (RPA) and some controversial AI in the past. Although these are not new items for 2020, it's likely for them to catch a second wind and become more widespread and beneficial to human's daily life.

TOPIC B 5G technology in Building Smart Sustainable Cities

Current Situation

I. Overview of the topic

Thanks to the development of electronic and wireless network technology, mobile communication technology has been improved rapidly within the past forty years. Up to now, mobile communication technology has undergone four generations altogether, and the fifth is now nearly mature. The latest generation is expected to improve the network speed further and lower its power consumption. Still, 5G technology has to overcome certain obstacles to commercialize, and to achieve a further goal, building smart sustainable city. As a technological tool for building a new smart sustainable city, 5G innovates urban application with technological progress and will accelerate the process of highly intelligent urban lighting, pension, and other aspects in the future. The construction of smart sustainable city has become the trend of the world's urban development, while the 5G network is the network connecting the wireless sensors of the whole urban system. 5G provides direct solutions for the power grid, security, transportation and other aspects of smart city, bringing various social and economic benefits, and is the cornerstone of smart sustainable city.

Smart sustainable city gathers human wisdom and endows things with intelligence on the basis of fully integrating, mining and using information technology and information resources, so as to realize the precise management of various fields of the city and the intensive utilization of urban resources. Thus, the word “smart” here actually means the city needs to be oriented to solve various problems in the process of urbanization, such as traffic congestion, environmental pollution, etc. And “sustainable” can be understood as the construction of a new smart city should have a long-term plan, and adhere to the idea of “easy first, difficult second, urgent first,” to solve the urgent problems of the common people, and implement in stages and steps. Such development goals put forward greater requirements for the technical network, requiring the ability of intelligent iteration and intelligent extension. Due to the important role of information resources in today's social development, developed countries have come up with smart sustainable city construction plans to promote the rapid development of information technology so as to achieve the purpose of seizing the commanding heights of a new round of information technology industry.

II. Past Actions

Universal Progress

In order to lay the groundwork for the follow-up development, the ITU has issued several directive documents targeting the emergence of 5G technology. Just like any other newly emerged industry, 5G will face many obstacles during its development. Early breakthroughs of related products will often stress on straightforward hardware partitioning, not on the performance points that were set by the ITU, which actually defines the 5G technology. In that case, the standards set by the ITU are more like goals for step by step development rather than some required implementations for the initial stage of this industry.

Moreover, in the aspect of building smart sustainable cities, ITU also plays its unique role in providing more feasible measures. ITU launched the first global smart city online community in 2016 to help urban planners build a sustainable smart city. The new community aims to identify the main “difficulties" that pose challenges to urban development. The launch of the community is part of the preparatory work for the first global smart city forum organized by the International Electrotechnical Commission (IEC) in cooperation with the International Organization for Standardization (ISO) and ITU, which was also successfully held in 2016. (Luo 2017) In order to accelerate the standardization process, the management of ITU decided to merge the standardization work of smart sustainable city and the Internet of Things(IoT) originally scattered in different research groups of ITU at the meeting by setting up a new research group SG20. The establishment of SG20 shows that ITU hopes to play an important role in information and communication technology in a wider range and play a greater role in promoting global economic and technological development through in-depth integration with transportation, medical, power, and other industries. At the same time, the establishment of SG20 in ITU solved the problems of scattered standards, large coordination workload, and long development cycle of IoT and smart sustainable city. (Luo 2017)

Other Efforts

In general, the increase of sufficient smart sustainable city will lead to a shift from proof of concept and conducting tests at selected points to a real improvement of community projects. By the end of 2019, 40% of local and regional governments put the application of 5G technology down into transforming infrastructure in the smart sustainable city to be built. (5G and smart cities trends for 2019 2019) According to the McKinsey Global Institute, North America, Asia Pacific, and European countries are taking the lead in launching smart cities. In 2019, the infrastructure construction of smart and sustainable cities was carried out in these areas. As a matter of fact, the Eden Strategy Institute chose London as the world's top smart city government in the period from 2018 to 2019.

As expected, many countries are digging into the deployment of 5G technologies and smart sustainable cities with different orientations and strategies. In the United States, the government has announced its plan to commercialize 5G technology in

some selected areas in the states. Verizon, the telecom operator in the United States, has been established as a forerunner with the 5G Technical Forum. (Ryan 2018) Most of the smart city programs in the United States are planned and promoted by local governments according to the environmental characteristics of their own cities, especially in cooperation with private and enterprises to carry out smart city projects. At the same time, different cities focus on the development of individual areas. For example, in New York, the city government has developed the Smart Screen City 24/7 Plan in accordance with the features of the great demand for network use and multiple public intelligent screens of New York City.

In 2016, the German government also introduced the Digital Strategy 2025. According to the new Strategy, Germany will invest 100 billion euros to build a national gigabit optical fiber network by 2025. (Digital technology industry is to meet the outbreak period 2017) Specifically speaking, Germany's digital strategy is to build a series of digital systems such as intelligent factory, intelligent transportation, intelligent city and intelligent home based on information technology such as big data, so as to comprehensively improve Germany's economic competitiveness and promote social innovation and development.

Rio de Janeiro is the leader of smart city development in Brazil. After the debris flow disaster in 2010, the mayor of Rio decided to establish the Rio Operation Center (COR), which is supported by IBM. The center has established a coordinated operation mechanism of more than 30 government departments to collect real-time information of traffic, weather, lighting, power, and other parameters through the use of sensors, satellites, video systems, and GPS systems. Then, this information will be used to manage and change traffic flow around traffic accidents and congestion areas through the use of computerized traffic lights and provide effective navigation services for ambulances.

III. Future Outlook for 5G in Smart Sustainable Cities

The main obstacle for smart city to move from theory to practice is to deal with the amount of data generated by the Internet of Things (IoT) and the speed and bandwidth of real-time data processing. From public transport to the enforcement of the law, all of this will be a case in point.

Cost-saving is a huge convenience brought by 5G, which can make cities possess a bigger and better construction under the same budget. In fact, by reducing energy use, traffic congestion, and fuel costs, smart cities can save $160 billion in both vehicle traffic and grid management. (Accenture 2019) It also leads to the result of less commuting time, improved public safety, and developed efficiency of the smart grid.

More importantly, the emergence of 5g means that cities will be able to use artificial intelligence to deal with the tough work of data collecting. Thus, the traditional tasks that are supposed to be finished manually can be realized automatically now with the help of the generated data.5G is beginning to play a key role because billions of facilities can be connected by its impressive features. 5G architecture, which is based on software, has

the flexibility of pushing autonomous machine learning, can collect all statistics, organize it, and then could automate many of the processes that are done by human beings today. Eventually, a city can be more efficient, ordinary tasks can be automated, and more complicated tasks can be assigned to human workers in the city.

With the emergence of the 5G network, data traffic will grow exponentially. It is believed that 5G technology will bring one opportunity after another, and more and more applications will emerge as the times required to achieve the expected goal of smart sustainable city, and users will realize the true convenience and excellent network connection everywhere in the near future.

Problems to be Solved

I. Future Uncertainties of 5G Technology

Lack of International 5G Standards

More spectrum bandwidth will be required to deploy 5G networks to the high capacity requirements, increasing the need for spectrum. Although efforts have been made, there is still a lack of international standards of the spectrum. The ITU is expected to decide on the additional spectrum for IMT in the frequency range between 24 GHz and 86 GHz at the World Radiocommunication Conference in 2019 (WRC-19).

Existing mobile allocation	No global mobile allocation
24.25 – 27.5 GHz	31.8 – 33.4 GHz
37 – 40.5 GHz	40.5 – 42.5 GHz
42.5 – 43.5 GHz	
45.5 – 47 GHz	47 – 47.2 GHz
47.2 – 50.2 GHz	
50.4 GHz – 52.6 GHz	
66 – 76 GHz	
81 – 86 GHz	

Figure 4: New spectrum bands under study for WRC-19 (ITU, Setting the Scene for 5G: Opportunities & Challenges 2018)

5G use cases could potentially be met by a variety of spectrum frequencies. For example, low-latency and short-range applications (suited to dense urban areas) are likely to be suitable for mmWave frequency (above 24 GHz). Long-range, low-bandwidth applications (more suited to rural areas) are likely to be suitable for sub-1 GHz frequencies. While the lower frequencies have better propagation characteristics for better coverage, the higher frequencies support higher bandwidths due to the large spectrum availability at mmWave bands. Huawei, for example, has proposed a multi-layer spectrum approach, which summarizes this approach best. (Huawei 2019)

Due to various reasons, countries like China and the United States have chosen to develop their 5G technology in an entirely different frequency spectrum. It means that Chinese telecommunication operators cannot deploy their servers in the United States as it is not compatible with the local terminals. Also, the international roaming service between these two countries will be very complicated. As many countries have already gone very far in developing their own chosen spectrum, it will be very hard for them to give up their current spectrum and turn to the universal standard. Therefore, the challenge for other countries will be to select globally harmonized spectrum bands for 5G.

Security Concerns about 5G Technology

Since 5G technology supports massive machine-type communications, the larger the coverage is, the bigger the cyber-attack threats will be. With the tremendous interconnection of information, hackers may illegally attack the network to gain profits and tamper with or delete data, causing a severe threat to cybersecurity.

As networks evolve to deliver the huge number and diversity of information and communication technology applications expected of the 5G era, the biggest threat from China Mobile, Huawei, and ZTE Corporation that the US felt were about national security. Europeans countries and the US regard it as an integral part of soft sovereignty. The countries that could commercialize 5G technology to the fullest range could protect themselves from the supervision of other countries.

International Competition

5G technology is an essential breakthrough in digital technology and is promised to lead the next generation of its field. The development of 5G technology will affect the security and economy of a country, which makes it unsurprisingly fierce competition among nations and companies for 5G leadership. Let's take the China-US competition as an example to elaborate on this issue.

Although American companies were the ones who led the world into 5G, none of the four companies which dominate the market of significant network facilities (Ericsson, Nokia, Huawei, and ZTE) is from the US. The development of 5G technology is now led by European companies (Ericsson and Nokia) and China's carriers (Huawei and ZTE). The situation depicted above puts America in a dilemma. Washington has always been accusing Beijing of its aggressive global campaign of cyber espionage, which, as a result, makes 5G technology competition a crucial part of American national security. When the core telecom supporting equipment connects to the manufacturer over a specialized channel, it can and perhaps will provide feedback on the facility status and gets access to updates and software patches when needed. The operation over the dedicated channel will not be shown to the operators, but the manufacturer can easily disable or even hack the equipment. This is why the US firmly opposes products from Huawei and warned its allies of cooperating with Huawei. Therefore, the possibility of security breaches leads to fierce competition for 5G leadership.

Furthermore, the security crisis will cause the US extra expenditure. Comparing with its counterparts, the telecom networks of Huawei save about 30%. The US will not copy China's government-centric model for 5G technology, but it will have to come up with a comprehensive strategy to combating non-tariff barriers of trade.

All parties around the world have attached great importance to the development and commercialization of 5G technology. Apart from the US and China, Asian countries and European countries are also competent competitors. The Republic of Korea has already implemented 5G base stations nationwide. All of its three mobile carriers SK Telecom, KT and LG Uplus have launched 5G services to customers and businesses. As the second biggest economic entity in Asia, Japan is also accelerating its 5G development. Japan's telecom regulation body has allocated spectrum to operators DoCoMo, KDDI, Softbank, and Rakuten this week, to make sure the country will be ready for a 2020 commercial launch goal for 5G (Chamberlain, 2019). Also, the European Union has also carried out its 5G for Europe, an Action Plan. According to the plan, Europe will cope with the massive growth in the use of communication and wireless technologies by humans and machines (DIGIBYTE, 2015).

Case Study: The Case of Huawei in the United States

U.S.'s Huawei ban is one of the hundreds of cases where the fierce competition of 5G technology in the international arena is shown.

The government of the U.S. claimed that the government of the People's Republic of China has opaque ownership of Huawei and the judiciary and rules of law are not independent enough to prevent the misuse of data, (The U.S. Department of State 2019), and therefore, Huawei is not trustworthy. In one of its publications on 5G security, the U.S. government uses China as an example after making it clear that 'trust cannot exist where telecom vendors are subject to an authoritarian government.' (The U.S. Department of State 2019) On Aug.13th, 2019, the U.S. formalized the ban of the contract between the government and Huawei, before which in May, an executive order had already manifested the opposite attitude of the government towards the use of Huawei devises in American enterprises.

While the U.S. government claimed that Huawei ban is a result of security concerns, it is widely considered to be a mean of oppressing Huawei in the field of 5G, and further, a part of the trade war with China, the aim of which is to debilitate China's economy and development of technology. In recent years, China's technology strategy is turning from initially domestically focused on shaping the global information and communications technologies (ICT) products, and China is considered to have the domination of ICT and related areas. (Inkster 2019) Before the Huawei ban was formally conducted by the U.S., Huawei-related cases such as the arrest of Meng Wanzhou, CFO of Huawei, are modified as 'a battle for technology dominance', and Huawei ban is an extension. (Inkster 2019)

II. Obstacles to Utilizing 5G Technology in Building Smart Sustainable Cities

Besides the uncertainties of 5G technology mentioned above, there are other obstacles in utilizing this technology in the building process of smart sustainable cities. The main

problems are difficulties in finance, legal and administrative regulations, and long-term maintenance.

The Demand for Huge Investment

Compared to the traditional radio waves with medium- (between 1-6 GHz) and low- (below 1 GHz) frequency bands, the radio waves of 5G usually have high frequencies, with some of them above 24GHz, so they propagate over much shorter distances. (ITU 2019) While one base station in quite a large area is enough in the traditional network, a significantly increased number of base stations, or small cells, are needed in the 5G network. Although the production and construction of the 5G base station are technologically permitted, the cost should be addressed when it comes to a large scale of deployment. It is estimated that the cost of commercialization in a small city is US $ 6.8 million, at least, and US $ 55.5 million for a large dense city. (ITU 2018) Therefore, high levels of investment are needed in utilizing 5G technology in smart sustainable cities.

In spite of the potential profits, however, not all investors would like to take risks in such huge investments. Some investors cannot see the profit model in 5G economics clearly, so they may not be confident enough to invest in 5G deployment.(The China Academy of Information and Communications Technology 2019) The lack of motivation to invest in the deployment of 5G infrastructure seems to add fuel to the flames, given that the cost of the large scale of deployment is high.

Domestic Legal and Administrative Obstacles

The utilizing of 5G and the building process of smart sustainable cities should be under proper regulation of the government. However, rules and regulations in this field are considered to be out of date to a certain degree by some scholars and institutions. In this aspect, there are mainly two problems:

Permission

In some cities, it sometimes takes one to two years for telecom operators to get approval of their application for small-cell implementation. (Accenture 2014) Given that some cities require separate reviews of each installation and the density of the small cells is 100 times higher than that of the macro station in the 4G network (Accenture 2014), a large scale of construction would be almost impossible without proper adjustments in legal and administrative aspects.

Fee policy

The fee policy used on macrocells has been directly carried out in the construction of 5G small cells in some instances according to related research. Such fees imposed on small cells are relatively too high and are a result of the ignorance of the differences between

macrocells and small cells, which is making the deployment of 5G small cells unfeasible. (Accenture 2014)

Difficulties in Long-term Maintenance

In order to meet the requirements of higher transmission rates, a new type of modem chip is used in the 5G devices, whose degree of complexity and costs are both much higher. (Liao Qian 2019) In addition, such devices require larger energy consumption whose large scale of deployment and long-term maintenance pose a challenge to the capacity of power supply

Due to the higher speed and capacity of 5G networks, much more efforts are expected to be made in the operating and maintenance of 5G network in smart sustainable cities. For example, privacy and security are a public concern for smart sustainable cities. With more users and things linked into the network, myriad connections between them will be created, and a new round of information explosion is coming. Without effective management, there will be a larger possibility of information leak-out than there is in the age of 4G. When it comes to emergency cases, the failure in system recovery is going to bring about greater loss due to the same reason.

Potential Social Impact

There are some worries of negative social impacts that the utilizing of 5G technology in building smart sustainable cities probably brings about.

Digital divide

Since the threshold of 5G technology is rather high compared to traditional telecom technologies and deployment and maintenance are both costly, it is hard for less developed countries to develop 5G technology, let alone utilizing it in building smart sustainable cities. And if the operating costs of 5G infrastructure cannot be cut down, it will be unaffordable for the lower class to use it in their daily life. Consequently, digital dived between countries, between urban and rural areas, and between different groups of people will probably be broadened by the wide use of 5G technology in cities.

Job opportunities

It is believed that the construction of 5G infrastructure creates job opportunities. The deployment of 5G infrastructure across the United States is estimated to create 3 million job opportunities. (Accenture 2014) However, it still needs to be considered whether the utilizing of 5G technology will decrease job opportunities after the deployment is completed.

Lack of Motivations to Reform

As mentioned above, there are obstacles to utilizing 5G in building smart sustainable cities, and the consequences of broadening digital divide and decreasing job opportunities pose challenges to policymakers. Compared to 5G technology, 4.5G seems to be a better choice.

4.5G, also 4G LTE-Advanced Pro, is the outcome of Long-Term Evolution (LTE) whose legacy is 4G and an outcome in the run-up to 5G. It has now appeared to be an evolution version of 4G, most of the features of 4.5G are predicted to be similar to the proposed 5G systems. (P. 2016) More importantly, the spectrum of radio waves of 4.5G is about 5GHz, which means the high density of base stations in the 5G network is unnecessary in 4.5G. (P. 2016)

Possible Solutions

I. International Cooperation

Setting Standards for Globally Stable, Secure and Reliable 5G Technology

Currently, there are several sets of standards for global 5G development (also see in Past Actions). However, organizations like ITU and 3GPP are still discussing the newest version of the global standard. The problem that exists within the current global standard is that the universal frequency spectrum of the 5G technology is still up in the air. As global telecommunication operators are going deep into the 5G deployment, significant divergences of frequency spectrum have shown themselves in different countries. Besides the frequency divergence or spectrum licensing, there are several other key factors that require attention when different stakeholders are dealing with the global standard. To begin with, streamlining small cell deployment is crucial, especially in many developed countries. The US state government of California has granted the local wireless industry to access the “street furniture". (California State Government 2017) Operators can design tailor deployment plans for different cases to ensure less redundant constructions are made during the process. Apart from that, it is equally crucial to address local planning challenges. The City of London Corporation recognized that the lack of power to exercise the right of way should be blamed for low fiber investment. The corporation developed a standardized wayleave toolkit to facilitate the delivery of fiber infrastructure effectively and efficiently. The toolkit is now available to all local authorities in London. (City of London 2016)

Apart from looking at the present, the new standard also needs to set eyes on the future. It is very important to secure the maximum compatibility of future technologies, as the fifth generation of telecommunication won't be the last generation. Besides, it is also crucial for the new global standard to embrace all developing countries.

Global Collaboration and Advocacy of 5G and Smart Sustainable Cities

Dialogues and cooperation have been carried out between leading countries in the telecommunication industry. 3GPP is established to secure the smooth transform from the second generation to the third generation of telecommunication networks. 3GPP, at that time, gathered all leading countries in 3G development, aiming to bring this technology to the international level rather than restricting it in several countries. It is a platform set for any negotiation and dialogue between all stakeholders. Today, global operators can still make full use of this organization for more 5G cooperation. Also, similar actions can be taken between countries that are leading the 5G development. On the other perspective, the discussion over smart sustainable cities has also received

wide attention. The ITU currently plays a significant role in providing a consolidated platform for discussions on policies, strategies, and standards related to 5G in smart cities development. The research team established by the ITU answers directly to the most crucial challenge of developing smart sustainable cities, which is the obvious fragmentation in the international agency.

Intercompany cooperation is as important as intergovernmental cooperation. The international community has witnessed many bilateral contracts being signed in all parts of the world. However, this is far from enough. It is extremely crucial for the operators in this industry to expand the scale of cooperation from the bilateral level to the unilateral level.

Fundamentally speaking, 5G and future city planning are not competitions solely between those leading industrial countries. Developing countries are also required to join the R&D process of 5G technology and trials of future city planning. As a matter of fact, due to its relatively low development level, which provides sufficient room for improvement, cities in developing countries can be the ideal experiment field for smart sustainable city. Association of Southeast Asian Nations (ASEAN) is also examining the potential of 5G in building smart sustainable cities in Southeast Asia. ASEAN has drafted an agenda for the deployment of ASEAN Smart Cities Network (ASCN), and 26 pilot cities in the ten member states have been identified to become a part of this network. (Ariffin 2018) Similar actions can be deployed in all developing regions around the world.

Case study：3GPP in the Transitioning Period

The 3rd Generation Partnership Project (3GPP) is established to secure the smooth transform from the second generation to the third generation of the telecommunication networks and to assure the maximum compatibility of future technologies. Today, facing the confrontation between 4G and 5G, 3GPP is also working on the standardization of the next generation of telecommunication networks. As expected, after the initial delivery in late 2017, which ratified the Non-Standalone 5G New Radio specification, in 2018, 3GPP has on timely completed the first full set of 5G standards. (3GPP 2018) It is described as the first milestone for the 3GPP submission towards IMT-2020. In Release 15, 3GPP focused on the initial stage of developing 5G technology. (IEEE spectrum 2018) As the Release 15's work has matured and drawn close to completion, 3GPP's focus is now shifted to the second phase of 5G development. (Alleven 2017)

In the next phase, 3GPP reckons that a comprehensive combination of Long Term Evolution (LTE) and 5G New Radio (5G-NR) is critical though challenging. Firstly, it is a generation breakthrough for 5G to thoroughly abandon LTE (the band used by 3G and 4G). However, on the current stage, there are two primary options for developing a network technology that is qualified to be called 5G, continue to develop LTE Advanced, or turn to 5G-NR. 3GPP acknowledges that it is not possible to abandon LTE, which means we still need to face the restrictions of LTE for quite a long time. Secondly, the ongoing research

of 5G-NR technology also faces problems. The telecommunication industry needs to switch to a broader frequency spectrum of the band if the operators finally adopt the 5G-NR technology, but it will mean a total upgrade of current operational devices. In that case, in the Release 16, the second and yet the most crucial phase of 5G development, 3GPP emphasizes the importance of further enhancement to the LTE technologies as well as the development of 5G-NR technology. Still, the right of choice is in the hand of all operators in this industry. The second phase of 5G development is anticipated to be completed in June 2020. (3GPP 2019)

II. Governmental efforts

Policy Intervention on 5G Infrastructure

The biggest hurdle faced by many 5G operators is the cellular coverage of the 5G network. Small cell deployment is, by far, the most promising and cost-effective solution of improving 5G network density. Small cell network facilities can be easily deployed in a short timeframe, which facilitates operators to quickly expand their capacity and provide more stable network services to its users. However, it still means hundreds of small cell wireless facilities installments across cities and states in order to deliver 5G service to all citizens in the city. Policy-makers may consider removing tax burdens to reduce investment costs associated with fiber in order to facilitate the deployment of 5G networks. Furthermore, the government must provide appropriate supports to the 5G operators. The government of the United States has issued a federal standard for small cell deployment regulation, aiming to streamline the whole process for the wireless industry. (Chamberlain 2018) Furthermore, the large authority has been given to the wireless industry in the US. Wireless providers are granted the ability to access public right of way (which shortens the time of getting construction permits from the government) and existing “street furniture. (Chamberlain 2018)

Traditionally, the network services industry is monopolized by the company that possesses the highest level of technology. Logically, those leading tycoons are most likely to win the right of infrastructure deployment, and in some cases, share the revenue with the local government. However, 5G generation has gone through a major paradigm shift in both ways of thinking and deployment. The wireless era differs from the previous wireline era from all aspects. It is bound to revolutionize the whole industry. The government should abandon its old assumptions previously used on those telephone network monopolies, and draft tailored and industrial-friendly regulation for this newly emerged market.

Planned City Extensions

One of the most important hurdles placed in front of most urban planners of developed countries is the lack of sufficient room to upgrade the infrastructure. At the same time, although many communities are now embracing the idea of sustainable city development, the inclusion of such concept has no actual influence on how well plans actually promote sustainability principles without a thorough understanding of sustainable planning or political commitment to put it into practice. Policymakers should think through all factors that might affect the future of the city. In other words, the city extension should be compatible with the future generation, and it is crucial to think ahead.

Promoting 5G Technology in Public Services and Industries

5G technology can revolutionize the city in all aspects, including the connectivity between industries. However, the acceleration of the digitization process in key industrial sectors based on 5G connectivity, as well as the advent of novel business models, will require closer partnerships between the concerned sectors and the telecommunication sector. While a few markets will naturally lead innovation, and attract most of the initial investments, a number of sectors recognize the need to run pilot trials to increase predictability, reduce investment risks, and validate both the technologies and the business models. Experiments are also needed to provide input for the standardization organizations.

Public services may be an early adopter and a promoter of 5G connectivity-based solutions, encouraging the emergence of innovative services, contributing to a critical mass of investment, and addressing issues of importance for society. For instance, such a role could involve migrating public safety and security services from existing proprietary communications platforms to commercial 5G platforms, which will be even more secure, resilient, and reliable.

In order to trigger the new 5G innovation ecosystems, industry suggested setting up a specific 5G venture financing facility to support innovative start-ups aiming to develop 5G technologies and related new applications across industrial sectors. This could foster substantial digital innovation at the regional scale, beyond connectivity. The modalities for this financing capacity will have to be further specified to determine the appropriate financial instruments and avoid overlaps with venture financing opportunities already available for the digital sector.

Country Positions

I. The United States

It is reported that the United States and China, with global digital wealth highly concentrated on several platforms of theirs, have become the world's leading players in the field of digital development.(UNCTAD 2019) Nonetheless, digital divide characterized by different features exists in all countries, including the U.S. and China. To eliminate the digital divide and create digital opportunities, and to develop its own 5G technology simultaneously, the U.S. has formulated a series of policies.

Trump administration has been taking measures so as to bridge the digital divide that has left hundreds of millions of rural residents behind. It was estimated in February 2019 that nearly 39 percent of rural Americans lacked sufficient broadband access. (Kratsios and Liddell 2019) Later in the same year, Li argued that although T-Mobile, a U.S. communications operator, had announced its success in establishing the first national 5G network, the network can only cover nearly 200 million people, with the left 120 million mainly consisted of rural Americans. (Li 2019) Severe digital divide, exposing citizens to education, health-care, agriculture of totally different levels, is likely not only to hinder the construction of SSCs but also to sharpen social inequality, thus threatening social stability. Through the conduct of a National Spectrum Strategy to guide policy-making regarding the lifeblood of wireless networks and the executive action to improve network infrastructure buildout by increasing commercial access to Federal lands and facilities and streamlining the permit process for communications infrastructure on Federal lands, Trump administration is making efforts to lay foundation for future SSC building and to eliminate the domestic digital divide.(White House 2019)

The U.S. takes a rather cautious attitude towards research and development of 5G technology, directly attaching this issue to its preservation of national security. Domestically, the federal government does pre-study and publishes reports in advance of further action, such as the report on Research and Development Priorities for American Leadership in Wireless Communications and the report on Emerging Technologies and Their Expected Impact on Non-Federal Spectrum Demand. (White House 2019) Besides, in pursuit of the National Spectrum Strategy, Washington emphasizes independence in terms of the frequency spectrum, stating that “access to spectrum is a critical component of the technological capabilities that enable economic activity and protect national security". (White House 2018)

At the international level, Washington has taken a tough line against China—one of its most competent rivals in the field of ICTs. In addition to focusing on the exploitation of different spectrum from China, the U.S. also chose to ban Huawei, China's leading ICTs solution supplier, from entering the U.S. market. As Washington puts pressure onto them,

Australia, New Zealand, Japan, the Czech Republic, etc., have also imposed restrictions on the use of Huawei 5G solutions. (Kaska, Beckvard and Minárik 2019)

II. France

The French government announced to spend 500 million euros on promoting the digital transformation of the French industry and enhancing the global competitiveness of the French industry. (Gong 2018) Since the inauguration of President Macron of France, France has accelerated the pace of industrial digital transformation. Various investment plans are inclined to this field, providing financial and policy convenience, hoping to seize the digital opportunity and revive the industry of France.

France had planned to start deploying 5G technology in January 2020, but due to the divergence between government and telecom operators, the auction of 5G spectrums was postponed, thus delaying the commercial launch of 5G in France for three months. (Yicai 2019) Compared with other European countries, the French government offers operators relatively lenient terms. However, although France has explored 5G, compared with the United States and China, the number and scale of research and development of 5G projects in France are slightly insufficient because France devoted most of the expenditure on 5G theoretical research so that France slightly lacks in the application.

In May 2016, the French government made a periodic inventory of the implementation. It is called the “New Industrial France” strategy, and it would last nearly three years, proposed to optimize the layout further and increase investment in the area of the smart sustainable city. (Digital technology industry will meet the outbreak period 2017) In this strategy, the French government proposed to drive industry transformation and to achieve upgrading through innovation and formulated 34 specific industrial development plans. After the launch of the “Future Industry” plan, the “New Industry France” strategy quickly moved into the second stage. The adjusted overall layout of French “Reindustrialization” obtains nine industrial solutions, including data economy, intelligent IoT, digital security, intelligent diet, new energy, sustainable city, ecological travel, future transportation, future medicine, and other nine fields.

III. China

Currently, China's proportion of optical fiber broadband network and 4G network scale are of top-level in the world, with an Internet penetration rate of more than 70 percent. (Cyberspace Administration of China 2017) China is playing an active role in bridging the digital divide at home and abroad.

Unlike the U.S., Beijing adopts a “Chinese mode,” which puts more emphasis on the function of government instead of the market during the process of developing ICTs. Therefore, the ICT development plan is naturally integrated into the national goal of

eliminating poverty. These two aspects became even more significant as they combined together, with one boosting the other—the construction of ICT infrastructure in poverty-stricken areas can contribute a lot to local economic, educational, agricultural and medical development while such infrastructure construction will also bridge the digital divide and lay a solid foundation for ICT development. Led and coordinated by the Office of the Central Cyberspace Affairs Commission, China's departments are jointly promoting the implementation of five network poverty-alleviation projects: network coverage, rural e-commerce, network intelligence support, information service, and network public welfare. (Office of the Central Cyberspace Affairs Commission 2019)

China also seeks to help eliminate the international digital divide. For one thing, what China, the largest developing country, is doing to bridge its domestic digital divide will serve as an important reference for other countries in the world. President of China-EU Digital Association claimed that the Chinese mode of deploying a unified optical fiber network in rural areas by the government and making it accessible to all telecom operators afterward is worth referring to in other countries. (Office of the Central Cyberspace Affairs Commission 2017) For another thing, Chinese companies have been providing practical assistance for African developing countries, which helps create digital opportunities for them. Huawei, for example, offered Zambia a cutting-edge Global System for Mobile Communications – Railway solution, which can improve operational efficiency and boost economy along the line, to reinvent one of its railway lines into the first one in Africa that complies with the European Train Control System Level 3 standard. (Huawei 2016)

China is making proactive preparation for construction of SSCs. Early-stage exploration and experiments are happening in several relatively advanced cities and provinces. For instance, Tianjin, which has accelerated its pace of scientific and technological innovation in recent years, is attempting to drive its industry to the high end by advancing intelligent technology including face recognition, underwater intelligent robot, visual fire protection system, unmanned aerial vehicle, quantum communication, etc. (Xinhua Net 2019) Moreover, the government-oriented ICT infrastructure construction—the very basis of network application—in backward areas will also have a far-reaching positive impact on the construction of SSCs in China.

IV. Japan

Japan vigorously promotes the development of the digital technology industry. At the end of 2016, the Ministry of economy and industry of Japan announced plans to spend 19.5 billion yen to support digital scientific and technological research, build the fastest supercomputer in the world, so as to establish a research platform for Japanese manufacturers, help them develop and improve driverless cars, robots, and medical diagnosis services, and keep them in many electronic fields. (Digital technology industry will meet the outbreak period 2017) With 17.4 sites per ten thousand people, Japan is leading the world in terms of telecommunication infrastructure and internet networks. (Deloitte 2019)

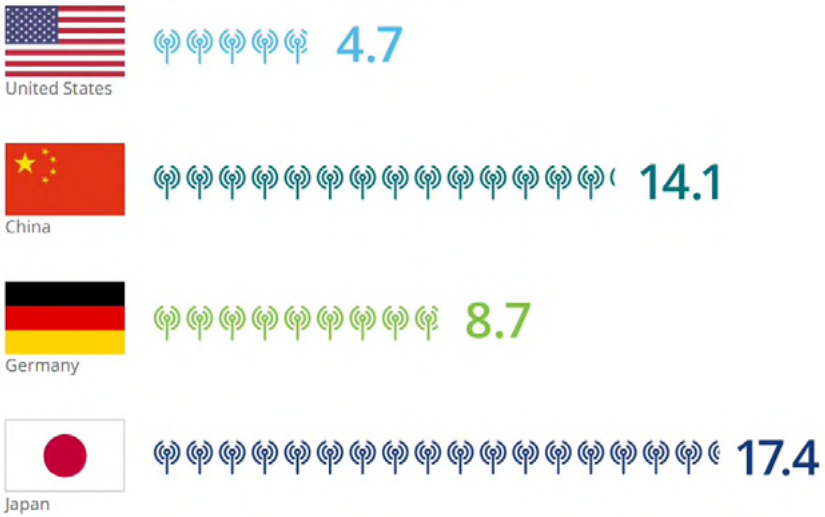

Figure 5: Signal Stations per 10,000 People (Deloitte 2019)

As a close ally of the United States, Japan tends to act correspondingly with the United States. Japan's telecom regulatory body has imposed a 5G prohibition on Chinese vendors like Huawei and ZTE. (Kapko 2019) Japan's large wireless operators have all turn to other alternatives; even many of them have conducted numerous trials with Huawei. (Kapko 2019) The fact is that Huawei almost engaged in 80% of the mobile industrial activities of Japan. (Kapko 2019) Chinese companies have won a significant market share in Japan, which is almost impossible to cut off overnight.

Japan launched the "I-Japan smart Japan strategy 2015" in 2009, aiming to integrate digital information technology into every corner of production and life. The main focus of the "I-Japan" strategy is aiming at three aspects, which are e-governance, medical and health information services, education, and talent training. (RFID Headlines 2016) Because of the living environment, cultural tradition, social pressure, and other factors, Japan has a strong sense of crisis, and this sense has affected Japan to pay more attention to energy utilization and residents' life in the process of smart city construction. In general, the theme of smart city construction in Japan is "low carbon" energy conservation and emission reduction.

V. Kenya

Digital divide is clearly a serious issue for African countries. Africa is the world's poorest region and, African countries, especially countries in Sub-Saharan Africa, are left far behind by the rest of the world in terms of the development of ICTs. Digital divide exists between African countries and other countries in the world, between countries in sub-Saharan Africa and those in North Africa, as well as between different areas at the domestic level.

One of the major obstacles standing in the way of bridging digital divide in Africa is the poor infrastructure here. Attracting foreign investment has become an important approach for African countries to meet the needs of the computer industry, software development, and the Internet service industry, all of which share a common core—digital technology. (Ministry of Commerce of the People's Republic of China 2012) For example, in Kenya, a sub-Saharan African country with a moderately good economic base, extremely rare in this region, projects to bridge digital divide are often carried out by foreign partners, such as the Digi-Truck project to provide digital skills training to rural and remote communities in Kenya co-implemented by Huawei and a Belgian nonprofit organization Close the Gap, (Huawei 2019) and the Digital Literacy Project which provided one million tablets to primary schools co-launched by Nokia and UNICEF. (Nokia 2019)

Exactly due to the lack of ICT infrastructure, many African countries are paying more attention to infrastructure construction rather than further policymaking and legislation of 5G technology development and application at the present stage.

VI. Brazil

Brazil possesses relatively advanced ICTs compared to other South American countries. The digital divide, though still exists, is narrowing, leaving the Brazilian government more human and financial resources to develop its 5G technology and to start its construction of SSCs.

Vigorously promoting the development of R&D, Brazil is now among the world's ITCs leaders. It is reported that Brazil, by signing a partnership agreement with the EU, the U.S., South Korea, Japan, and China to develop 5G platform, has become the sixth country to join the decision-making body that decides how 5G technology will operate in the world, from research to standardization and platform implementation. (Presidency of the Republic of Brazil 2017)

Apart from the field of 5G technology, Brazil is also at the leading edge of SSCs construction. São Paulo, Brazil's largest country, has developed an approach to predict air quality via AI and Big Data analysis, which can help calculate the pollution level one to two days in advance. With such a method, it becomes much easier and more convenient for policy-makers, municipalities, and governments to take action to prevent related diseases and death. (ITU 2019) Hopefully, this air quality prediction system, which marks the start of SSCs exploration of Brazil, will serve as a model for smart solutions to other aspects of urban life for Brazil and for the world.

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