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Global views on ICT-enabled business and its impact on the economy:

Development opportunities of digital transformation in beyond 5G era

Akihiko SHINOZAKI

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Akihiko SHINOZAKI[2]

Abstract

This proceeding has been prepared as a keynote address at the International Forum being organized by the Taiwan Communication Society on November 18, 2021. The speech addresses two aspects of the digital economy, *digital dividends* and *analog complements*, and indicates the importance of human networks on top of ICT networks. The speech comprises three topics. First, it demonstrates the dynamic changes in the global community driven by the rapid spread of digital technology and its power to create earning opportunities for developing countries, that is, *digital dividends*. One typical case represents India, where ICT-enabled offshoring has been successful, with active cross-border movement of human resources. Second, it considers the importance of *analog complements*, that is, a wide range of institutional reforms that include education and training to improve the skills of human resources to achieve a prosperous digital economy. It also considers the critical role of global coordination led by major international frameworks, such as APEC + India, for a desired digital economy. Third, it shares the Japanese government's ICT policy geared toward the 2030s, the "Beyond 5G Promotion Strategy," as well as the basic principles and background of recent policies. These topics are selected to encourage insightful discussions among participants and to assist in reshaping a multilateral partnership toward a promising digital economy leveraged by ICT-enabled businesses.

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Keywords: Digital Economy, Digital Dividends, Analog Complements, Offshoring, Cross-border Human Network, APEC, Global Partnership, Beyond 5G

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[2] Professor, Faculty of Economics, Kyushu University, Japan. Senior Research Fellow, The Economic and Social Research Institute, Cabinet Office, Government of Japan.

Global views on ICT-enabled business and its impact on the economy:

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Akihiko SHINOZAKI

1. Introduction

It is my great pleasure to be with you this afternoon and to share my presentation about the global view of the digital economy, entitled "ICT-enabled business and its impact on the global communities: Development opportunities of digital transformation in beyond 5G era."

Today, I will talk on three topics of the digital economy. The first, "digital dividends," represents broader development benefits from innovation in information and communication technology (ICT). This technology generates a variety of ICT-enabled businesses. I would like to explain one of the symbolic businesses, that is, India's offshoring, which has reshaped the international service trade in the 21st century. The second topic, "analog complements," represents challenges that must be addressed to reap the full benefit of ICT by maximizing digital dividends. Analog complements include training and education for human resource development, as well as institutional reforms such as the reshaping of regulations and competition policies, which involve both domestic reforms and international corporations. The third topic is "the Japanese government's ICT policy" toward the 2030s and the principle it is based on. I would like to provide a brief on the "Beyond 5G Promotion Strategy" and the background of the government's recognition of the Japanese economic situation over the last three decades.

Before discussing the details, I would like to underline two aspects of the digital economy: *digital dividends* and *analog complements*. Digital dividends are the benefits of *using* digital technologies, which creates a variety of ICT-enabled businesses and consequent global earning opportunities, not only in developed countries and regions but also developing ones. In contrast, analog complements are never technology itself or digital in nature but have a significant role in using technology effectively and in achieving the maximum benefits of digital technology.

2. Digital dividends

2-1. Dynamic changes in the global community

2-1-1. Global views in 1995

To begin with, I would like to present to the global community several figures that represent dynamic changes in the world over the past decades, since the mid-1990s. The driving force behind these powerful changes is the rapid spread of ICT, which has shaped

the global digital economy.

Figure 1 clearly demonstrates the global situation as of 1995, approximately a quarter of a century ago. The chart shows the relationship between income level (GDP per capita) on the horizontal axis, and coverage population (percentage of population) on the vertical axis in terms of fixed-line telephones (green dots), mobile phones (blue crosses), and the Internet (red triangles). In 1995, more than a hundred years had passed since the invention of practical telephony by Alexander Graham Bell, and the fixed-line telephone was the dominant communication technology in the world.

More importantly, the linear relationship between GDP per capita and fixed-line coverage in 1995 is very clear. This indicates that the higher an individual's income, the greater their access to technology. This fact points to developed countries having had a distinct advantage in terms of technology at the time.

2-1-2. Global views at the turn of the millennium

With the change of the millennium, five years later, the mobile phone started to take off, catching up with fixed-line telephones, followed closely by the development of the Internet (Fig. 2). Despite this change, the linear relationship remained, indicating that higher-income countries had an advantage in terms of technology, with the income of a country showing a direct correlation to their technological advancement.

For this reason, the international community was afraid of the "*digital divide*," which could expand the existing gap between developed and developing countries, or the "*haves*" and "*have nots*." However, the picture has changed dramatically since the mid-2000s. Please carefully note the next three slides.

2-1-3. Global views since the mid-2000s

In 2005, mobile phone development overtook other technologies, and in 2010, the advancement of the mobile phone, followed by the internet, was highlighted more clearly, overtaking the fixed-line telephone. The last figure shows that mobile technology had spread evenly throughout the world by 2015 (Fig. 3, 4, and 5).

This indicates that these innovations reached billions of people in just ten years. Human history has never experienced such a rapid spread of a brand-new technology. These slides illustrate what we have experienced over the past decade.

2-2. From digital *divide* to digital *dividends*

2-2-1. Digital divide: "beginning to close"

What was the turning point, exactly, in the bridging of the digital divide? To identify the year when the global spread of mobile technology began to accelerate, we conducted a statistical breakpoint analysis in 178 countries and regions and classified them into six groups: advanced economies (orange dots), BRICS (light green), ASEAN (dark green), African countries (red), transition economies (pink dots), and others (light blue), as shown

in Figure 6.

Figure 6 indicates that the average or median year of acceleration in advanced economies, including Taiwan, was 1997. Then, BRICS, ASEAN, transition economies, and African countries followed, with average or median acceleration years ranging from 2002 to 2005. Overall, the mid-2000s was the turning point in terms of the global spread of mobile phones.

Thus, Dr. Jeffery Sacks, professor at Colombia University and former Advisor to Secretaries-General of the United Nations for the Millennium Development Goals Project, declared in 2008 that "the digital divide is beginning to close."[3] He also wrote that "extreme poverty is almost synonymous with extreme isolation, especially rural isolation. But mobile phones and wireless Internet end isolation, and they are already proving to be the most transformative technology of economic development of our time."

This is what we have experienced over the past decades. We can now say that since the mid-2000s, the global community has experienced dynamic changes powered by new technology for the first time in history. The trend of these changes is still continuing and even accelerating.

2-2-2. User-side innovation

Due to rapid technological progress and global expansion, the international community receives vast digital *dividends* instead of a digital *divide*. Digital dividends refer to the benefits of *using* digital technologies, which are *user-side* innovations, rather than producer-side ones. For example, farmers, fisherfolk, and nomadic traders in rural areas can use mobile technology in innovative ways, such as for obtaining weather information concerning the best timing for planting, fertilizing, or harvesting, and checking the prices of their products to discover the best marketplace *before* they travel to sell their fish or livestock (Fig. 7).

This is but one example of the changes brought about by technology that provides billions of people in developing countries with *inclusion in the market economy*. One of the typical areas is *financial inclusion*, brought about by developments like mobile payment such as M-Pesa, which was launched in Kenya in 2007.

2-2-3. Creation of the cross-border human networks

Besides mobile payments, many other ICT-based new businesses have emerged, such as crowdsourcing, ride-sharing, online vacation rentals, and a wide variety of delivery services. These are known as "ICT-enabled" *user-side* new businesses.

Until the end of the 1990s, innovation was contained within the limited area of developed nations. Since the 2000s, however, innovation has become ubiquitous in the global community. Accordingly, we can see two types of global momentums: the

[3] See Sachs (2008).

deployment of 1) advanced ICT networks and 2) cross-border movement of human resources, or human networks. Although the COVID-19 pandemic has disrupted physical movement, the cross-border human network has become stronger, with a massive exchange of information.

Thus, it is assumed that once we recover from the pandemic, cross-border movement of human resources will resume and make the creative human network more powerful alongside ICT innovation.

2-3. Emerging offshoring business

2-3-1. Services: from non-tradable to tradable

One of the symbolic cases, in terms of ICT-enabled businesses leveraged by both information networks and cross-border human networks is the offshoring between the United States and India, which has encouraged economic development in India and has reshaped the international service trade in the 21st century.

According to UNCTAD (2009), offshoring is a cross-border service trade that is categorized into two types of businesses (Fig. 8). One is the ICT business, such as programming, software development, and data processing. The other is ICT-enabled services, such as call centers, customer contact, financial analysis, accounting, R&D, and a variety of knowledge-based services in back-office jobs.

Traditionally, physical products of goods only dominate international trade because non-physical services are mainly on-site businesses, such as face-to-face transactions. Therefore, services are considered to be non-tradable businesses.

However, ICT made certain types of service transactions tradable. The emergence of offshoring represents a new type of international trade, along with the global spread of ICT.

2-3-2. Expansion of the world's largest service market

International services trade with the United States, the world's largest services importer, expanded 2.5 times from $193 billion in 1999 to $489 billion in 2015, only to be interrupted by a decline in the late 2000s due to the global financial crisis triggered by the Lehman Brothers bankruptcy (Fig. 9).

The growth momentum was especially strong in the offshoring segment, which includes business, professional, and technical services, such as for computers and data processing. The segment grew by 3.6 times, from $37 billion in 1999 to $136 billion in 2015, without any decline, even during the financial crisis. By 2008, the volume of the offshoring segment exceeded traditional service trades such as cargo and transportation, travel, and financial and insurance services.

Consequently, the segment accounted for 27.8% of the total services imported to the United States in 2015 and exceeded travel services (23.1%), cargo and transportation services (19.9%), and financial and insurance services (14.9%).

2-3-3. Emergence of India as a leading service provider

During the strong growth of offshoring segment, India emerged as a leading service trade partner of the United States. It ranked below the top twenty largest service providers in 1999 and progressed to the tenth and sixth positions by 2008 and 2015, respectively. With this dynamic change, the volume of India's exports of services to the United States increased by more than 17 times, from $1.4 billion to $24.7 billion (Fig. 10).

As is well known, China is the world's largest provider of ICT-related products, both goods and services (Fig 11). It produces $2,076 billion, followed by the United States ($1,921billion) and Japan ($602 billion). However, focusing on the ratio of value-added to total production, China represents 25.7%, just half or less than half the United States (58.9%) and Japan (49.0%).

In contrast, India is responsible for 70.3% of the value-added to total production ratio, which is increasing, whereas it is decreasing in China. India has thus emerged as one of the most competent and promising ICT service providers in the world.

One of the driving forces that made India a major service provider was the Y2K (the year 2000) programming issue at the turn of the millennium. A former CEO of Tata Consultancy Services, India's largest information service company, stated that the "Y2K problem created an enormous opportunity for us to scale up our operations."[4]

3. Analysis of offshoring

3-1. Economic puzzle in offshoring

3-1-1. Puzzle in previous economic studies

Thus far, the offshoring story seems quite a happy one in terms of both expansion of international service trade and the development of the Indian economy. However, from the economics viewpoint, the story is quite confusing, as previous studies reveal three contradictions.

The first is the geographical distance. Some empirical studies, such as that of Van der Marel and Shepherd (2013), indicate that geographical distance has a negative impact on service trade. The second factor is income level. Traditionally, the international service trade was considered intensive among high-income countries because the volume and variety of services expand, in terms of both demand and supply, as the economy develops. Kimura and Lee (2006) estimate a gravity equation model and find that per capita income shows a statistically positive effect on the growth of service trade.

These studies suggest that both geographical distance and income disparity negatively affect the growth of service trade between the United States and India. For example, India is located at a considerable distance from the United States geographically. Likewise, the income disparity between the United States and India remains extremely

[4] Ramadorai (2013), p. 95.

large. India's per-capita income was only $1,640 in 2015, whereas that of the United States was $56,770, thirty times more than that of India.

3-1-2. Puzzle in the development path

The third contradiction is the development path. Traditional development theories adopted Petty–Clark's law, explaining major productivity shifts sequentially from agriculture to manufacturing, and then to services.

The United States is a typical case, which progressed "from the Industrial into the Information Age in the last decade of the twentieth century."[5] Likewise, the concepts of the "flying geese" or "catching-up" model are familiar in international trade theories[6], from which service trades were considered intensive among advanced economies.

India's development path, however, seems to be quite different. Farmers still comprise the majority of India's population. The percentage share of agricultural workers was 54.6%. However, ICT-enabled businesses in the high-tech service sector are still prosperous. India has leapfrogged straight from an agriculture-centric economy to the software-intensive Information Age, and somehow bypassed the manufacturing-based industrial age.[7] Therefore, previous studies and traditional theories do not sufficiently capture and describe the growth of India's offshoring.

3-1-3. Key factors to solve the puzzles

One of the key factors that solve these puzzles is active human networks in high-tech business communities between the United States and India. Several case studies on offshoring refer to the importance of cross-border human networks on top of ICT networks.

In other words, higher-skilled Indian engineers and experts played a vital role in the fast growth of high-tech firms in the United States, such as Microsoft, IBM, Intel, and in particular, many other start-ups in the Silicon Valley.[8] Foreign engineers usually require H-1B or L-1 visas, which are non-immigrant visa categories for workers in specialty occupations. Offshoring business models, therefore, rely heavily on H-1B and L-1 visas.[9]

Therefore, we need to employ a new analytical framework that incorporates the cross-border movement of human resources, or cross-border human networks, in addition to ICT networks.

With this background, we employ "network theory" as the analytical framework with

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[5] Chandler (2000), p. 3.
[6] See Kojima (2000)
[7] Fong (2009) provides a comprehensive review of leapfrogging development and Singh (1999) adopts this view to illustrate the Indian telecommunication industry.
[8] See JETRO (2008) and Atkinson (2004).
[9] See Kirkegaard (2005) and Economic Policy Institute (2016). In addition, English is a common language in India's advanced education and Indian students consider math and algebra to be promising subjects, which creates favorable conditions for business with the U.S. (Blinder (2006)).

a specific focus on cross-border networks of skilled labor as well as information networks to examine the rapid expansion of offshoring according to the concept of "leapfrogging" development.

3-2. Offshoring based on network theory

3-2-1. Key concepts

The key concepts of network theory are based on three items: regular network, small-world network, and multi-level network. A regular network has highly ordered and proximity-based features in its structure, whereas a small-world network has a few random links to a distant node via re-wiring of the regular network (Fig. 12).

In general, individuals and organizations create a regular network based on proximity, with limited and close links to each other. If they randomly rewire some of their links to a distant node, they can create a small world. In other words, re-wiring provides a proximity effect between distant nodes, which leverages and revitalizes the entire network. The critical question is what is the trigger for re-wiring? We pay special attention to the cross-border movement of skilled labor.

The third key concept is multi-level network. The economy consists of several layers of networks, such as personal networks like friendships, organizational networks like relations between companies, and cross-country networks such as international trade. These networks sometimes affect each other across different layers.

For example, personal-level relations influence those of the affiliated organization or country; likewise, a country- or organizational-level relationship influences individual-level behavior and performance.[10]

3-2-2. Offshoring based on the key concepts

These three concepts are useful in analyzing offshoring such that a large number of H1-B and L-1 visa holders—or competent students, professionals, and technical experts—emigrate to the United States from their home countries. This is a trigger for re-wiring. Then, they create a small-world network by joining U.S. multinational companies or starting up their own businesses, consequently creating cross-border business networks between the countries.

Finally, these networks trigger service trade expansion between their countries and the United States at the national level. Thus, we can now see the interaction between the different layers of networks, that is, multi-level network. (Fig.13)

Thus, adopting network theory, a small world is understood to be generated by cross-border human networks of skilled labor in addition to global ICT networks even though there are large geographical distances and huge income discrepancies.

[10] See Hitt et al. (2007).

3-3. Empirical analysis of offshoring

3-3-1. Model and methodology

Based on network theory, we adopt the following model (1) to conduct two types of empirical analysis. The first is a panel data analysis to clarify the factors that determine the expansion of service trade. Then, we conducted a graphical modeling analysis to illustrate the transformation path for the expansion of international service trade and the consequent leapfrogging development.

$$usaimp_{ij} = C + \beta_1 visa_{ij} + \beta_2 networkreadiness_{ij} + \beta_3 nipercap_{ij} + \beta_4 \textit{englishdummy}_{ij} \ \ldots (1)$$

[Note] *usaimp*: service export to the United States, *visa*: number of H-1B & L-1 visas issued, *networkreadiness*: Network readiness index, *nipercap*: GNI per-capita, *englishdummy*: English proficiency factor (official language dummy), *i*: from 1999 to 2015, *j*: 31 countries (United States*, Canada*, Mexico*, Brazil, Argentina, Chile*, Ireland*, United Kingdom*, Italy*, Netherlands*, Switzerland*, Sweden*, Spain*, Germany*, Norway*, France*, Belgium*, Japan*, Australia*, New Zealand*, Singapore, Hon Kong, South Korea*, Indonesia, Thailand, Philippines, Malaysia, China, India, Israel*, South Africa) *: OECD member countries. The sources of the dataset in this study are shown in Figure 14.

3-3-2. Results of the analysis

As Figure 15 shows, the results of the panel data analysis demonstrate that skilled labor networks, income level proximity, and ICT networks have shown statistically positive effects on the expansion of service trade to the United States in the 21st century. *After* the financial crisis in 2008, skilled labor networks and ICT networks had a more powerful impact on the service trade to the United States. In contrast, income level proximity has less impact on the service trade to the United States.

Figure 16 illustrates the results of the graphical modeling analysis with the results of the panel data analysis. It clarifies that *before* 2008, high-income countries had a direct impact on the service trade to the United States whereas skilled labor in low-income countries desired H-1B or L-1 visas that generated re-wiring effects and shaped “small world network,” promoting service trade to the United States.

Before 2008, ICT networks were closely associated with income levels and had an indirect impact on the services trade to the United States. However, these relations transformed *after* 2008. Income proximity has no direct impact on the services trade to the United States, whereas ICT networks, as well as skilled labor networks, displayed more direct and bigger impacts *after* 2008.

3-3-3. Implications of the analysis

Our analysis has three implications. First, although high-income nations have

traditionally had stronger service trade links with the United States, our study clarifies how these trade links have recently changed.

Second, we show that cross-border human networks of skilled labor, as well as ICT networks, become more significant driving forces to expand international service trade. Therefore, the services trade model needs to account for the movement of labor.

Third, our analysis shows that policymakers need to recognize the importance of cross-border human networks of skilled labor in addition to ICT networks to promote economic growth and development.

4. Analog complements

4-1. Digital dividends and analog complements

4-1-1. Earning opportunities with ICT-enabled new biz

Offshoring is just one story of digital dividends. We can also see a variety of *digital dividends* driven by ICT-enabled businesses worldwide. The driving force to generate a new business is the global spread of the *digital platform* where AI, big data, IoT, and various other innovations are systematically accumulating (Fig. 17).

Anyone can use these *digital platforms* anywhere. This business environment creates huge *earning opportunities* for billions of people who have fewer chances to earn, especially those in developing countries and even those in the least-developed countries, such as Sub-Saharan African countries (Fig. 18).

As a result of these earning opportunities, we can observe an increase in GDP per capita or an improvement in living standards. According to a World Bank Report in 2016, a survey in 12 African countries reported that "65% of people believe that their family is better off because they have mobile phones, whereas only 20 percent disagree."[11]

Figure 19 explains this result. The Gini index, a well-known indicator for measuring inequality, demonstrates that per capita GDP or income distribution has improved in the long term and that the improvement trend has accelerated since the mid-2000s, along with the rapid spread of ICTs. These are the facts of *digital dividends*, and they indicate that we must get the most out of technology.

4-1-2. Analog complements

However, this is just one aspect of the digital economy. The other is *analog complements*, which refer to the challenges we face and have to address to reap the full benefit of technology by maximizing *digital dividends*. When referring to *analog*, we must keep in mind the following three points:

First, technology has spread rapidly, which has increased opportunities and *might* boost economic growth, as I mentioned earlier. Second, however, the great spread of technology alone is not sufficient, since all of these positive impacts have fallen short and

[11] See World, Bank (2016), p. 16.

are still in the growing process in order to maximize the benefits to all people. Third, to achieve the desired digital economy, we must recognize the importance of a wide range of institutional changes, which include the following:

- Reforming regulations to ensure fair competition among businesses.
- Reinforcing education and training to improve human resource skills.
- Reshaping the global partnership framework toward a desired digital economy.

These aspects are far removed from the technology itself and are quite *analog*, rather than *digital*. Nevertheless, these concepts have very close ties with each other and are critical for a successful digital economy. Therefore, we must keep in mind that *digital technology* and *analog complements* are two sides of the same coin.

4-2. Institutional changes

4-2-1. Regulation reform

Regulations were the first type of required change. For example, a ride-sharing business like Uber, is not allowed in Japan. Uber-eats is allowed, but driving Uber taxis with ordinary licenses is still illegal. A driver must have a special license, designated as a *taxi driver*. Thus, Uber is no longer a ride-sharing business and is rather just a traditional taxi business.

There seem to be many complicated reasons behind this, one of which is that the traditional taxi business is strongly controlled or somewhat overregulated. Furthermore, existing taxi drivers are afraid that the ride-sharing businesses will be too competitive and render them redundant, meaning that this new business will wipe out their jobs.

Therefore, it is required to transform the regulation, seeking a win–win solution between traditional *offline* or *analog* taxi business and newer ICT-enabled newer *online* or *digital* ride-sharing businesses. We are still struggling with trial-and-error efforts for the best solution.

4-2-2. Education reform

The second analog complement is education. The tension between technology and jobs is a classical and ongoing issue. Technology has surely taken over legacy jobs, resulting in *permanent job losses* rather than *temporary layoffs*. However, new technology puts a premium on certain types of jobs that technology complements rather than substitutes.

Unfortunately, however, it is impossible to anticipate and compile a list of future jobs line by line, particularly because of the rapid changes in digital technology. The solution to this conflict is the continuous upgrading of skills throughout our careers, such as *lifetime education* or *lifelong learning*. Additionally, we should keep in mind that ICT-*enabled* jobs are emerging now and will continue to do so in the future.

There are still many open questions concerning training and education for ICT.

Nevertheless, we can assume that the digital economy requires *creativity*, *teamwork*, and *critical thinking* to produce solutions to social problems. An important fact is that the traditional education system has been slow to respond to this challenge. Therefore, we must *move fast* to reform the education system.

In this context, the COVID-19 pandemic seems to be a significant trigger to *move fast* to provide an online education system, although we are still in the early stages of trial-and-error efforts for the best and brightest education system.

4-2-3. Global partnership with APEC + India

The third and most important analog complement is a global partnership, because the digital economy provides worldwide digital platforms and generates *leapfrogging* development, leveraged by the global spread of knowledge and information.

When knowledge and information spread globally, it promotes *borderless mobility* of not only goods and services, but also businesses, capital, and even cross-border movement of human resources, as previously mentioned.

Because digital platforms are shared globally, it is impossible for each country or small groups like the G7 to address all the issues, which include digital taxation, privacy protection, intellectual property, AI ethics, big data handling rules, algorithm openness, cyber security, and even national security, among others. Therefore, we must seek an alternative, inclusive rather than an exclusive approach, to global partnerships.

I believe APEC + India, or what I call "IPEC (Indo-Pacific Economic Cooperation)" could be a great platform to address these challenges, since "Free and Open Indo-Pacific" is a key concept in the global community. APEC + India consists of major emerging and developing economies, as well as developed economies.

Since APEC + India, or "IPEC," represents a wide range of economies in terms of income level and coverage populations of technology (Fig. 20), it plays an important role in bringing the global community together in seeking a prosperous digital economy with desirable *analog complements*.

4-3. Japan's ICT strategy toward the 2030s

4-3-1. Background and fundamental recognition of the policy

Before concluding this presentation, let me share the Japanese government's ICT policy moving toward the 2030s. One of them is "Beyond 5G Promotion Strategy: Roadmap toward 6G," released in June 2020.

A background of recent government policy derives from the recognition of the Japanese economic slump, which has been well described in the long-term trajectory of East Asian economies since the 1950s. Until 1990, the Japanese economy had been a front runner, followed by the four dragons: Singapore, Hong Kong, Taiwan, and Korea. This trajectory is illustrated as a typical "flying geese development" model (Fig. 21).

However, since the 1990s, when the digital revolution began to take off, the Japanese

economy has entered a long stagnation, whereas Singapore, Hong Kong, Taiwan, and Korea have continued to develop into advanced economies. Consequently, they *leapfrogged* over Japan, and Malaysia, Thailand, China, and Indonesia follow the same development path. The East Asian development trajectory since the 1950s clearly illustrates the changes from "flying geese" development to "leapfrogging" development in the 1990s.

Therefore, the Japanese government's recent ICT policy pays attention not only to ICT business or the industry alone but also macro-economic views to revitalize Japanese society overall. In other words, the world has been changing "fast" but Japan has been "slow to move," which underlies the government's policy as a fundamental recognition.

4-3-2. Society 5.0 and Beyond 5G Promotion Strategy

The key concept of the Japanese government's policy over the last five years, regarding science and technology, has been achieving "Society 5.0." It follows the trajectory of the hunting, agricultural, industrial, and information societies. "Society 5.0" is a human-centered society that balances economic advancement with the resolution of social issues through a highly integrated system of cyberspace and physical space.

Two aspects of global momentum underlie the concept. The first is the rapid deployment of advanced information networks. The other is the worldwide momentum of cross-border movement of human resources.

With this momentum, the economic value of the radio-frequency spectrum has increased because the powerful progress of mobile technology enhances mobility in every aspect, such as vehicles, goods, services, money, information, knowledge, and human resources. With this as a background, "Beyond 5G Promotion Strategy—Roadmap towards 6G" was released in June 2020 to realize vigorous and resilient "Society 5.0" in the 2030s (Fig. 22).

A driving force is the integration of cyber and physical space with an effective combination of AI, big data, and IoT. The government set a midterm target at the OSAKA-KANSAI Expo 2025 as a "Beyond 5G Ready Showcase." A related policy report was released on August 2021. The Ministry of Internal Affairs and Communications (MIC) organized a policy roundtable and held an intensive discussion regarding the spectrum policy in the age of digital transformation.

The report consists of three parts (Fig. 23). The first is current situation where it discusses spectrum allocation, related policies, and challenges. The second is future vision where it notes the effective use of spectrum and its goals in the age of digital transformation. The third is required policy to achieve the desired society in the age of digital transformation.

One of the goals is to develop and cultivate a new spectrum, of more than 100 GHz to meet the expanding demand via two policy measurements. The first is effective reallocation of the existing spectrum. The second is intensive investment in R&D for new

spectrum technology and its practical use in collaboration with global partners.

4-3-3. Grab the chance by changing with technology

Unfortunately, the global presence of the Japanese business is small in today's 5G markets in every segment: infrastructure, handset gadgets, software, and services of application. These slumps derive from being "slow to move" toward the new fields, not only in terms of the producer side but also the user side of the technology such as Fintech, ride-sharing, remote work, telemedicine, and every aspect of digital transformation.

Thus, one of the basic principles of the strategy consists of "Global First," which considers the domestic market to be a part of the global market, as well as attracting global talent for the interactive human networks. To this end, the strategy sets priorities and concentrates resources on high-priority measures to effectively promote global collaboration. It also designs ecosystems that drive innovation and encourage free and agile efforts by diverse players.

The strategy follows the prescribed policy concept named "Grab the Chance by Change with Technology," released in August 2018 (Fig. 24). It is well known that Japan has been facing the "quiet crisis": a diminishing demographic trend and an aging society resulting in sluggish economic growth.

To resolve the crisis, the government has established a new strategy, targeting the decade of the 2030s for an improved future. It focuses on *social changes* leveraged by aggressive investment in technology, which we call "Grab the Chance by Change with Technology." The concepts of a desirable future in the 2030s consists of 1) inclusion of diverse individuals, 2) connectivity with local communities, and 3) transformation in business practice (Fig. 25). Thus, the abbreviation ICT also makes reference to these concepts.

4-3-4. Main message: "MOVE FAST" and the Digital Agency

The Japanese government most strongly emphasizes "MOVE FAST." This stands for moonshot, opportunity, value, focus, aggressiveness, super-diversity, and trust (Fig. 26). The main message of the strategy is *moving fast* to change and driving society toward a desired digital economy, where both *analog complements* and digital technology are critical elements.

Briefly, Japan's strategy depends upon recognition of the following facts (Fig. 27). First, we have a huge potential for digital dividends. Second, the driving force behind the chance is, of course, innovation in digital technology. Third, we also need reform concerning analog complements to maximize digital dividends; to reiterate, "grab the chance by change with technology."

One of the symbolic cases is the newly established Digital Agency, which I would like to briefly mention (Fig. 28). The Agency was launched on September 1st this year. The mission is to reform government operations in a user-friendly manner through digital

technology. The existing government's ICT systems lack compatibility and total optimization because they have been invested by each organization separately and developed through complicated and unique customizations in a fragmented manner.

With this background, the Agency seeks benefits for both Japanese citizens and governmental staff through the improvement of productivity in government operations. The Agency sets nine goals, as shown in Figure 29. The budget is about $3.5 billion, and the number of employees is about 600, of which 250 engineers and staff are from the private business sector. This is an unusually large proportion of government organizations.

However, these measures have just started, and details are still unknown regarding the scope of the authority and what the Agency covers, and how it implements its decisions. In short, it is still at an early stage, and the activities would be followed with great interest.

5. Conclusion

To make the digital economy prosperous, we must walk a fine line between 1) ensuring that the potential advantages of digital technologies are accessible and affordable, and 2) facilitating analog complements—such as regulations—to ensure a favorable business climate, strong human capital, and global partnership with the governance of transparency and accountability based on the common value of liberty and democracy (Fig. 30).

With all these factors carried out successfully, dividends could be maximized in the digital economy. Finally, cross-border human networks as well as ICT-networks play a significant role in economic development and APEC + India, or "IPEC" could be an important platform to take the initiative in addressing global challenges and to build a bridge across the global community.

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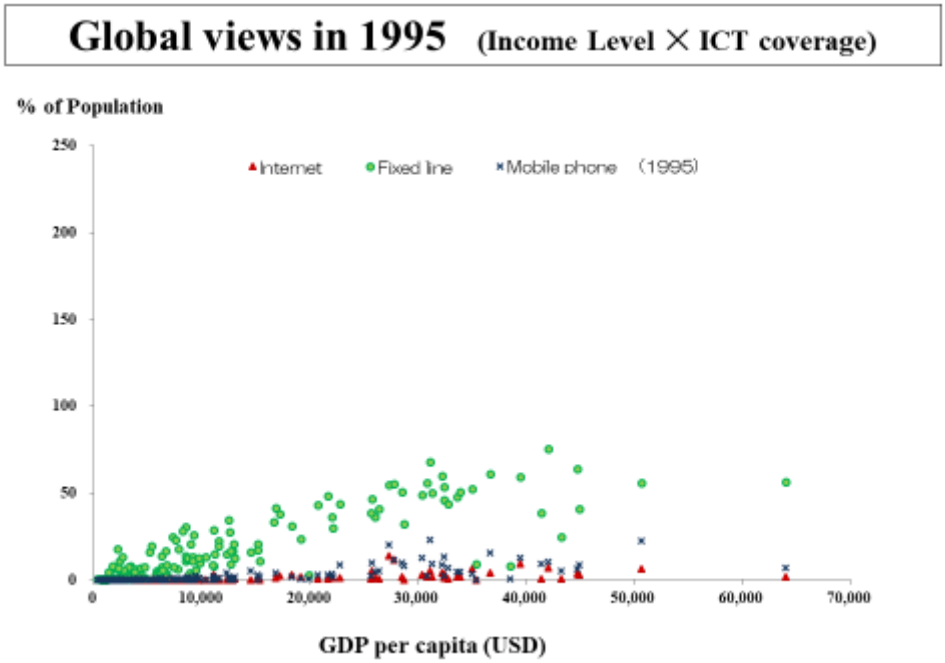
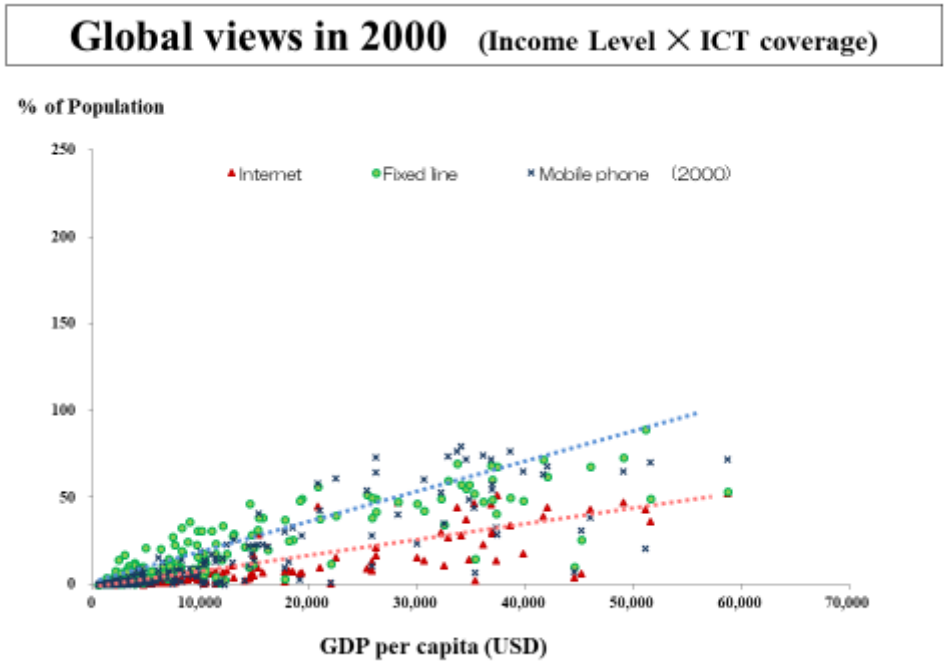
Figures

Figure 1.



（Source）Noguchi, et al.（2018） http://www.icr.co.jp/ICT/index.html#DP

Figure 2.



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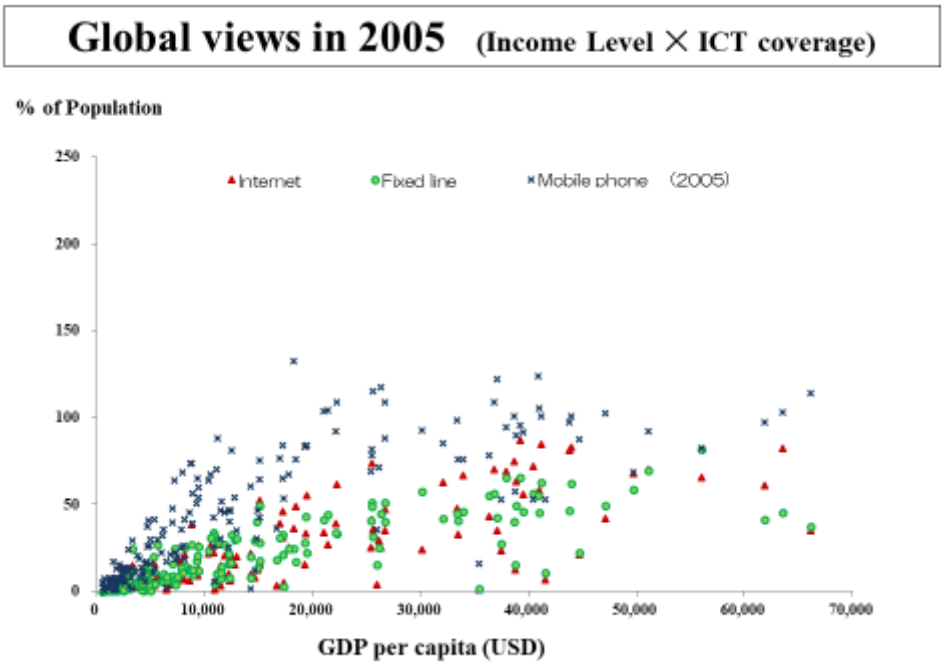

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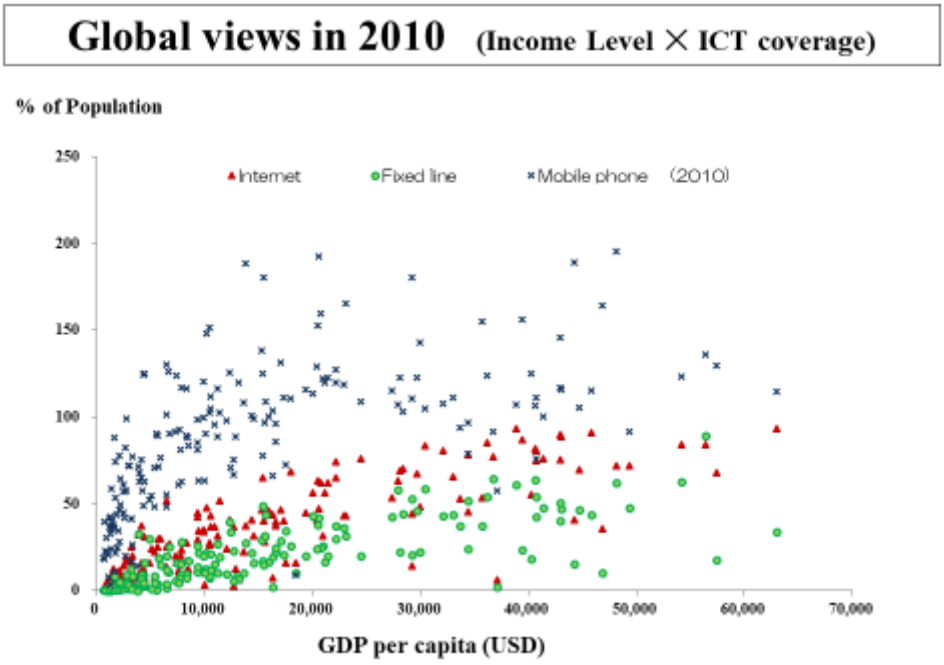

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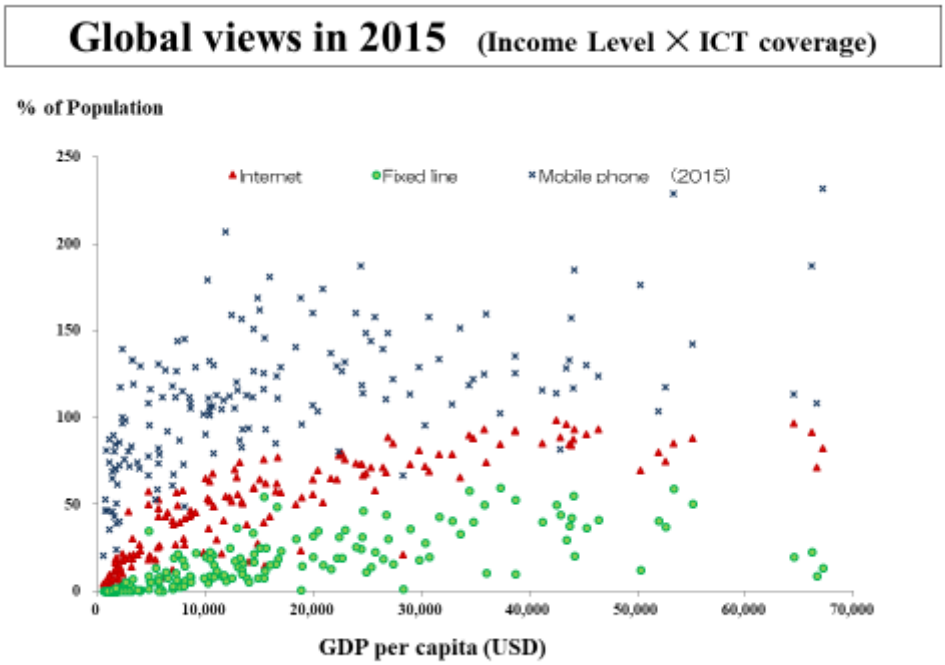

（Source）Noguchi, et al.（2018）　　http://www.icr.co.jp/ICT/index.html#DP

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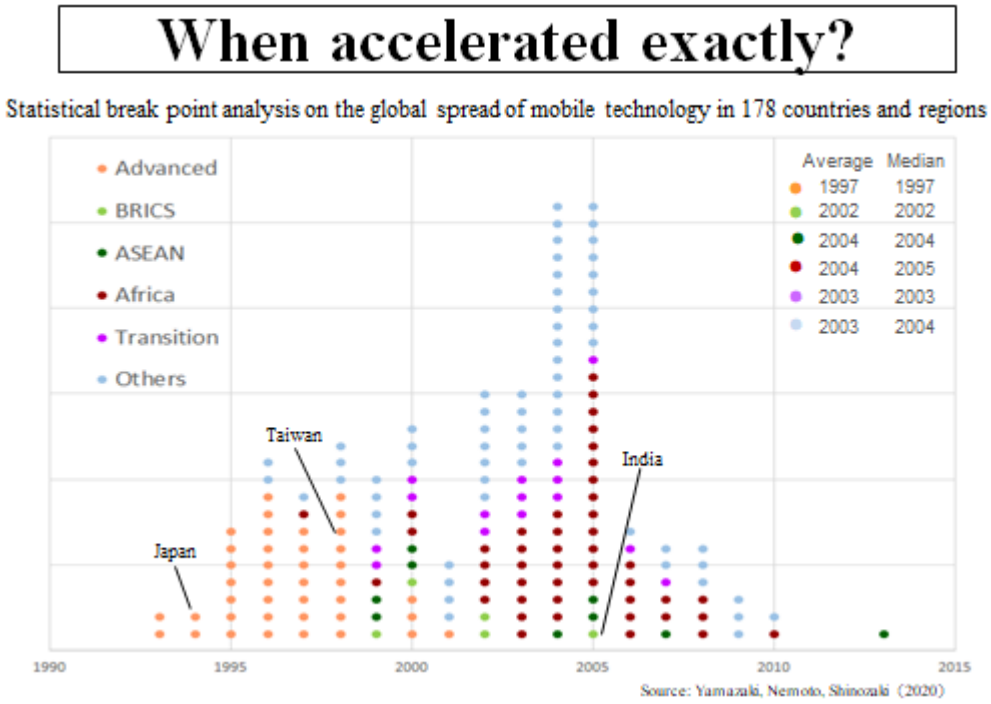


(Source) Yamazaki, et al. (2020)

Figure 7.

Figure 8.

Table III.8. Categories of services affected by offshoring

Service category	Examples of service activities
IT services	Programming, systems integration, application testing, IT infrastructure management and maintenance, IT consulting, software development and implementation services, data processing and database services, IT support services, data warehousing, and content management and development
ICT-enabled services	
Front office services	Call centres and customer contact centres (inbound and outbound)
Back office services	Data entry, human resources, payroll, finance and accounting, procurement, transcription
KPO	Financial analysis, data mining, engineering, research and development, insurance claims processing, architectural design, remote education and publishing, medical diagnostics, journalism

Source: UNCTAD (2009) Information Economy Report 2009, p. 74, Table III.8.

Figure 9.

Telecom, Computer, Information, and Business Service in the U.S. Service Trade [Import]

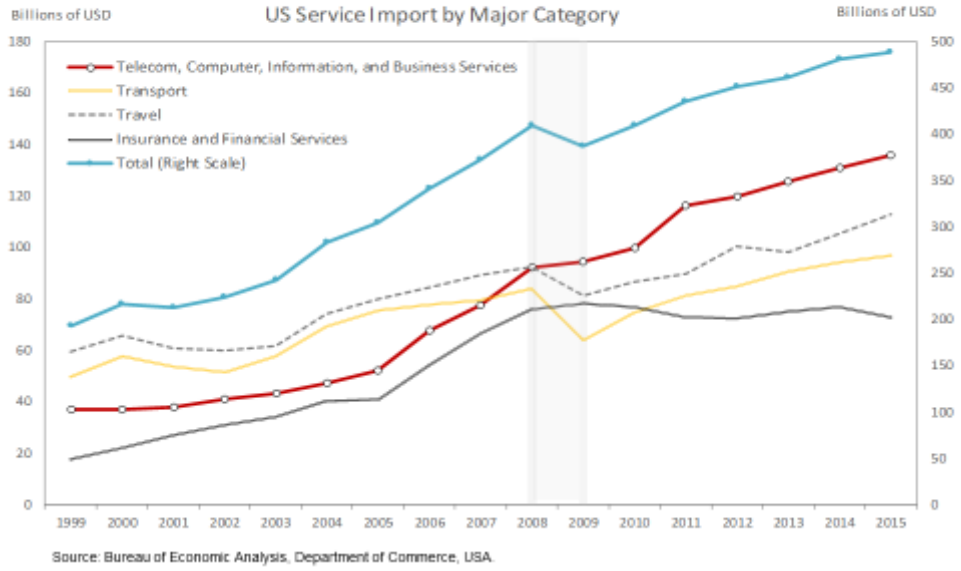


Figure 10.

U.S. Service Import by country

[Millions of dollars]

	1999		2008		2015	
Rank	Country	Imports	Country	Imports	Country	Imports
1	United Kingdom	26,237	United Kingdom	45,259	United Kingdom	52,891
2	Canada	16,598	Germany	33,372	Germany	31,668
3	Japan	15,284	Canada	25,973	Japan	29,411
4	Germany	13,710	Bermuda	24,675	Canada	28,992
5	Mexico	9,688	Japan	24,609	Bermuda	25,051
6	France	7,975	Switzerland	19,274	**India**	**24,693**
7	Italy	5,845	Mexico	15,904	Mexico	21,930
8	Bermuda	5,363	France	15,148	Switzerland	21,323
9	Korea	5,171	Ireland	13,822	France	16,372
10	Netherlands	4,843	**India**	**12,654**	Ireland	15,882
:	:	:				
:	:	:				
:	:	:				
:	:	:				
:	:	:				
21	**India**	**1,439**				

Source: Bureau of Economic Analysis, Department of Commerce, USA.

Figure 11.

India creates outstanding value-added

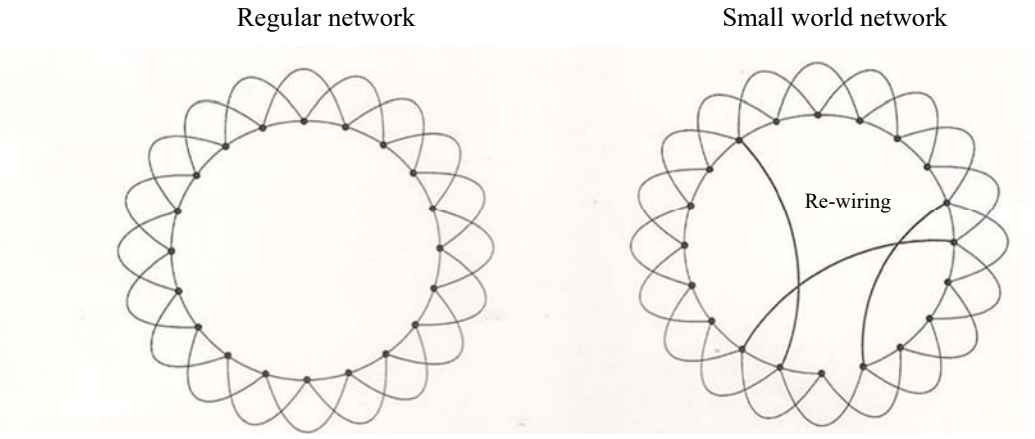
Size of production and value added in ICT industry from WIOD database

as of 2014 (billions of USD, %)

	Production (a)	Value-added (b)	Ratio of value-added (b)/(a)	(b/a in 2000)
1. China	2,076	533	25.7% ↓	(39.0%)
2. USA	1,921	1,132	58.9% ↑	(52.1%)
3. Japan	602	295	49.0% ↓	(53.5%)
:	:	:	:	:
8. Taiwan	232	90	38.9% ↑	(37.8%)
:	:	:	:	:
11. India	147	104	70.3% ↑	(50.2%)

Source：Onozaki(2020) presentation handouts, SSI Annual meeting Session 5, Sept. 5th, 2020.
https://www.icr.co.jp/service/infocom-ict/download/discussion-paper/pdf/2021/DP_16_202101.pdf

Figure 12. Regular and small world networks



Source: Nishiguchi (2009), with some modifications.

Figure 13.

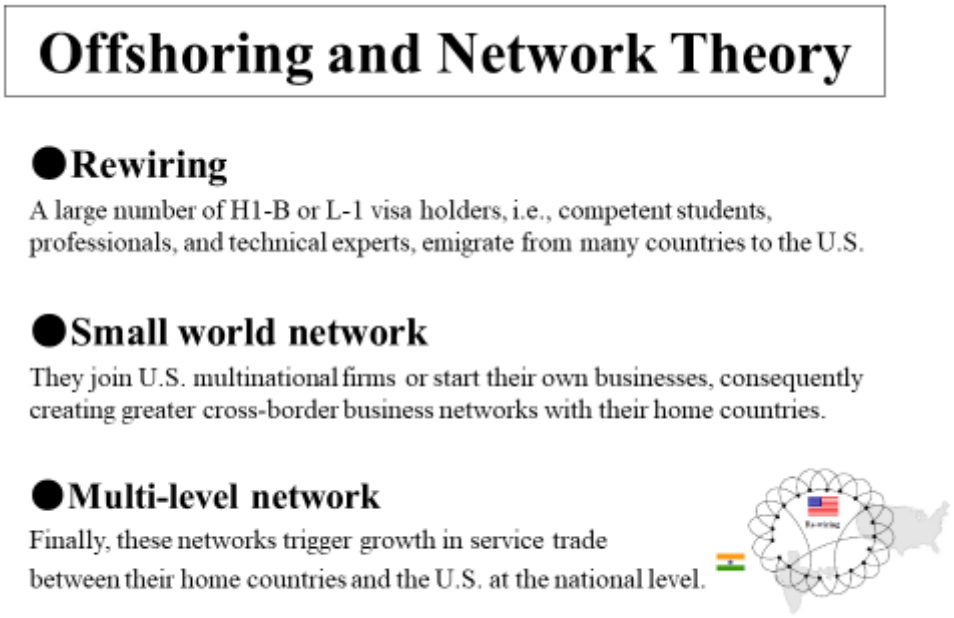


Figure 14. Dataset and Sources

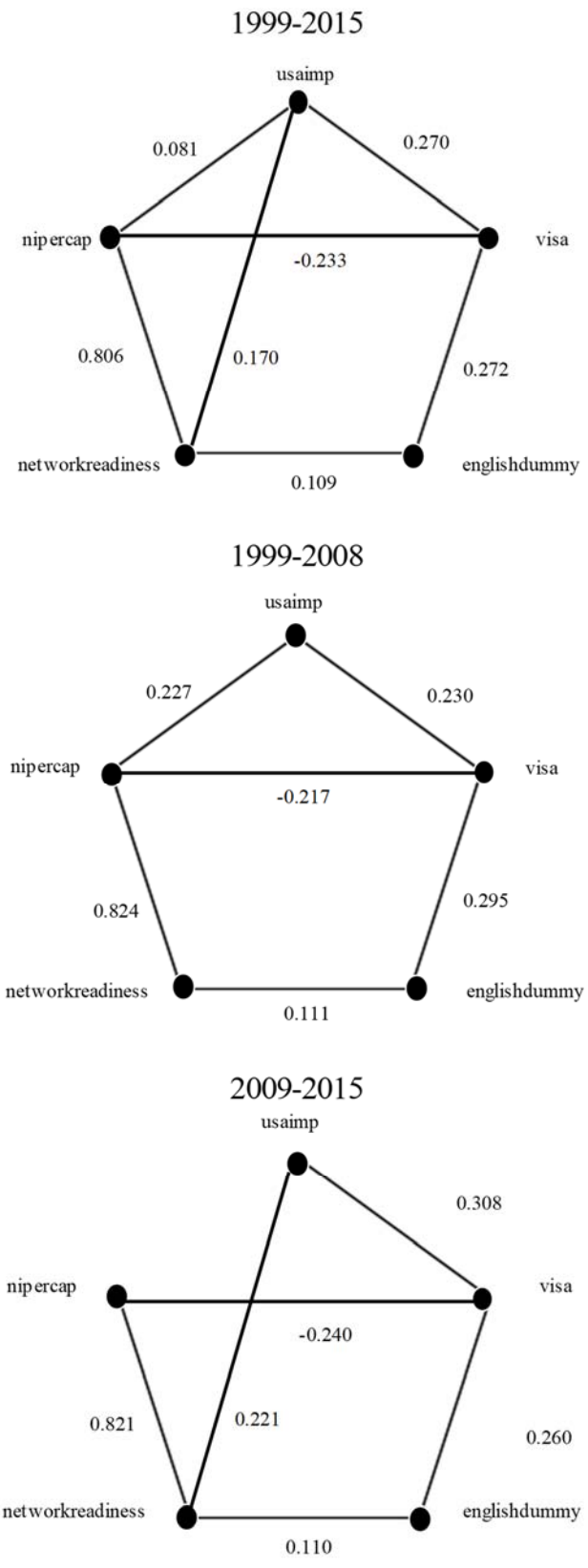
Variable	Abbreviation	Source
Service exports to the U.S. (millions of USD)	usaimp	Service imports from the statistics section of Private Services Trade by Area and Country, International Services, U.S. Department of Commerce, Bureau of Economic Analysis.
Number of H-1B visas issued (person)	visa	H-1B visa from the Visa Statistics, U.S. Department of State, Bureau of Consular Affairs, Nonimmigrant Visa Issuances by Visa Class and by Nationality.
Network readiness index	networkreadiness	Networked Readiness Index from *The Global Information Technology Report* issued by the World Economic Forum.
GNI per-capita (current international dollar: PPP)	nipercap	GNI per capita, PPP (current international $) provided by the World Bank.
English proficiency factor (Dummy variable)	englishdummy	"1" if English is an official or subsidiary official language and "0" otherwise

Figure 15. Results of panel data analysis

	[1999-2015 (*entire period*)]			
	fixed effect model		random effect model	
networkreadiness	2313.37	1830.36	2234.01	1808.40
	[4.085]***	[3.402]***	[3.994]***	[3.414]***
nipercap	0.27	0.28	0.26	0.27
	[11.260]***	[12.380]***	[11.090]***	[12.331]***
englishdummy	0.00	0.00	2091.34	288.51
	[.]	[.]	[0.603]	[0.084]
visa		0.22		0.22
		[7.574]***		[7.799]***
_cons	-9291.58	-8580.74	-9452.44	-8465.53
	[-3.877]***	[-3.791]***	[-3.109]***	[-2.889]***
Adj-R-squared				
within	0.34	0.41	0.34	0.41
between	0.09	0.16	0.11	0.16
overall	0.11	0.18	0.12	0.19
N	490	490	490	490

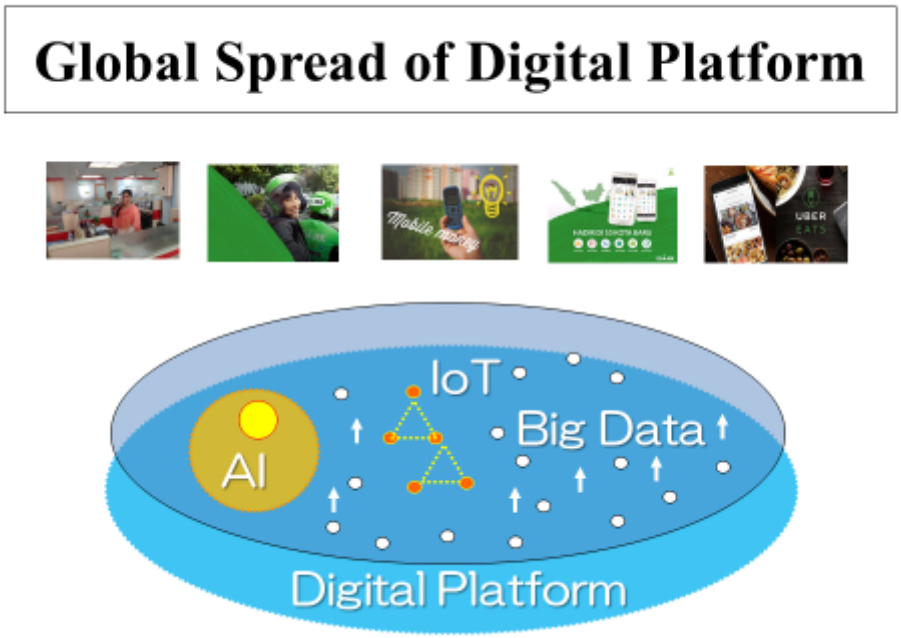
	[1999-2008 (*before*)] random effect model		[2009-2015 (*after*)] random effect model	
networkreadiness	1428.54	1205.43	1047.35	2196.35
	[2.714]***	[2.342]**	[1.321]	[3.235]***
nipercap	0.35	0.36	0.19	0.13
	[10.251]***	[10.764]***	[3.814]***	[3.127]***
englishdummy	1256.05	320.26	3753.76	1437.40
	[0.415]	[0.106]	[0.891]	[0.349]
visa		0.13		0.23
		[3.998]***		[8.320]***
_cons	-7907.95	-7445.78	-1317.59	-5634.25
	[-2.761]***	[-2.648]***	[-0.352]	[-1.659]*
Adj-R-squared				
within	0.36	0.39	0.22	0.46
between	0.13	0.17	0.08	0.17
overall	0.14	0.17	0.08	0.18
N	273	273	186	186

Figure 16. Results of graphical modeling analysis



Note: Figures represent partial correlation coefficient.

Figure 17.



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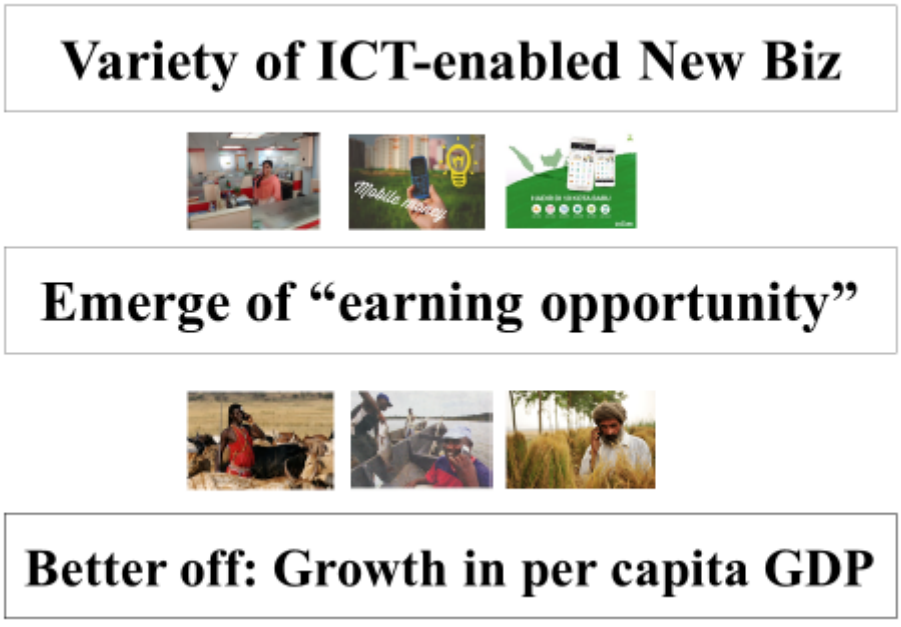

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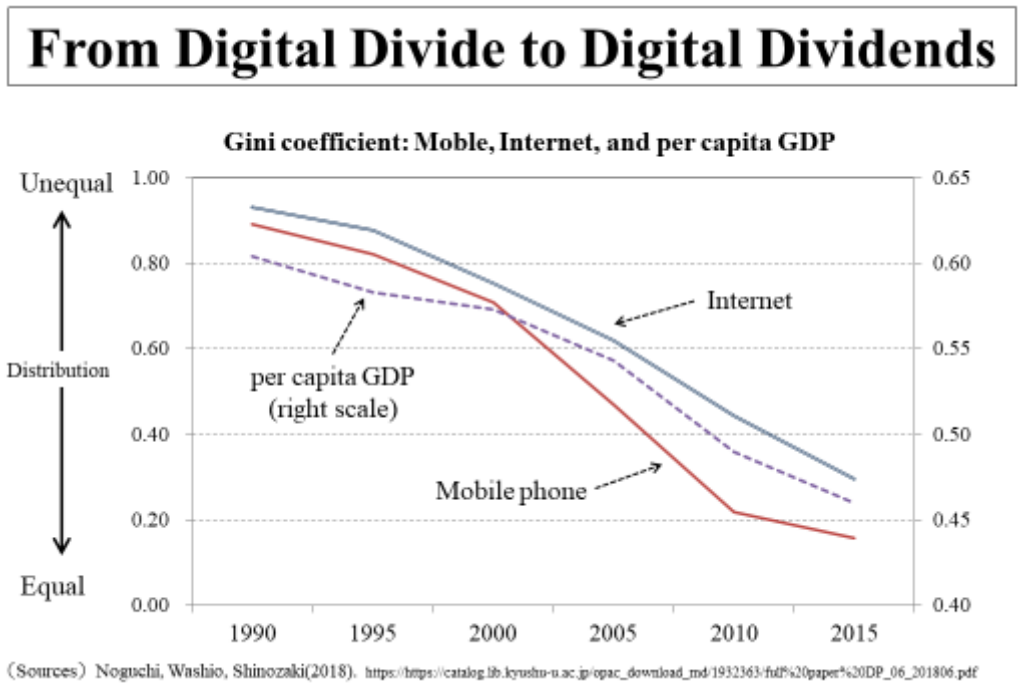

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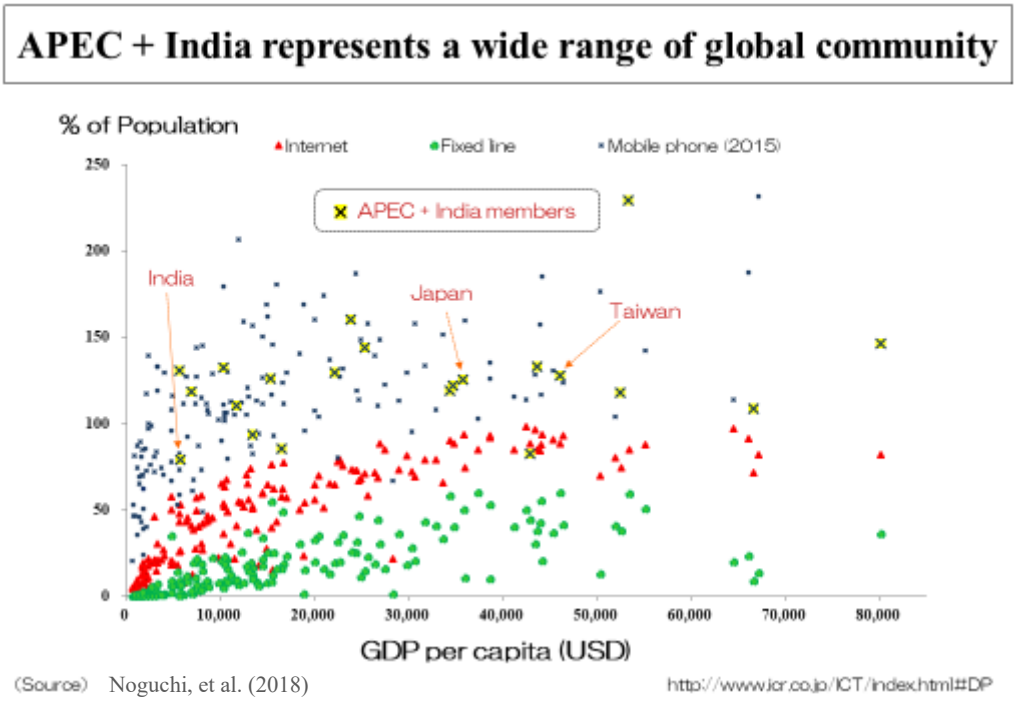

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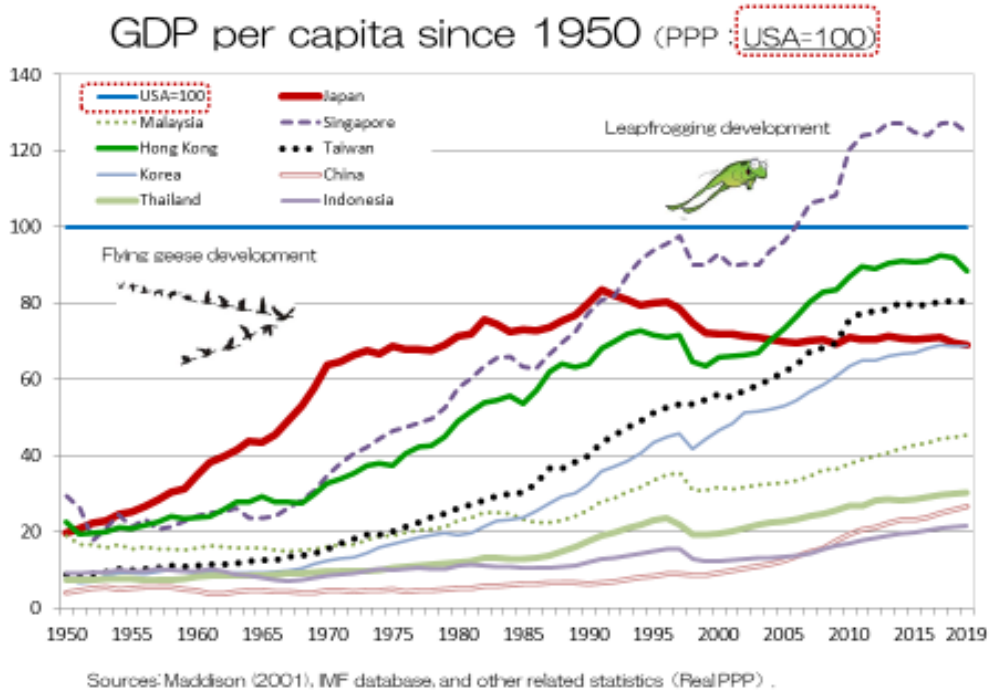

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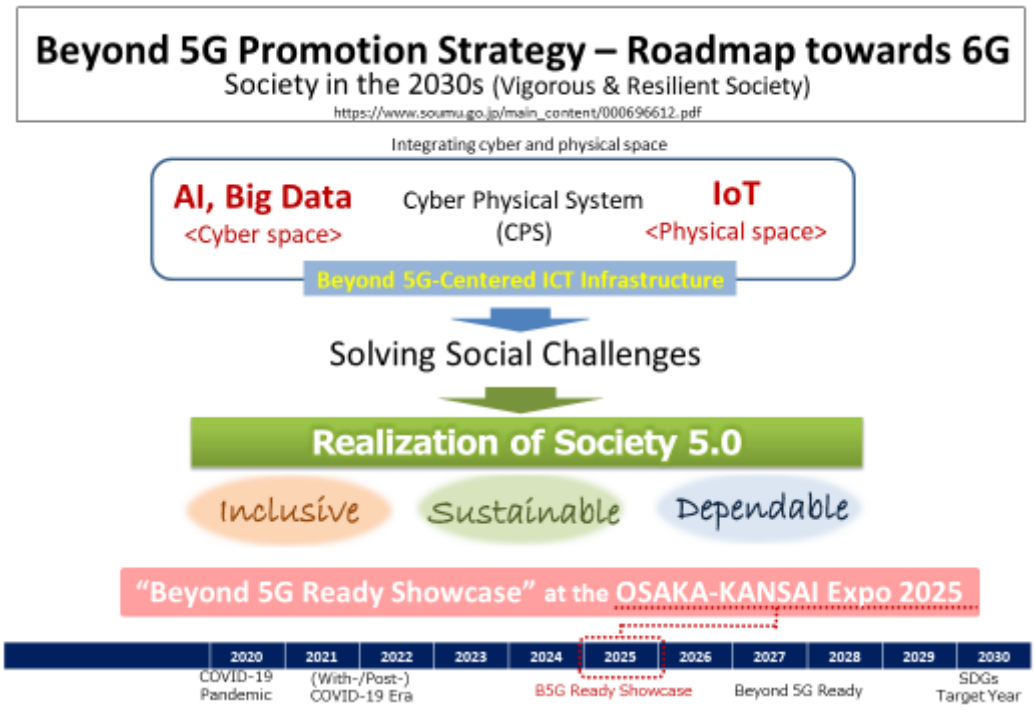

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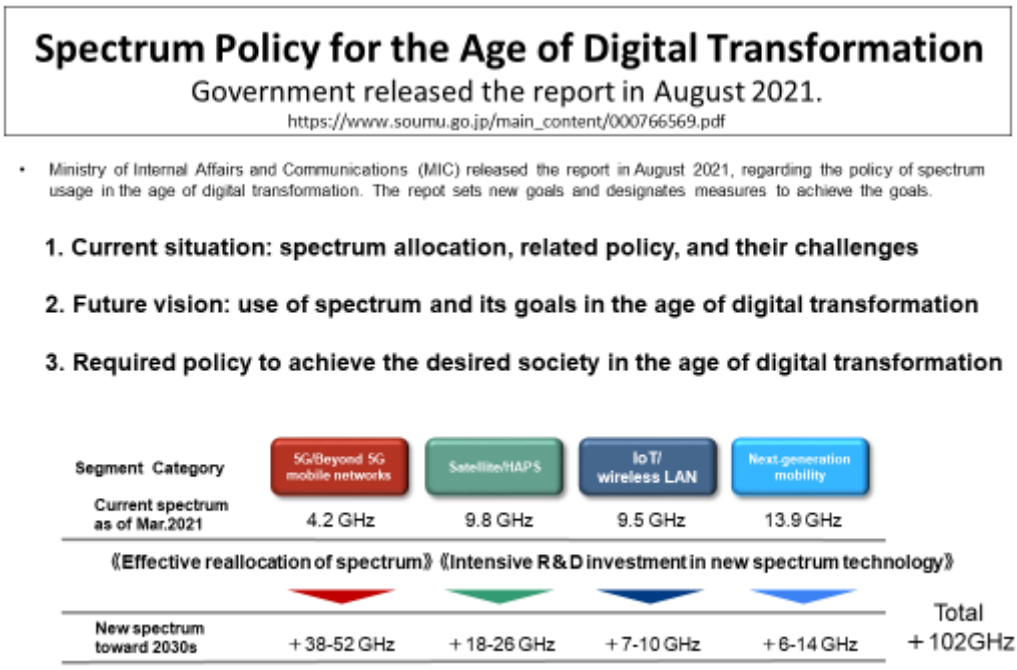


Figure 24.

https://www.soumu.go.jp/main_content/000563057.pdf

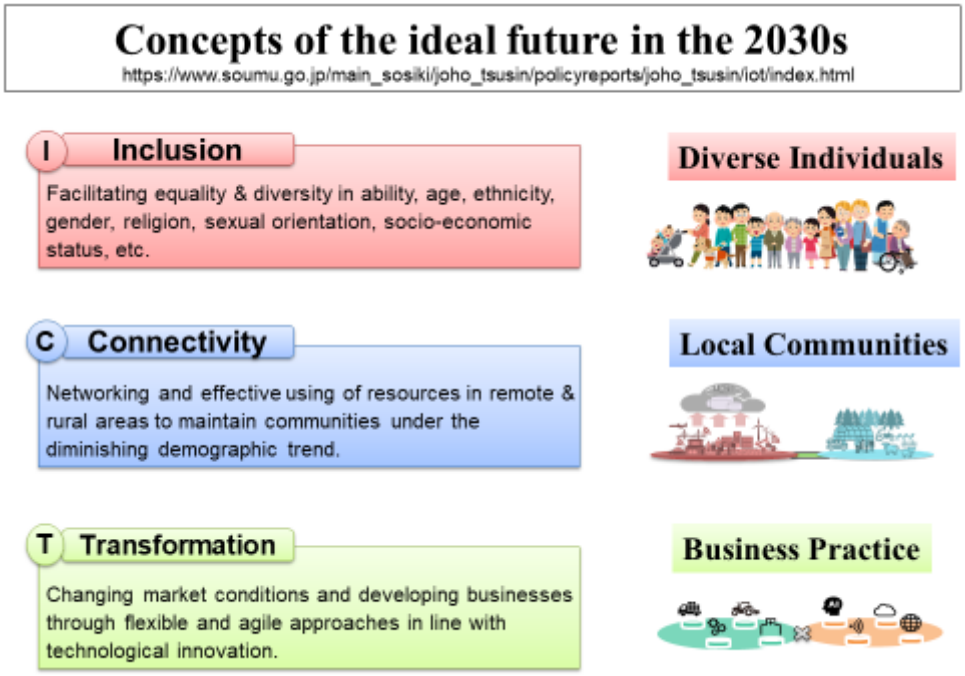
Grab the chance by change with technology!

August 2018

Information and Communications Council
Government of JAPAN

(Source) Information and Communications Council, Ministry of Internal Affairs and Communications, with some modifications by author. http://www.soumu.go.jp/main_content/000575126.pdf

Figure 25.



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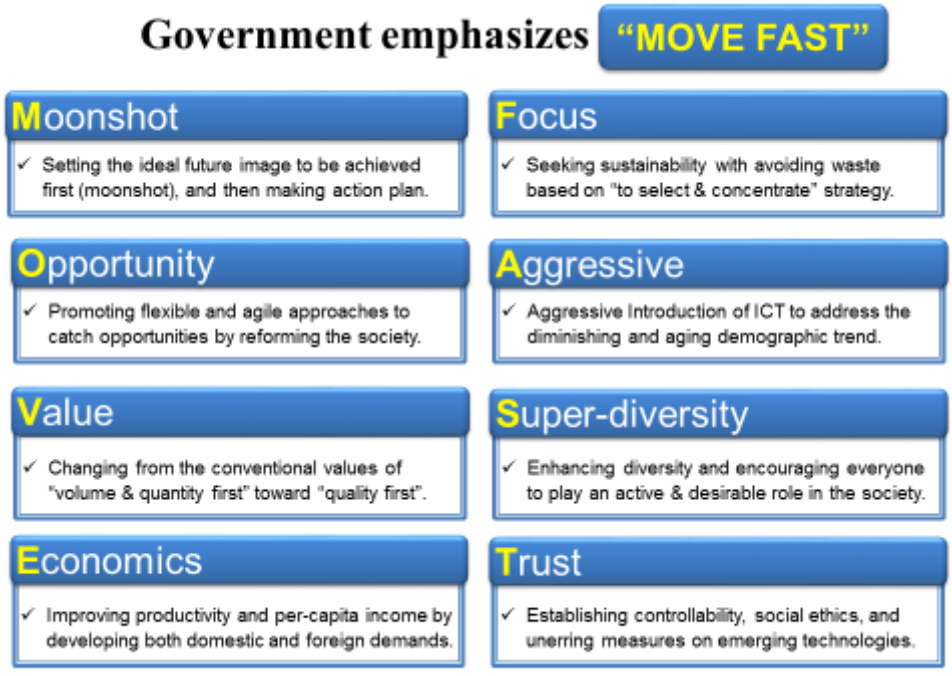

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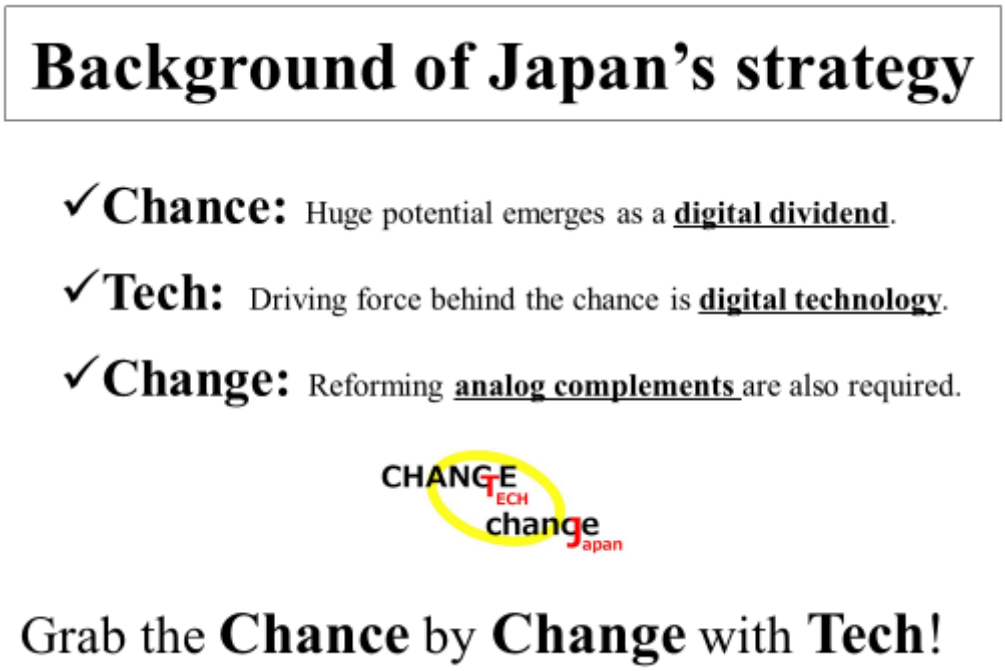

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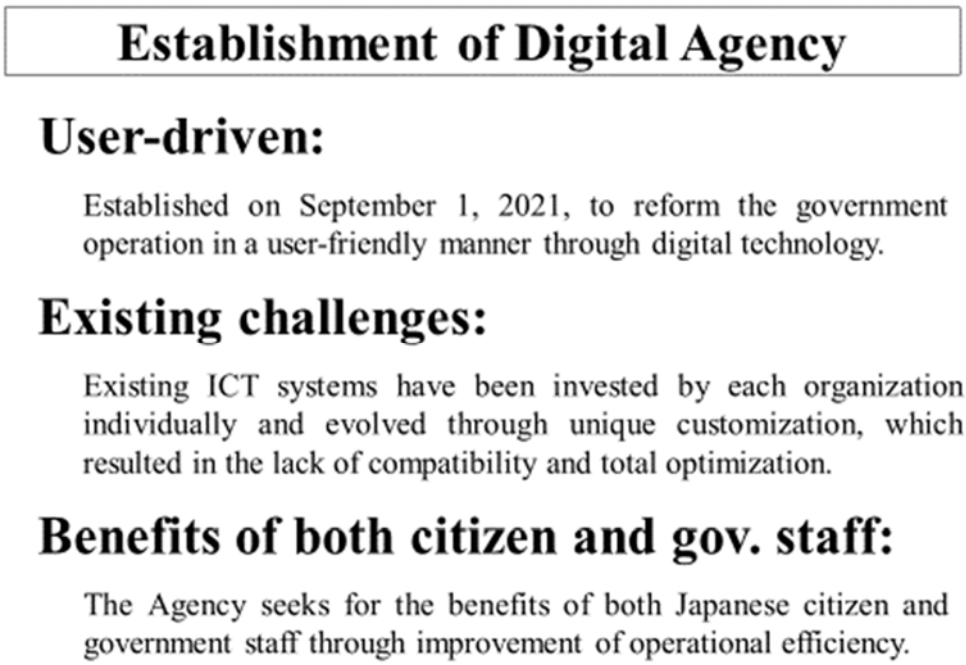

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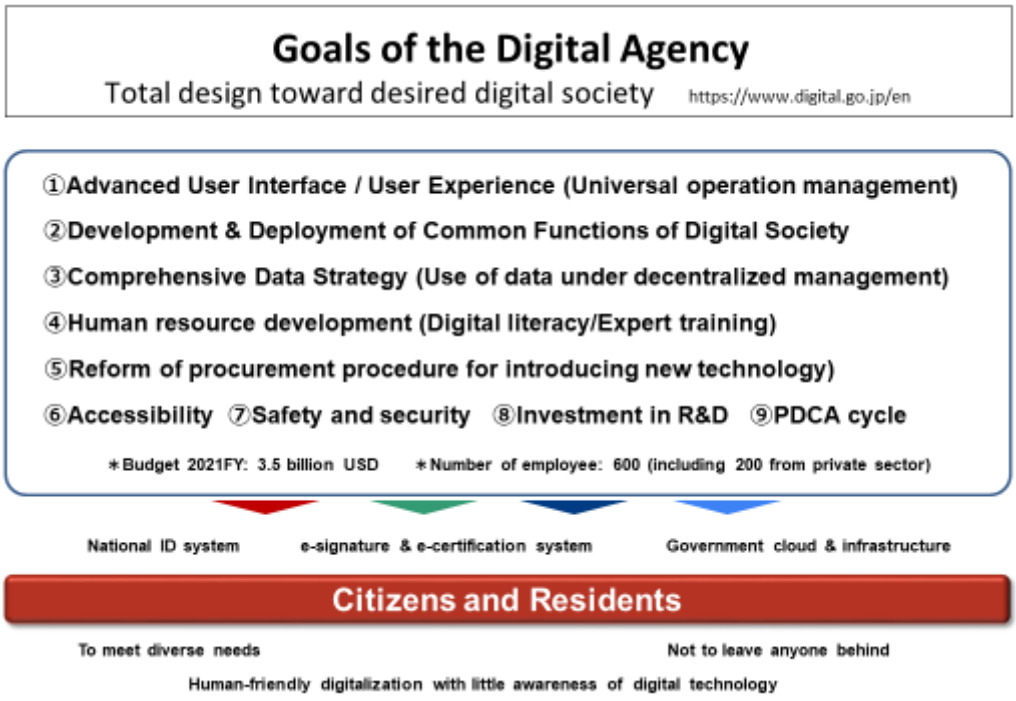

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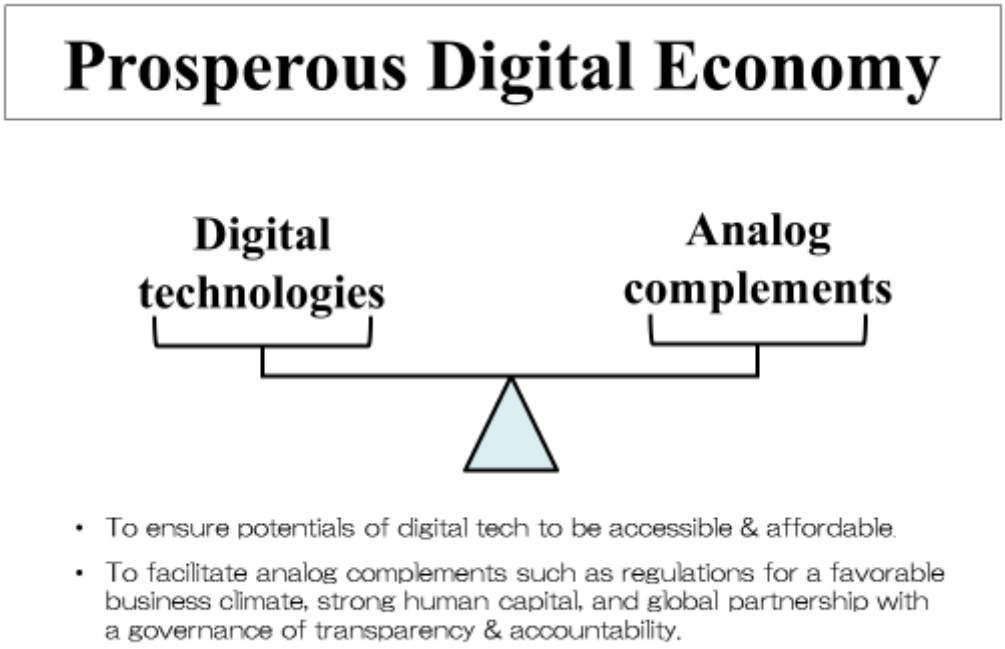

A list of back numbers

No.1 Deta de yomu jouhou tsuushin gijutsu no sekaiteki na fukyu to hensen no tokuchou (How does a global ICT indicator illustrate the long-run changes of the international community?), Masato NOGUCHI, Yusuke YAMAMOTO, Akihiko SHINOZAKI, January 2015, pp.1-25, in Japanese.

No.2 A role of investment in intangibles: How can IT make it?, Akihiko SHINOZAKI, July 2015, pp.1-20.

No.3 ICT ka no shinten ga kigyou no gyouseki to koyou ni oyobosu eikyou no jisshou kenkyu (An empirical study of ICT utilization for improving business performance and job creation: Evidence from logit model analysis based on company survey data), Satoshi WASHIO, Masato NOGUCHI, Nobuo IIDUKA, Akihiko SHINOZAKI, September 2015, pp.1-22.

No.4 Taibei sabisu boueki kakudai youin no kouzou bunseki (What expand U.S. imports of serveces?: Graphical modeling analysis of personal network and income level), Shigehiro KUBOTA, Yudai SUENAGA, Akihiko SHINOZAKI, January 2016, pp.1-13.

No.5 GDP sokuhou kaitei no tokuchou to suikei ga kakaeru mondai nit suite (Issues on revised GDP statistics and its challenges to be addressed), Nobuo IIDUKA, May 2016, pp.1-26.

No.6 Dejitaru Debaido kara Dejitaru Debidendo heno Henbou (Global transformation from digital device to digital dividends), Masato NOGUCHI, Satoshi WASHIO, Akihiko SHINOZAKI, June 2018, pp. 1-21.

No.7 The U.S. service imports and cross-border mobility of skilled labor: Panel data analysis based on the network theory, Akihiko SHINOZAKI, Shigehiro KUBOTA, July 2018, pp.1-12.

No.8 ICT wo katsuyo shita shisaku ga inbaundo kanko ni oyobosu eikyo (Impact of local governments' ICT policy measurement on the inbound tourism), Satoshi WASHIO, Akihiko SHINOZAKI, August 2018, pp. 1-16.

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ICR InfoCom Research, Inc. 株式会社情報通信総合研究所

Urban Net Nihonbashi Bldg., 2-14-10, Nihonbashi Ningyo-cho, Chuo-ku,
Tokyo 103-0013, Japan
For further information, mail to ict-me@icr.jp