Overview of ICT Strategy in Japan

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1. Introduction

The rapid development of information communication technology (ICT) has underpinned Japan's economic growth for the last few decades. Japan's total R&D spend as a proportion of its GDP has remained at the top among other industrialised countries. Japanese companies as the main actors in promoting R&D investment, have spent the largest amounts on ICT. Consequently, Japan has been robust in certain areas, notably excellent elemental technologies in advanced visual contents and TV. With fierce competition in the global ICT market, the Japanese government announced 'IT New Reform Strategy' and 'U-Japan' to realise a sustainable IT society with a strong aim to make Japan a front runner in IT by 2010. The Council of Science and Technology Policy (CSTP) has underlined the critical role played by ICT in realising a safe and secure society in Japan, as well as the country's contribution towards global issues such as climate change. In accordance with CSTP strategy, since 2006 the Ministry of Internal Affairs and Communication (MIC) has concentrated on researching new-generation networks to realise a ubiquitous network society that enables ICT

infrastructure to be used anytime, anywhere, and by anyone. The Ministry of Economy Trade and Industry (METI), meanwhile, has shifted priorities toward research projects in the field of new energy-saving products, including server storage/non-volatile memory, as well as organic electric luminescence.

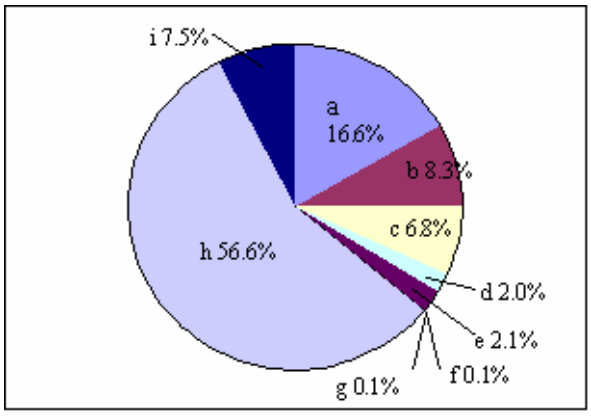
2. ICT in Japan: An Overview

2-1. R&D

ICT sector has an enormous impact on the economic growth of a country. This economic growth can be attained through productivity gains and companies' efforts in the wide application of ICT. The contribution rate of ICT to GDP growth in Japan has reached 40%.[1]

The total R&D expenditure in Science and Technology invested by companies, non-profit organisation, and public institutes, and universities accounts for 17.845 trillion yen (GBP 78.62 billion). Companies, as the largest investors in R&D, spend 12.745 trillion yen of which 4.5713 trillion yen (GBP 56.15) or about 40%, is spent on ICT-related R&D (Figure 1-1). The research funds for the information and communication equipment industry make up the majority of research spending by the information and communications industry.

Figure 1-1. Ratio of R&D spending for companies



a. Information and communication equipment industry
b. Electric machinery and equipment industry
c. Electric components and device industry
d. Software and information processing services
e. Communication services
f. Broadcasting services
g. Newspapers, publication and other information and communications services
h. Other manufacturing industries (total)
i. Other industries (total)

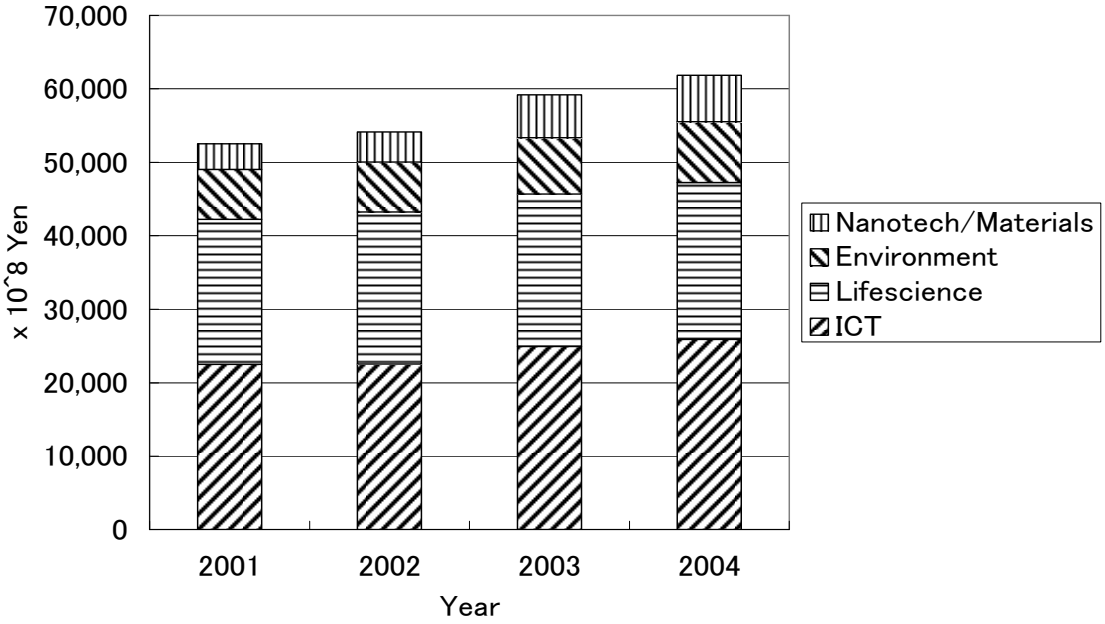
(Source: Based on MIC White paper Information and Communication in Japan (Year 2006))

Figure 1-2 shows the breakdown of R&D in the four prioritised research areas selected by the Cabinet. The share of ICT remains larger than other three prioritised areas,

[1] MIC, White Paper Information and Communication in Japan (Year 2006)

namely environment, and nanotechnology/ materials, and life science. The number of researchers in ICT field has been increased to 819,931. More than half of them are researchers associated to companies.[2]

Figure 1-2. **Trend of R&D in the Four Prioritised Research Areas**



(Source: MIC, White Paper Information and Communication (Year 2005))

2-2. Japan's Strengths and Weaknesses

Japanese ICT sector has strengths in FTTH (Fibre to the Home), high definition image technology, home network, and mobile equipment technology. Japanese competitive advantage is derived from its forte in optics and imaging, components for mobile telephones and TV, and advanced visual content. Japan has obtained a large share of the world's ICT market in other areas. For instance, its market share for DVD recorders dominates at 69.4%, with 54.1 % in plasma display TV, and 74.2% in digital cameras (Figure 2). While the market share of desktop PCs, notebooks both remain at low levels, the market share of electronic parts applied to mobile telephones, DVD, TV, and digital camera is high.[3]

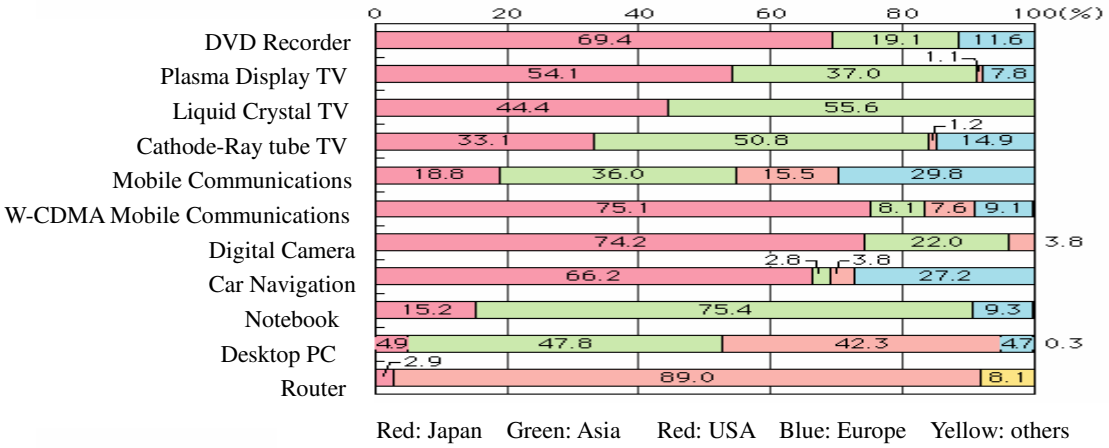
On the other hand, total architecture, solution services, business models for global development, IP systems are relatively weak areas. Table 1-1 and 1-2 show Japan's

[2] MIC, White Paper Information and Communication in Japan (Year 2007)

[3] MIC, White Paper Information and Communication in Japan (Year 2005).

strengths and weaknesses in next- generation IP network and wireless communication.

Figure 2. Japan's market share of main ICT equipment in the world (2004)



(Source: MIC, White Paper Information and Communication, Year 2005)

Table 1-1. Strengths and Weaknesses: Next Generation IP Network

Strengths	Weaknesses
-Optical transmission technologies such as WDM (Wavelength Division Multiplexing), PON (Passive Optical Network) -Audio technologies -AV terminal/imaging terminal technologies -Integrated/Process technologies -Environment for the usage of broadband -Management and technical know-how in FTTH, NGN -Customised technologies in cross-industrial fields	-MPU technologies -OS technologies -Originality in developing software technologies -Environment to create originality and new business -Creating concepts for systems -Innovative business models suitable for global development -Value chain

Table 1-2. Strengths and Weaknesses: Wireless communications

Strengths	Weaknesses
-Advanced technologies related to mobile communication technologies and applications -NGN technologies -Parts in mobile phones -Contents of animation and games -Good service and support for users	-Strong IP -Strategic channels for sales -Grasping overseas trends -Lack of engineers with high skills of communication and foreign languages

(Source: MIC, Study Report on ICT International Competitiveness, April 2007)

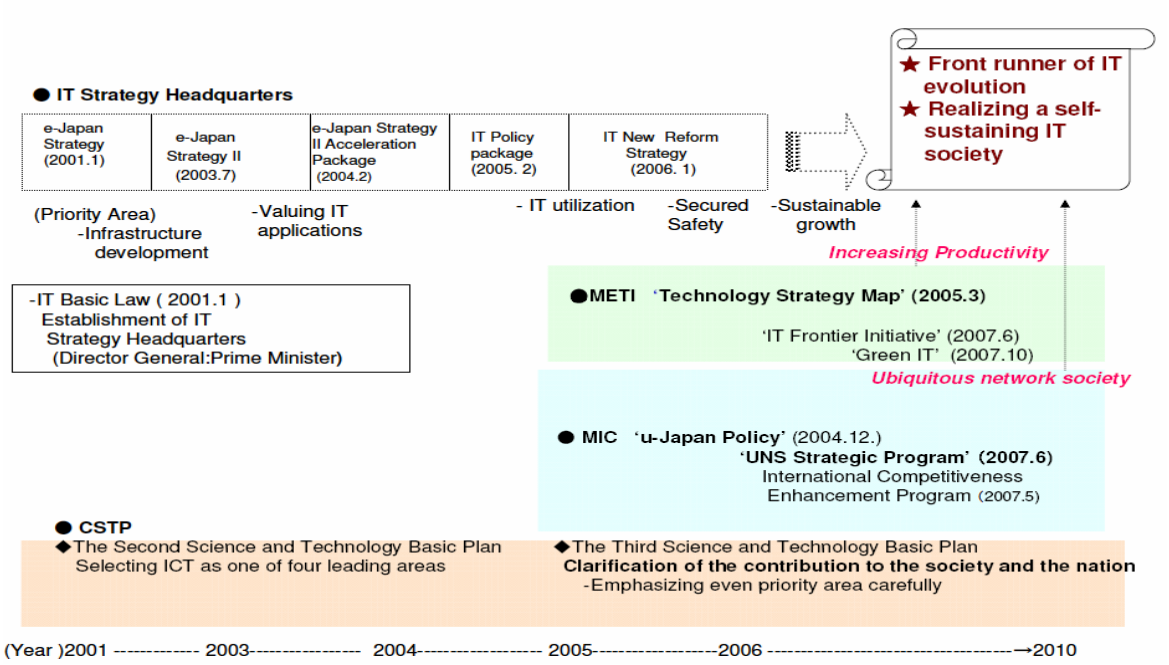
3. Government Policy on ICT

3-1. Transition of national strategies

The 'IT Strategy Headquarters' was established in 2001 under the leadership of former Japanese Prime Minister Junichiro Koizumi to implement a new national strategy called 'E-Japan' for IT-driven growth (Figure 3). E-Japan attached high priority to developing infrastructure and making the most effective use of available IT resources. In 2006, the IT Strategy Headquarters created 'IT New Reform Strategy' for the next step after 'E-Japan'. Its ultimate goal is to realise a self-sustaining 'ubiquitous network society' by 2010.

The Council of Science and Technology Policy (CSTP) is the headquarters for the consolidated, comprehensive and coherent promotion of Japanese S&T aimed at identifying key technologies in terms of national interests underlined in the S&T Basic Plan. The CSTP allocates the budget in accordance with the National Guidelines for Evaluation Government Funded Research and Development. In the field of ICT, the ICT section of CSTP has the responsibility of assessing prioritised research areas in MIC, METI and other ICT-related ministries.

Figure 3. Overview of National Strategies for ICT



(Source: This figure is created by the author based on MIC's official report)

3-2. CSTP Prioritised R&D

In comparison with the 2nd Science and Technology Basic Plan, the 3rd Plan gave high priorities to the achievement of a secure and wealthy society by using IT and developing human capital, developing science, and strengthening industrial competitiveness. With such an aim, the ICT section of CSTP underlined the need for a new system to maintain seamless investment from basic research to commercialisation. Optics, mobiles, robot, electronic appliances are particularly considered key areas for investment. As shown in Table 2, CSTP identified ten research topics under three main themes. Currently forty-two R&D programs are being carried out under ten research topics. The largest amount of investment is focused on next generation network technologies for convenience and comfort, ubiquitous network technologies, creating contents and technologies to use information and security technologies to achieve a safe and secure IT society.

Table 2. Strategically Prioritised Research Areas in ICT

1.	**Science: R&D basis for continuos innovation** (¥ 8,534 /GBP 37.24 million)
	① The world most advanced next generation supercomputer
	② Advanced IT specialist training
2.	**Industry: Sustainable development through innovative IT technology** (¥ 19,235 /GBP 84.74 million)
	③ Design and manufacturing technology suitable for ultra and low energy consumption
	④ Technologies of display, storage, ultra high speed device
	⑤ Robot technology available at home and town
	⑥ Software development support technologies
3.	**Society: Society to obtain benefits of IT achievements** (¥ 32, 07/GBP 141.82 million)
	⑦ Next generation network for convenience and comfortable
	⑧ Ubiquitous network technologies
	⑨ Creating contents and technologies to use information
	⑩ Security technologies to achieve safe and secured IT society

（Source: CSTP）

The ICT section in CSTP has a Project Team (PT) composed of 17 expert members from academia and industry. They regularly hold meetings to evaluate ongoing research projects under the national guidelines and, if necessary, provide some advice to decision-makers in altering the direction of or adding new projects. Table 3-1 and Table 3-2 indicate the main view of CSTP, the largest funded R&D and newly established R&D from 2008.

Table 3-1. The Highest Funded METI and MIC ICT R&D Projects

The Name of the R&D Project (Ministry)	Budget (million) (FY2007/FY2008) Period of project	The Targeted Technologies
(Device) MIRAI Project (METI)	Budget ¥ 6,200 (GBP 27.3)/ ¥ 5,000 (GBP22.0) 10-year project FY 2001- FY 2010	-High-quality and low-power consuming semiconductor device through industry -academic-government collaboration -CMOS, EUV Lithography System etc.
(Contents) Information Big Voyage Project (METI)	Budget: ¥4,570 (GBP 20.1)/ ¥4,108 (GBP 18.1) 3-year project: FY2007-FY2009	-Technologies to search and interpret information to meet users' needs. (Example: Protocol/basic technologies to realise service linkage, resource management technology, real-time management, and security management technologies to protect private information)
(Network) R&D of Element Technology for the Use of Frequency in Mobile Communication System (MIC)	Budget: ¥4,241 (GBP18.7)/ ¥3,799 (GBP 16.7) 5-year project FY2005-FY2009	-The Fourth Generation Mobile Communication System -ITS system, Cognitive Wireless Communication Technology
(Network) Photonic Network Technology (MIC)	Budget: ¥3,465 (GBP15.3)/ ¥3637 (GBP16.0) 5-year project: FY2006-FY2010	-To complete a technology basis for fibre communication by 2010, the following six technology areas will be developed: 1) Ultra-large capacity fibre node technology 2) Fibre wave utility technology 3) Fibre wave access technology 4) Accumulated active fibre access system 5) Fibre network technology basis 6) Extreme fibre network system technology

(Source: The table is created by the author based on the materials from CSTP)

Table 3-2. The Prioritised New R&D Projects

The Name of the R&D Project (Ministry)	Budget (million yen) Period of project	The Targeted Technologies
(Device) Green IT Project (METI)	¥3,000 (GBP13.2)	-Energy-saving technologies for server storage and electric power saving network equipment
(Device) Dream Chip Development Project (METI)	¥1,200 (GBP 5.3)	-Solid semiconductor device technology and communication device suitable for high frequency etc.
(Network) New Next Generation Network Technology Basis (MIC)	¥ 2,130 (GBP 9.4)	-New network architecture (design principle) for next generation IP network

(Source: CSTP)

3.3. ***MIC policies towards ICT***

3-3-1. UNS Strategic Programme

In 2006 MIC announced its 'U-Japan' strategy with five policy packages: 1) development of ubiquitous networks, 2) advanced usage of ICT, 3) upgrading enabling environment, 4) international strategy, and 5) technology strategy (to strategically promote R&D and standardisation in priority areas, and to strengthen international competitiveness through innovations). To implement the U-Japan strategy, the MIC designated three areas it considered vital to realise a ubiquitous network society. The MIC developed 'UNS Strategic Programme' (**U**niversal communications, **N**ew generation networks, and **S**ecurity and safety technology strategies) in July 2006. The programme consists of three primary technologies and ten specific research projects with the goal of creating a society where anyone could benefit from IT at anytime and anywhere (See Table 4). New-generation network technologies are rated as one of the most significant technologies by CSTP.

Table 4. Ten R&D projects in UNS Strategic Program

1. New generation networks technologies (¥ 42 billion/GBP185 million)
-New generation networks architecture
-Ubiquitous mobility
-New ICT paradigm
-Ubiquitous platform
2. ICT security and safety technologies (¥ 11 billion/ GBP 48.46 million)
-Secure networks
-Sensing/Ubiquitous time-space infrastructure
-Context awareness environments
3. Universal communications technologies (¥ 4.6 billion/ GBP 20.26 million)
-Universal contents creation
-Super-communications
-Common reality communications

(Source: MIC)

3-3-2. Next Generation Network Basic Technology (GBP 9.4million/ FY2008)

In FY 2008, the new Next Generation Network Basic Technology is the only project that obtained the highest rating of 'S' from CSTP. Next-generation network architecture drew much attention since it was identified as a successor of the IP network. It is a significantly critical research area in terms of international competitiveness. To become a world leader in this field, MIC decided to intensify the activities of international standardisation. The project for next generation network basic technology is based on developing totally new network architecture for next generation IP. More specific research areas include elemental technologies in dynamic network with capabilities of auto-recovery function and transmission efficiency, and virtual technique enabling to set up communication speed and quality.

3-3-3. National Institute of Information and Communication Technology (NICT)

An incorporated administrative agency, the National Institute of Information and Communication Technology (NICT) supports national ICT policies by providing technological advice and co-operates with academia, industries, and overseas research institutes. NICT has been conducting R&D into ICT with the comprehensive objective of achieving a ubiquitous network society as it is the sole national research institute in the field of ICT. NICT has not merely conducted its own research but also support

technology-intensive SMEs and promote their commercialisation.

In April 2006, NICT started a 5-year, mid-term plan. NICT consolidated ongoing projects into three R&D areas: 1) new-generation network technologies, 2) key technologies for universal communications, and 3) ICT for security and safety. As for new-generation technologies, NICT established next generation promotion headquarters in October and will conduct R&D, examine technology roadmap, and its social and economic impacts. NICT's R&D efforts contribute to both international standardisation and the transfer of technology to industry.

3-3-4. ICT Committee for International Competitiveness

MIC decided on a two-year programme, over FY2006 and FY2007, focusing on international competitiveness in the ICT sector and established a special panel called ICT Committee for International Competitiveness in May 2007. The Prime Minister serves as a Chair of this Committee. With the Committee, the promotion of R&D has been carried out together with international standardisation and intellectual property strategies with NICT. Thus, the Committee will closely collaborate with IT Strategic Headquarters, Intellectual Property Strategy Headquarters in the Cabinet Office.

3-4. METI policies towards IT

3-4-1.Technology Strategy Roadmap

METI has published a Technology Strategy Roadmap for the selection of the most important R&D areas since 2005. To understand the trend of advanced industrial technologies and clarify the road toward innovation, the roadmap reflects the opinions of a 'task force' composed of 500 researchers and experts from New Energy and Industrial Technology Development Organisation (NEDO) and National Institute of Advanced Industrial Science and Technology (AIST). METI's Technology Strategy Roadmap is a relatively long-term view around 10 years or so and designed to strengthen international competitiveness in Japan's ICT industry with increasing safeties and reliabilities. Since 2005 the technology strategy map has been re-examined and renewed every year, the roadmap went through three processes: introductory scenario, technology map, and technology roadmap.

Introductory Scenario -Indicates the thread on how R&D outcomes diffuse to society and intended policies

↓

Technology Map - Overseas technology agenda and specifies important technology agenda and important technology

↓

Technology Roadmap -Indicates the progress of functions required as a milestone on the time table

As Table 5 shows, the Technology Strategy Roadmap focused on six specific fields, namely, semiconductor, storage/non-volatile memory, computer, network, usability (including display), and software.

Table 5. Most important ICT technologies identified by Technology Strategy Roadmap

1.Semiconductor	To reduce power consumption through combining high capacities of arithmetic and animation processing in one chip in response to increasing demand for system LSI with multifunctions
2. Storage/ Non-volatile Memory	-To develop server and mobile equipment with larger memory capacity -Magnetic storage, fibre storage, FALSH, and FeRM and MRAM
3. Computer	-New server with capabilities to rewrite information similar to the supercomputers by connecting mobiles whose function is equivalent to PC and multiple information equipment
4. Network	-Develop new services enabling to delivery of delicate animations through the Internet
5. Display	-Flexible seat display, 3D Display, electric appliances enabling operation in distance and collaboration etc.
6. Software	-Provide a total development platform in built-in software, high reliable software, secured electric mail system

(Source: METI)

3-4-2. Green IT Project (GBP13.2 million/ FY 2008)

To reduce power consumption, METI has initiated an energy-saving project so-called 'Green IT' composed of two major topics: 1) server/storage energy saving technology, electric power saving technologies of network equipment, and 2) display technology with organic EL.

The Green IT Promotion Council', consisting of academic, government, industry experts was established in January 2008 under the chairmanship of Mr. Katsuhiko

Machida, the former President of Sharp and Chair of JEITA. The Council will produce most effective energy-saving technology and conduct an assessment and long-term forecast of the awareness. In May 2008, METI will hold a Green IT International Symposium and invite vendors and researchers from abroad to appreciate 'Green IT Japan' with a target of contributing to the G8 Toyako Summit in July 2008.

3-4-3. Dream Chip Project (GBP 5.3 million/FY2008))

Semiconductor device technologies are fundamental technologies not only in the ICT sector but almost all other sectors too. In recent years, the rise of Taiwan, South Korea, and other competitors triggered fierce competition. According to METI, Japan needs to carry out three-dimension device technologies adding to the ongoing research on micro fabrication technologies. The three-dimension semiconductor device technologies contribute to multifunction, miniaturisation, and low power consumption. Additionally, METI focuses on the three-dimension devices, Field Programmable Gate Array (FPGA) and Multiple Frequency Communication Device for mobile phones in accordance with public needs.

3-4-4. IT Frontier Initiatives

To accelerate productivity derived from IT utilisation, METI set up a study committee chaired by Mr. Teruyasu Murakami (Chairman of Nomura Research Institute). The committee continued discussions with academia, business experts, and government officials from January 2007 and completed a report in June 2007. The committee's comprehensive report demonstrates that SMEs, which actually share more than 99% in total companies in Japan have not successfully raised productivity through IT utilisation. The study also suggests that service sector in Japan should more actively invest in IT to promote their productivity.

4. Conclusion

Japan implemented new national strategies for ICT in 2006, the year the Third Science and Technology Basic Plan was released. The ICT section of CSTP undertakes the responsibility of assessing national ongoing projects and selecting significant new research areas with experts from private and public sectors. CSTP's opinions are reflected in the budget allocation. MIC and METI are the two primary ministries conducting ICT related R&D. MIC has expanded next-generation network research, closely collaborating with NICT. Meanwhile METI has focused on energy-saving

research projects namely, ‘Green IT’ under the concept of eco-innovation and sustainable growth.

Adding to these efforts for improving the method of selecting and concentrating significant research areas, noteworthy is the government strategies for promoting commercialisation of technology and productivity. Recently, METI and MIC established the special committee to analyse the impact of international standardisation and intellectual property rights on the growth of the ICT sector. Experts have argued that weak global business management and the lack of comprehensive policy toward intellectual property and international standardisation is one of the main factors causing the decline of Japan’s market share in mobile communications and PC. Moreover, Japanese companies are convinced that competencies in creating strategic international alliances with complementary strengths are significant for them to produce services and goods that meet various new needs arising from globalised ICT market.

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