Project Research
“Application of Information and Communication Technology in Developing Countries”

Final Report

October 2015

Infrastructure and Peacebuilding Department

Japan International Cooperation Agency

Entrusted to

International Development Center of Japan

Foreword

Japan International Cooperation Agency (JICA) has been assisting policy-making, human resource development, infrastructure development and utilization promotion in the field of Information and Communication Technology (ICT), including broadcasting, in developing countries around the world. Rapid change in the communication environment, represented by the explosive spread of mobile phones in Africa, is positively influencing the traditional assistance approach and bringing forth unique, innovative problem-solving methods across the globe. Academics report that these methods often contribute to the effective and efficient maximization of the development assistance effect, and the international development assistance organizations, such as the World Bank, are accelerating the utilization of ICT in assistance projects in various sectors. Concurrently many of the goals in “The 2030 Agenda for Sustainable Development” (commonly known as SDGs), officially adopted in September 2015, specified the importance of promoting the utilization of ICT from different perspectives. Therefore, JICA conducted this research with the aim to sort out and analyze its numerous past surveys and projects, collect and analyze cases of other organizations, and to organize basic information for the planning of strategies on mid- and long-term utilization of ICT.

The research team of International Development Center of Japan (IDCJ), led by Dr. Joji Terahara, collected and analyzed enormous domestic and international resources for this research. Related departments at JICA, as well as domestic and international ICT-related companies and organizations, were also interviewed. Hypotheses were formed based on the result, and the team at our department (Hiroshi Takeuchi, Masayuki Furukawa, Jotaro Tateyama, Tomoyuki Naito) went through several months of intense discussions and correction of drafts, which resulted in this report.

We wish that this report contributes to the promotion and further progress of development assistance related to the utilization of ICT in various sectors. Lastly, we would like to express our sincere gratitude for everyone who cooperated for and assisted in the research.

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Abbreviations

3G	3rd Generation
ADB	Asian Development Bank
ADePT	Automated DEC Poverty Tables
ADSL	Asymmetric Digital Subscriber Line
AHA Center	ASEAN Coordinating Centre for Humanitarian Assistance on disaster management
Ajax	Asynchronous JavaScripts + XML
ASEAN	Association of South-East Asian Nations
ASYCUDA	Automated System for Customs Data
BBL	Brown Bag Lunch
BEMS	Building Energy Management System
BHN	Basic Human Needs
BOP	Base of the Economic Pyramid
BOT	Build, Operate and Transfer
BS	Broadcasting Satellite
C/P	Counterpart
CAD	Computer Aided Design
CAESAR	Center for Advanced Engineering Structural Assessment and Research
CAREC	Central Asia Regional Economic Cooperation
ccTLD	Country code Top Level Domain
CEO	Chief Executive Officer
CEP	Complex Event Processing
CIRT	Cyber Incident Response Team
CIS	Customs Intelligence System
CS	Communication Satellite
CSIRT	Computer Security Incident Response Team
CSV	Comma-Separated Values
DAISY	Digital Accessible Information System
DB	Database
DFID	Department for International Development

DOD	Detailed Outline Design
DRM	Disaster Risk Management
EKG	Electrocardiogram
EO	Earth Observation
ERP	Enterprise Resource Planning
ESCAP	Economic and Social Commission for Asia and the Pacific
EU	European Union
F/S	Feasibility Study
GDA	Global Development Alliance
GDLN	Global Development Learning Network
GIS	Geographic Information System
GMS	Greater Mekong Subregion
GPS	Global Positioning System
HIS	Health Information System
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HP	Home Page
HS	Harmonized Commodity Description Coding System
HTML	Hyper Text Markup Language
IaaS	Infrastructure as a Service
IATA	International Air Transport Association
IC	Integrated Circuit
ICB	International Competitive Bidding
ICHARM	International Centre for Water Hazard and Risk Management under the auspices of UNESCO
ICT	Information and Communication Technology
ICT4D	Information and Communication Technology for Development
IDB	Inter-American Development Bank
IDRC	International Development Research Centre
IFC	International Finance Corporation
IHP	International Humanitarian Partnership
IoT	Internet of Things

IP	Internet Protocol
ISO	International Organization for Standardization
IT	Information Technology
ITS	Intelligent Transportation System
ITS	Intelligent Transport System
ITU	International Telecommunication Union
ITU-D	ITU Telecommunication Development Sector
JAIF	Japan-ASEAN Integration Fund
JAXA	Japan Aerospace eXploration Agency
JCAP	JICA Country Analysis Paper
JICA	Japan International Cooperation Agency
JST	Japan Science and Technology Agency
LTE	Long Term Evolution
M/M	Man/Month
MDGs	Millennium Development Goals
MIGA	Multilateral Investment Guarantee Agency
MS Office	Microsoft Office
NACCS	Nippon Automated Cargo and Port Consolidated System
NCB	National Competitive Bidding)
NHK	Nippon Housou Kyoukai
NICT	National Institute of Information and Communication Technology
NID	National Identification
NIED	National Research Institute of Earth Science and Disaster Prevention
NPO	Non-Profit Organization
NSDI	National Spatial Data Infrastructure
NTT	Nippon Telegraph and Telephone Corporation
OD	Outline Design
ODA	Official Development Aid
OJT	On-the-Job Training
OLPC	One Laptop Per Child Foundation

OS	Operating System
OSS	Open Source Software
PaaS	Platform as a Service
PACS	Picture Archiving and Communication System
PC	Personal Computer
PDM	Project Design Matrix
POS	Point of Sale(
PKI	Public Key Infrastructure
QCD	Quality, Cost, Delivery
RDBMS	Relational DataBase Management System
REDD	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries)
RETA	Regional Technical Assistance
RFID	Radio Frequency Identification
SaaS	Software as a Service
SATREPS	Science and Technology Research Partnership for Sustainable Development
SDGs	Sustainable Development Goals
SDI	Spatial Data Infrastructure
SE	System Engineer
Sida	Swedish International Development Cooperation Agency
SIM	Subscriber Identity Module
SMS	Short Message Service
SNS	Social Networking Service
SQL	Structured Query Language
STEP	Special Terms for Economic Partnership
TA	Technical Assistance
TQM	Total Quality Management
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UNFPA	United Nations Population Fund

USAID	United States Agency for International Development
WCO	World Custom Organization
WFP	World Food Programme
WHO	World Health Organization
Wi-Fi	Wireless Fidelity
WMO	World Meteorological Organization

Executive Summary

Chapter 1 Prologue

Background

Until now, Japan International Cooperation Agency (JICA) has been providing traditional type of assistance in terms of Information and Communication Technology (ICT) as a development issue such as policy recommendation for the promotion of ICT policy within developing countries, improvements to ICT infrastructure, capacity building of personnel for ICT and others as an economic infrastructure. However, demand for such assistance in ICT sector in developing countries is on the decrease or becoming more diversified. In developing countries, ICT infrastructure is becoming rapidly available and the demand for assistance utilising ICT to solve various development issues is on the increase worldwide.

In developing countries, ICT infrastructure has made an improvement on a certain level and at the same time ICT literacy is rapidly improving. In recent years, ICT is becoming recognised as a common infrastructure crossing over various development issues and an effective tool to advance industries and economic growth as well as make improvements to the lives of citizens. In this way, ICT's positioning is going through a major change within development issues due to the rapid advancement of ICT technology and widespread availability in the society.

Taking into account such changes in the positioning of ICT within development issues, JICA has begun providing new type of assistance as opposed to the traditional type of assistance. There are also case studies of such assistance using Japan's advantages as 'ICT developed country' with extensive experiences. However, under such sudden major changes, JICA is yet to be equipped with an appropriate assistance policy for ICT. JICA is required to take measures on how to deal with such rapid changes surrounding ICT environment within development field.

Objectives

This research will explore case studies of assistance using ICT by the Japanese government as well as by other donor agencies for more effective and efficient provision of assistance through promotion of ICT application within various development issues. This research will also examine how JICA should deal with the changing environment surrounding ICT and development such as types of ICT technologies to be used, points of concern for its usage and expected challenges as well as necessary implementation mechanism and measures for the promotion of ICT utilization and application in the future. Based on the results of this report, it is expected that in the future, the whole of JICA would work as a team to raise awareness in terms of ICT application and conduct discussions on its usages in order to pursue the maximization of development effectiveness.

Report Composition

This report composes from two parts. Part one composes from this report itself which summarises the research results within Japan of the Project Research "Application of Information and Communication Technology in Developing Countries".
The second part composes from appendixes.

Having reviewed the latest trend on the developments of ICT, Chapter two 'Current state and trend of ICT' summarises the past records of ICT utilization and application by the Japanese government and multilateral/ bilateral donor agencies. Data utilised for this research is attached in the appendixes.

Based on the analysis of trends in Chapter two, Chapter three 'Challenges to and prospects for ICT utilization', examines the priority issues to be tackled with from two points of view, one being operation process, the other being project implementation. This chapter puts in perspective how to apply such important trends into assistance projects, having projected the outlook of ICT usages in developing countries in 2025.

Chapter four 'Amending JICA's ICT thematic guidelines and development strategic targets'

presents reorganisation of JICA's 'ICT thematic guidelines (revised in March 2012)' as one of countermeasures for the challenges posed in chapter three.

Chapter five 'Internal and external cooperation enhancement' also presents another countermeasure for the challenges posed in chapter three on how JICA should deal with ICT utilization and application in the future, both internally and externally.

Chapter 2 Current state and trend of ICT

Current state and trend of ICT

The biggest developments relating to ICT were the widespread availability of computers as well as internet. In addition, in year 2000, mobile phones began to be popular. Types of devices have also increased which presented more ICT business opportunities as in the spread of internet.

Introduction and widespread availability of new ICT technology had a great impact on both our personal lives and work. However, this is not a global trend. It should be noted that the path taken by developed countries including Japan and the path developing countries are taking now are not necessarily the same.

In this report, based on the experiences of both developed countries and developing countries, as an ICT industry's trend, five inter-related concepts namely Mobile Networks, Cloud Computing, Internet of Things (IoT), Big Data and 3D printing will be discussed. These concepts could have a big impact in our future work and private lives.

Case studies of ICT utilization and application – cases of Japan's assistance

Japan's assistance utilizing ICT will be outlined by category of assistance schemes (technical cooperation, grant aid, capital assistance, loan assistance). The research covers assistance schemes which began from 2005 onwards.

Since the contents of technical cooperation vary depending on the issue and the project implementing country, this section outlines the overview from several points of view.

Many of the projects within thematic issues which require relatively high technical inputs (e.g. water resources/ disaster management, natural resources and energy, urban and regional development, environmental management, etc.) apply ICT tools such as Geographic Information System (GIS). For example, in the field of disaster management, there are cases which use wireless sensor networks such as monitoring weather and environmental conditions in real time using satellite or remote sensors. In the field of environmental management, there is a case of monitoring and data management of atmospheric air/ rain, water quality and soil. Such projects require high technical expertise in each field, but the consulting companies or experts in charge have appropriate knowledge on related ICT.

In the field of governance or economic policy, there are various cases of ICT application such as information sharing and dissemination or establishing a system to improve efficiency of administrative tasks such as accounting, asset management, data processing and others.

Among thematic issue of health and agriculture/rural development, many projects support capacity development of medical personnel or local administrative officers as well as strengthening related organisations. Under such projects, there are cases of developing a database or information websites to improve efficiency of administrative tasks such as paperwork efficiency and information sharing.

Among projects to assist overseas expansion of SMEs which are proposal based programs, there are cases of remote diagnostics or establishing an information network on community healthcare. There are also solution-based projects which attend to the needs of general public such as distribution system using internet or an experiment to provide agriproducts information to retailers or customers.

Among projects to promote private sector technology which are also proposal based programs, examples are found within the field of transportation, agriculture/rural development, disaster management and urban/regional development. Among Base of Pyramids (BoP) business promotion survey, examples are found in the field of education, resource/ energy and agriculture/ rural development.

Within the scheme of grant aid, capital assistance, there are examples of ICT utilization and application in various fields. In the field of health and medical sector, various medical equipment are provided. In the field of peace building, landmine detecting machines and demining machines are provided. In the field of transportation sector, Intelligent Transport System (ITS) equipment are provided. On the other hand, in addition to the provision of equipment, there are also cases of collaboration with technical cooperation projects. Although the type of collaboration is not fixed, but in general, technical cooperation starts first followed by the provision of equipment (for ICT utilization and application). Then the technical cooperation project implements trainings on the usage of such equipment.

Within the scheme of loan assistance which signed the loan agreement from 2005 onwards, there were four projects directly addressing ICT sector (four cases in communication sector) and three projects which mainly use and apply ICT (others). The four cases found in the communication sector were infrastructure development in which telecommunication business itself belonged to the public sector and were highly public in nature. On the other hand, among other three cases, two of them were Special Terms for Economic Partnership (STEP) and the equipment are expected to be procured in Japan. In addition, other infrastructure development projects also utilise ICT for the operation of its facilities, but the specifications and other details are unknown from the ex-ante evaluation reports. For example, such cases are found in the field of railway, water supply and sewage systems, power plants, and dam reservoirs. Although the project itself is building facilities, it is assumed that ICT technology is utilized for the operation of such facilities.

Results of the utilization of ICT in assistance by international institutions and bilateral assistance institutions

World Bank: The World Bank Group has rich experience of assistance in the field of ICT. The rate of ICT utilization in non-ICT fields reached 74% during 2000s, and ICT is used in 1,300 projects.
The World Bank practices 2 approaches: Framework Agreement and development of tools by ICT.
74 projects in the field of ICT were approved between 2005 and 2015. 3 cases below represent the characteristic of the World Bank's projects: the promotion of comprehensive utilization of ICT by the government of a relatively small country, Rwanda; the introduction of solutions to the governmental core system in Bangladesh; and the project closely related to the national finance in Ghana. They are all classified in the field of governance in Japan.

Asian Development Bank (ADB): ADB developed its ICT strategy in 2003 and set 3 main goals: creation of an enabling environment through improvement of policies; provision of infrastructure; and human resource development for ICT literacy and professional skills.
ADB's approach is characterized by the number of TA (technical assistance)-type projects. It usually conducts RETA (regional TA, multilateral TA) first to form consensus in the region (GMS or CAREC), then implements TA in countries with relatively high development needs to create a master plan. The utilization of ICT is also promoted in the field of education, governance, health, agriculture and finance.
For example, ADB conducted ICT in Basic Education Project in Uzbekistan and ICT Development Project in Maldives.

Inter-American Development Bank (IDB): IDB developed the Institutional Strategy 2010-2020, which was revised in 2015. It consists of 4 sector strategies, and ICT is placed in the Sector Strategy Institutions for Growth and Social Welfare (approved in March 2011). Its projects focus mainly on e-learning in the field of education.

United Nations Development Programme (UNDP): In 2000s, UNDP's assistance policy changed from the one targeting individual projects and programs to the one concerning more comprehensive strategies and policies. As a result, policy approaches on national and international level increased in the field of ICT, in addition to the provision of services. In conformity with the organizational policy, the current priority assistance areas are poverty reduction through sustainable development, democratic governance, and climate change and disaster resilience.

Department for International Development (DFID): DFID, one of the British ministries, affirms the importance of ICT in the development assistance. Based on this view, it advocates the utilization of ICT in initiatives such as establishment and implementation of innovative approaches for poverty reduction, improvement of policies and cooperation with civil societies and private sectors, and partnership with international institutions and bilateral assistanceinstitutions. Its specific approaches put importance on establishment of universal access, provision of regional services based on the existing system, feasible and realistic utilization of ICT and capacity building.

United States Agency for International Development (USAID): USAID has used ICT in assistance for developing countries since 1970s. It started to focus on the field of ICT in 1990s as the information revolution prospered, and mainly assisted the development of telecommunication infrastructure and capacity building for its application. One of its major activities was the development of the Internet environment, as in the Leland Initiative which was launched in 1995 and conducted eventually in 22 African countries, and the Internet for Economic Development Initiative which was conducted in 21 developing countries from 1996. As assistance of the ICT sector and the utilization of ICT as tools advanced in 2000s, ICT was applied to various fields of assistance.

As the communication technology and national-level Internet environment improved, USAID turned the focus of its ICT infrastructure assistance to the gap between urban and rural areas, with the aim to close the digital divide by developing universal broadband

infrastructure. The Global Broadband and Innovations Program (GBI) is an initiative to achieve such a goal, as a succeeding project of the aforementioned Leland Initiative and Last Mile Initiative (LMI) which aimed to provide means of communication to rural and poverty-stricken areas.

Although ICT is utilized extensively in USAID's development assistance, its target area is the region around India. This shows that despite of its successful introduction of ICT in various fields, USAID may be limiting or need to limit its application according to the regional capacity.

USAID mainly cooperates with large American ICT-related companies, such as Intel, Cisco Systems and Microsoft. For instance, Intel concluded over 20 partnerships to cooperate extensively in the livelihood assistance for women, development of broadband networks, improvement of education, assistance for entrepreneurs and small and medium companies, and activities in the field of medical health and climate change.

International Telecommunication Union (ITU): ITU is an UN specialized agency that develops international standards related to telecommunication technology and broadcasting. ITU-D, ITU's telecommunication development sector, takes on 2 roles as a UN agency specialized in development activities and as an implementing organization for cooperation projects funded by the UN Development System, etc. It aims to develop telecommunication technology in developing countries and promotes establishment of telecommunication networks, technical assistance, and development and application of services.

Its areas of action include ICT applications, cyber security, emergency telecommunications and climate change. Only 12 projects are in the area of ICT application, but the half concern health and medical care such as Telemedicine and m-Health. Another example is e-Cabinet Documentation Center (CDN). The area of cyber security has 17 projects which aim to establish the national and governmental CIRT. 8 projects are in the area of emergency telecommunications, but few concern the establishment of a specific system, such as an early warning system.

Many of ITU's projects utilize ICT in health and medical care in the area of ICT applications. One of IUT's eHealth-related projects conducted in cooperation with World

Health Organization (WHO) is the Global eHealth Projects Repository, a repository which was developed to share information related to the effective utilization of ICT.

Chapter 3 Challenges to and prospects for ICT utilization

Trend Analysis of the ICT utilization and Application at JICA

This Chapter analyzes the project cases which include ICT utilization and application component and presents its trend as well as the matters to be noted for its promoting.

Approximately 10%, or 185 out of 1830, of JICA projects involve the use and application of ICT. When looked at by sectorial issue, the percentage of the ICT utilization and application varies depending on the issue, from 5 to 40%.

Here are the figures as to what sort of ICT tools are used in the projects which have an element of the ICT utilization and application. Out of 185 projects, 62 of them use database, or the utilization rate of 33%, which is the highest figure. This is followed by Geographic Information System, or GIS (35 projects or 19%), monitoring systems (18 projects, 10%), the Web (Internet) (13 projects, 7%), and simulation (11 projects, 6%). Database is a common ICT tool which is used as a foundation for information storage regardless the sectoral issues, whereas GIS, monitoring and simulation are more correlated to specific sectoral issues. The sectoral issues which often utilize specific ICT tools are Urban and Regional Development, Water Resource and Disaster Risk Management and, Energy and Mining. The rate of ICT utilization and application in these issues ranges from 14 to 40%, which can be considered high. When the purpose for which the ICT is used is relatively specified, the rate of use and application in that sectoral issue tends to be high.

The rate of the ICT utilization and application in urban and regional development is 40%, which is significantly higher than other sectoral issues. This is due to high use rate of GIS. The latter has a higher degree of perfection as an ICT tool and many of the counterparts already have techniques to use them. It can be the reason why the technology is widely used. In other sectoral issues such as Water Resources and Disaster Risk Reduction, and

Energy and Mining, it is often used in monitoring system and remote sensing, in addition to GIS. In the projects which require specific ICT tools, the ICT is utilized to the extent which the dispatched experts can cover with their own knowledge and experience. For that reason, while the range of the ICT utilization is somewhat limited in such cases, the project objectives can be achieved without any major problems. This is considered to be the reason why specific tools are used more than others.

On the other hand, the issues other than the above, namely Governance, Infrastructure, Economic Policy, Environment Management, Education, Health, Private Sector Development, Agricultural and Rural Development, Fisheries and, Natural Environment Conservation, the rate of the ICT utilization and application is limited to 5 to 12%. No frequent use of specific ICT tools are observed in these sectorial issues, but rather, it is often the case that systems specialized for certain operations and with individual specifications are used, accompanied by some software development.

Mobile phone, which is the most notable mobile device, is rapidly spreading in the developing country as well although the situation varies from region to region. It is now a sweeping trend. Nevertheless, there are not many JICA projects where mobile phone use and application are involved. Among the completed JICA projects, there are almost no cases which explicitly apply the following technologies: Cloud Computing, IoT (Internet of Things), Big Data, open data, and 3D printing.

The use of Open Source Software (OSS) is spreading globally. In particular, Linux is commonly used as an Operation System of the basic software for network servers and Web servers, which control networks. However, OSS is not used in most of the JICA projects. In practice, nonetheless, it is presumed that there are cases where Linux is used, not windows. It is also confirmed that an OSS (QGIS) is employed for GIS in some software of general applications.

In developing countries, correction of digital divide, development of copyrights legislations against illicit use of pirate software, nurturing ICT human resources and, progress in

software industry are national agendas. The spread and expansion of OSS is expected to play potentially a certain role in attacking such agendas.

This research analyzes the success stories and lessons taken from the ex-post evaluations, and picks up the following three points as reasons for successes: 1) Making results “visible”; 2) Ripple effect of ICT utilization and application results to peripheral businesses, and; 3) Ensured technical transfer and continued involvement of human resources.

The typical lessons learnt found in ex-post evaluations are: 1) Understanding financial situation and capacity of the counterpart and taking right measures for them, and 2) Forecasting the changes of ICT implementation environment and taking right measures for them.

SATREPS is a research program scheme that researchers from Japan and developing countries collaborate with each other. In research areas of “Environment and Energy”, “Biological resources”, “Disaster Risk Reduction” and, “Infectious Diseases”, cases of ICT utilization and application are found in the following sectoral issues: Water Resources and Disaster Risk Reduction (8 projects), Natural Environment Conservation (3 projects), Environment Management (3 projects), Energy and Mining (2 projects) and Health (2 projects).

While there are many projects which use the JICA Partnership Program scheme, not many of them include ICT utilization and application element. Nonetheless, taking advantage of the scheme which is proposal-based, there are three projects which incorporated the local needs into the systems that have proved to be effective in Japan. Two out of the three projects are cases of distance medicine, and the other one is about poverty alleviation. Partnership with Japanese Private Sector is a proposal-based program which utilizes the already-existing technologies of the Japanese private companies. Many projects under the program aim for visible solutions, unlike the Technical Cooperation projects. There have been 217 projects by 2014 under the Partnership with Japanese Private Sector Program which started in 2012, and 9 of the projects have ICT utilization and application

component; 4 projects under Health, one each under Education, Water Resources and Disaster Risk Reduction, Transportation, Economic Policy and, Agricultural and Rural Development.

The Collaboration Program with the Private Sector for Disseminating Japanese Technology aims to see if and how the products, technology, systems etc. possessed by Japanese companies can be utilized for development. It started in 2013. Out of the 56 projects that have been adopted so far, seven of them involve ICT utilization and application: 3 on Transportation, 2 on Agricultural & Rural Development, one each on Disaster Risk Reduction and Urban & Regional Development.

Preparatory Survey (Promotion of BOP Business) is a program based on proposals by private companies which plan to do BOP businesses in developing countries. It started in 2010 and 100 projects have been adopted already. Seven of the projects involve ICT utilization and application: 5 on Education, one each on Energy and Mining, and Agricultural & Rural Development.

Trend analysis on ICT utilization and application by the international institutions and bilateral assistance institutions: With regard to measures which do not exist in JICA schemes, there are such items as asking the public to come up with project ideas – especially for public-private partnership --, ICT tools useful for development assistance, distance learning, and measures in the area of governance.

Priority Issues

Here are the issues sorted out by project process.

JICA Medium-term Plan: Although the term ICT itself is not mentioned in the JICA Medium-term Objectives or Medium-term Plans, the documents implicitly recognize the global transformation by ICT, as they mention such premises as “With the progress of globalization, the national borders are ‘easier to cross’ in the contemporary international society”. Despite this, no concrete cases of ICT utilization and application nor active efforts are mentioned in them. Since the Plan is an important, reference document for dealing with development issues, it is deemed necessary to clearly define about ICT utilization and

application and active endeavor for them, when developing the next (the fourth) Medium-term Plan.

JICA Country Analysis Paper (JCAP): The information contained in JCAPs affects planning of “cooperation programs” by country. Therefore, it is desirable that the position of the ICT utilization and application is clearly described when updating them.

“Information and Telecommunication Technology” thematic/sector guidelines: The guidelines need to evolve adapting to the time and incorporate new waves. The ideas for reorganization of the guidelines are presented in Chapter 4.

Incorporating and flagging the ICT utilization and application from the project-planning stage: From the stage of request to that of project adoption, projects are prepared according to the priority areas set under the frameworks of the Country Assistance Policy (Ministry of Foreign Affairs) and the Project Implementation Plan by Country (JICA). Therefore, it is rare that the ICT is out in front, with exception of some countries. In order to promote ICT utilization and application, it is necessary to set a rule that an ICT flag must be placed to those projects. The appropriate timing for flagging would be at the stage of answering to the Request Survey in case of a Technical Cooperation project based on such survey. However, it would be even more important that it (the involvement of the ICT component) is known at the stage of screening the Request Survey answers at each regional department.

Clarification of the merits/incentives of the ICT utilization and application: It is often the case that the partner government does not understand the methodology and the merits of ICT utilization and application at the planning stage of a Technical Cooperation project, and the ICT component ends up not included in PDM and not marked as “included.” For this reason, JICA clearly demonstrates the advantages of ICT utilization and application to the governments of developing countries.

Ensuring sequential use and application: Currently, the social media, Web and commercial software are actively in use. On the other hand, there are some projects which present original business solutions. However, there are very few projects which fill the gap between the two levels.

The procurement methodology of the needed ICT technologies: Because most of the current ICT solutions require only the soft aspects, the equipment procurement scheme, whose premises are to procure hardware or ready-made software, is somewhat unfit. For this reason, a flexible selection and employment of schemes for resolving development issues will be considered for the future. Notably, the case examples, conditions and extent of the combination of Technical Assistance and Financial Aid (ODA loans or Grant Aid) are needed to be organized.

Cross-sectoral ICT utilization and application: There exist some cases in which the ICT utilization and application are connecting different sectors. In developing country, rather than waiting for each sector to mature and become connected to each other, it is necessary to consider its active use when one can pursue non-sector-bound outcomes with the project in question.

Application of fruits of STREPS and Feasibility Studies (F/S) for Supporting SMEs (small and medium enterprises) program: SATREPS basically deal with development issues using advanced technologies, whereas F/S for Supporting SMEs are about application and expansion of the existing technology the small and medium enterprises have to the developing countries. If the technologies employed in STREPS or the F/S continue to be needed in the same country, it is considered proper to urge the country to request a Technical Cooperation project with the implementation organizations of the earlier projects as the base.

Project planning as a country faced similar challenges slightly earlier: A country faced a certain challenge slightly earlier than other countries cannot find references in other countries' experience to solve its current problems. Its way to solve the problems would later be referred to by other countries when they in turn face the same challenge in the future. Typical issues are declining birth rate & aging population, global warming and, disaster risk prevention & reduction. The issues such as the following also are subject for it: urban concentration, traffic congestion, safety and sanitation, protection of and support for the weak, decrepit infrastructure, regional depopulation and, efficient use of energy. The

efforts to more actively introduce the knowledge and experience (of Japan) as “a country faced similar challenges slightly earlier” in project planning are proposed.

The following are the issues regarding project implementation.
Ensuring cybersecurity: It is becoming difficult for developing countries to protect themselves on their own, as their cybersecurity tends to be vulnerable because of their weak or non-existent ccTLD (country code Top Level Domain) management and CSIRT (Computer Security Incident Response Team).

Cybersecurity at individual project level: Ensuring cybersecurity is a pressing issue, because its absence can put the entire national administrative system itself at risk.

Clarification of the standard for database use: What kind of database system is used is decided by project. Because a database contains large amount of information, the consequence is significant if the information is leaked. For this reason, it is important to select most adequate system compositions and to deal with the security strictly at the same time.
Active promotion of GIS: GIS should be actively promoted. GIS is a widely spread element technology of ICT and used as basis for geographical information.

System construction on the premise of mobile technology: The use and application of ICT need to be promoted with a recognition of mobile devices as important ICT terminals. Moreover, using Web-based solutions actively, rather than depending on the OS and applications of the terminals, leads to construction of highly usable system.

Open data: It is expected that Open Data becomes gradually common in developing countries too. However, there are various challenges such as how to motivate the data providers, establishing rules to data disclosure and use and, responsibility and cost for operation. With paying attention to such challenges and the needs of developing countries,

as well as general progress trend of Open Data use, the Open Data use should be kept in prospective.

Measures to the trend of the Open Source Software (OSS): The global trend suggests that OSS will be used in many projects in the future. JICA considers it necessary to eye the utilization of OSS in its future ICT utilization and application, while paying close attention to the trend.

Maintenance and Management Costs: It is possible that the sustainability decreases in case a medium- or large-scale system is introduced but the implementation agency cannot cover the maintenance and management costs. For this reason, when introducing an ICT solution, it is evident that one must confirm the recipient government's understanding and methods for cost coverage. On that basis, the sustainability needs to be ensured by devising solutions such as making the system easier to maintain and manage locally to reduce the cost, introducing BOT methods and, making the maintenance and guarantee period longer than the standard.

Prospect

The share of developing countries in the internet economy is assumed to grow from 30% in 2010 to 50% in 2025. Although ten years in the world of ICT is a long time and a totally new trend might emerge, here is the prospect that can be predicted as of today.

The world in 2025: Technological development of ICT: The ICT Growth Strategy Promotion Conference of the Ministry of Internal Affairs and Communications announced "ICT Growth Strategy" in June 2013, which defines its mission as "to become the most active country in the world in contributing to Japan's economic growth and the global society by means of ICT" to perform "globalization and overall promotion of the project" under the three visions: (1) creating new value-added industries, (2) solving social problems, and (3) improving and strengthening a common ICT infrastructure. With those measures, it is intended to achieve the following by around 2020: i) promotion of national development of infrastructure for sharing medical information, establishment and dissemination of ICT health model (prevention) and promotion of a new work style to deal with the problem of a super-aging society, and ii) concerning the problem of resources, (1)

research and development of effective data analysis technology and information sharing technology to establish a value chain consistent from production to distribution and consumption, and (2) research and development of censor technology and application technology to establish effective maintenance of roads and bridges. Although it is difficult to predict what will be developed and when for an individual ICT technology, “Technology Roadmap 2014-2025” prospects an overall trend that various technologies will be materialized.

Developing countries: During the United Nations Conference on Sustainable Development (Rio +20) held in June 2014, establishment of Sustainable Development Goals (SDGs) to supplement MDGs was discussed, which was approved during the General Assembly in September 2015. There are 17 of those SDGs, and some of them refer to ICT, if not specific applications (information access or diffusion rate of mobile phones). Applying ICT in many different ways will be an important factor to achieve the rest of the SDGs as well.

Although GDP is expected to exceed 10,000 dollars in around 10 developing countries which will thereby graduate from ODA by 2025, poverty will still remain in many countries including those graduates. The world population will increase from 7.34 billion to 8.14 billion in the next 10 years, and it is forecasted that the population share of lower-middle-income and low income countries will increase slightly.

While trends of population and economic development might vary from the current status, mobile phones are expected to spread on a continuous basis. Especially in developing countries, the diffusion of mobile phones started way before fixed phones became common (roughly 50% of population), and in 2015, the subscription rate reached 91%. This trend is expected to continue, and it is forecasted that the subscription rate of mobile phones will be around 120% of the population in 2015 and reach saturation as much as in the current status of advanced countries.

The rapid spread of the internet is also important. The number of internet users in Africa increased by as much as 317% in five years from 2007 to 2012. It increased by 294% in the Middle East and 143% in Asia, which reflects the fact that the internet has been established as an important infrastructure also in developing countries in such a short period.

Even under such situation, poverty will not have been totally eliminated in 2025, and assistance by advanced countries and international organizations will still be necessary to meet development needs of developing countries. As the information gap between advanced countries and developing countries will be much smaller then, it is assumed that developing countries will acquire various technologies and know-how through the internet, diversify types of financial access and provide administrative services of the government through the internet. On the other hand, technological and financial gaps between advanced countries and developing countries will also decrease. Although the time lag of general purpose technology will be virtually eliminated, areas where it is impossible for developing countries to catch up with will also expand.

Concerning individual trends and their application, the existing ICT technology and the future trends that are certain to come true are forecasted for around 5 years from now as follows:

Mobile: In a project targeted at the poor, it is possible and effective to use SMS in information services and public relations. However, SMS is not necessarily effective where the literacy rate is low. Application styles vary from regular dissemination of information (knowledge, market conditions, system) (e-mail newsletter style) to e-mail list for interactive discussions (list server style). Incorporating the push system will further improve the freshness of information.

Cloud computing: In developing countries, it is often difficult to establish a stable high-level server originally. In general, it is possible to reduce costs of incorporation and maintenance of ICT by cloudization, which should be promoted in developing countries on a long-term basis. It will also solve the shortage of ICT technicians. In case of establishing an information system in an organization managed by a user, it is necessary to have technicians to operate and maintain it within the organization. As it is not necessary in case of cloud, it is highly effective to use the cloud in developing countries where the shortage of ICT technicians is becoming more significant.

IoT: As the costs of sensors go down, the possibility of applying IoT (Internet of Things) in developing countries expands. It is applicable in development assistance in different sectors, contributing to monitoring and risk assessment such as health checkup, monitoring of

agricultural and stock-raising productivities, environmental monitoring, equipment control, traceability in the logistics sector, and should be promoted actively.

Big Data: Under the current situation of developing countries where it is not even clear what can be done by big data analysis, most of it is often regulated depending on the available data. Therefore, it is possible to start by analyzing on a trial basis. Structured data existing in developing countries consist overwhelming of information on mobile terminals (locations and times, connection with SNS) rather than data on commercial transactions such as POS. In addition, the application scope is expanded as big data analysis enables to target at unstructured data (images, video). While a high level of security is required for protection of personal information and confidentiality, data should be handled more carefully because legal regulations are not sufficient in developing countries.

3D printing: The Institute for Information and Communications Policy of the Ministry of Internal Affairs and Communications is studying the information infrastructure, the systematic infrastructure and the human infrastructure to support the fab society that will arrive when digital fabrication equipment such as 3D printer are widely spread. There are already many cases of trying to achieve the leverage effect in development using 3D printing not only in Asia but also in Africa, and the Institute considers those cases will significantly increase in the next few years. In prospecting up to 2025, while the whole world is connected by the internet and subscription of more mobile phones than the world's labor population is promised, the manufacturing sector will be run by citizens themselves, which can possibly change even the trade structure when advancement of diffusion of 3D printing and disclosure and sharing of blueprint designs through the internet are further promoted.

A case of incorporating as a tool for applying in a new trend of ICT

Following are the concept of applying IoT and big data in developing countries referring to the attempts by domestic vendors:

Landslide disaster: In a landslide disaster, the actual collapse can occur almost immediately after the premonitory phenomena are observed, which makes prevention and prediction important. The soil condition can be monitored to calculate the degree of danger of the

slopes at an earlier stage by determining the degree of danger of the slopes by GIS and intensively analyzing the information (including weather forecast) acquired from the special underground sensor, rain gauge and other sensors at high risk locations using IoT and big data. Accumulating data enables to disseminate warning information.

Detection of deteriorated transport infrastructure: It is intended to deal with the problem of deteriorated roads and bridges in developing countries. Roads and bridges are monitored through the wireless sensor network using sensors including vibration sensors that detect deterioration of durability caused by corrosion of steel parts of bridge and fatigue cracks of concrete.

Transport planning and traffic control solutions: The time series information of traffic users' locations can be obtained by mobile phones, monitoring cameras, road sensors and emergency phones. Analysis of those users' time series behaviors can replace the conventional person trip survey, which is reflected on highly accurate traffic planning and urban planning on a long-term basis. Immediate big data processing of such real-time information of time series locations enables to monitor traffic congestions, predict congestions and accidents "in advance", provide information to navigation software, communicate to the road control center and thereby avoid negative events.

Railway/airport security system: It is necessary to detect threats of terrorism timely, prevent crimes and minimize damages at railway stations and airports that are used by many people. Convenient and comfortable procedures for baggage inspection and immigration control are also required at railway stations and airports. The technologies of biometric authentication and behavior detection enable to strengthen security and risk control at stations, airports, concourses, inside of cars and airplanes and other important facilities such as control room and simplify immigration procedures.

Establishment of a smart city: Many developing countries depend on imports for energy sources which are expensive, and the demand for coolers is rapidly growing. The electrical distribution system with low electric consumption is made possible by incorporating various sensors on terminals of the electrical distribution network including smart meter (wattmeter), analyzing and operating by big data and thereby minimizing losses. It is also possible to reduce environmental impacts by incorporating solar power generation widely.

ICT application for further incorporation of remote education and inclusive education: Remote education can be considered to be a common tool applicable not only in the learning sector but also in education of local technicians for issues in different sectors. It is possible for JICA to improve efficiency of development by applying the technology of remote education in trainings for local counterparts. Concerning inclusive education, different ICT technologies are making it possible for persons in need of special education to access to high-quality education and information, as in hearing aids for persons with hearing impairments.

ICT application in the health and medical care sector: ICT application is very active in the health and medical care sector among international institutions and bilateral assistance institutions in many ways including remote medical care. The following cases are possible: (1) maternal and child health handbook and e-Health (Palestine), (2) maternal child health and e-Health (Cambodia), (3) in-hospital system, (4) remote medical care, and (5) infectious diseases.

Monitoring and livelihood improvement for poverty reduction: A poverty reduction project is made possible by combining the existing ICT technologies that are being used in advanced countries, monitoring the poor and simultaneously generating various benefits.

Chapter 4
Amending JICA's ICT Thematic Guidelines and Development Strategic Targets

Overview of Thematic Guidelines on ICT

In September 2003, JICA drew up "Effective Approaches to Development Issues – ICT" in which five development goals to achieve through the effective approaches were presented, and in December the same year published it as the first edition of "Thematic Guidelines on Information and Communication Technology." It has been amended in April 2005 and in May 2009, and also combined in March 2012 with "the Guidelines for Cooperation in the Broadcasting Sector (September 2009)" to become the current edition. Of those guidelines, this document deals only with the guidelines on ICT. Development Strategy Goals 1-5 set

forth in September 2003 remain the same as before, while intermediate goals are newly added.

When the latest edition was formulated in 2012, the following appendices were added: (1) Major cases of cooperation; (2) Efforts for information and communication technology by major donors; (3) Basic check items; and (4) Current conditions and prioritized issues of information and communication technology by area.

Intermediate goals and past cases of cooperation

The record of major cases of cooperation by decade and by intermediate goal shows that until 1990s the number of projects in the field 3-1 Development of ICT infrastructure had been largest. Most of these projects were loan assistance for development of telecommunication network (i.e., transmission line, subscriber network, switching equipment.) However, since year 2000, the number of 2-1 Professional development of ICT engineers, and 4-1 Promotion and application of ICT to individual development issues has rapidly grown. This trend indicates that the need for assistance in development of telecommunication network has decreased as privatization of telecommunication companies –that were previously state-owned in developing countries– progressed, along with expansion of mobile telephone network, leading the private sector to become the central player in development of telecommunication network.

4-1Application of ICT to individual development issues is the area where the number of projects is increasing rapidly. With regard to the form of use and application, as reviewed in Chapter 2, many of them became obsolete after 1990s.

Review on the Thematic Guidelines

Development Strategy Goal 1: Improvement of ICT policy-making capacity

In regard with Development Strategy Goal 1: Improvement of ICT policy-making capacity, there has been growing need for it as ICT evolves, while the number of projects has been on the increase also.

Concerning Intermediate Goal 1-1 Establishment of ICT policy, efforts have been taken mainly through technical cooperation with policy advisors and training programs. Therefore, in addition to 1-1-1 Establishment of ICT policy, we propose that 1-1-2 Establishment of telecommunication business policy (i.e., promotion of ICT investment by foreign investors, establishment of competition policy and criteria for authorization) and 1-1-3 Establishment of user protection policy (i.e. frequency assignment, monitoring of illegal radio wave) be added as sub-goals.

In 1-2 Development of human resources to support ICT, ICT-related industries are classified into hardware and software industries. However, ICT industry's main player is now the private sector and the industry is no longer special one even in developing countries but rather strategically important one which can serve as driving force for economic growth, as crucial as, or even more so than, other sectors. For this reason, this issue should be dealt separately in the theme "Private Sector Development" set by JICA. Therefore, 1-2 Establishment of ICT industrial development policy will be deleted.

1-3 Establishment of user protection policy has become an important area and will be even more so in the future. There has been fast-growing need for measures of protection on both national and individual level, including cyber security, but the number of assistance projects is limited against such high demand. Protection of intellectual property, including patent rights and copyrights, will be deleted because it is an issue to be addressed in general industry development policy, rather than ICT policy.

Development Strategy Goal 2: Development of human resources to support ICT

Development Strategy Goal 2 Development of human resources to support ICT is the field where aggressive efforts have been taken through technical cooperation. The high demand in this area is likely to continue for years to come.

Number of cases in 2-1 Professional development of ICT engineers peaked in 2000s and is gradually decreasing.

Sub-goal 2-1-1 Assistance for content making will be deleted because technical difficulty level is becoming lower than before. Instead, 2-1-2 Professional development of SEs, as well as 2-1-3 ICT Technologies, will be carried forward as sub-goals.

2-2 Professional development of ICT policy practitioners needs to be undertaken in conjunction with effort 1-1 to 1-3, as it is difficult to develop such human resources independently only under 2-2.

So far, there has been only handful of projects in the field 2-3 Improvement of ICT literacy. However, it is likely to bring about substantial benefit to bridge the digital divide and to address the poor, should there be a good approach.

Development Strategy Goal 3: Development of ICT Infrastructure

Development Strategy Goal 3: Development of ICT Infrastructure has been an area where many projects were implemented including loan assistance to develop telecommunication infrastructure. In the least developed countries, need for development of infrastructure is expected to continue. Due to this, sub-goal 3-1-1 Assistance for development of backbone network will include both direct development and indirect development.

3-1 Development of ICT base originally included sub-goals such as development of ICT park, development of data center and bases for public use. However, it is necessary to reconsider what area is appropriate for ODA to deal with.

Development Strategy Goal 4: Promotion of use and application of ICT

Development Strategy Goal 4: Promotion of use and application of ICT is the main theme of this project reserach.

4-1 Application of ICT to individual development issues should be carried out in more diversified area. Sub-goals remain unchanged.

4-2 Effective use of JICA-Net: JICA-Net needs to be available for broader range of use.

Regarding 4-3 Improvement in efficiency and effect of cooperation using ICT, this document deals with its operational aspect only. Since sub-goals 4-3-1 Diffusion and transfer of existing knowledge and 4-3-2 Sharing and creation of experience and knowledge are two similar concepts, only former will remain, and instead, 4-3-2 Promotion and introduction of new technology will be added. 4-3-3 Application of ICT in operation for project implementation remains as it is.

Revised Thematic Guidelines (proposal)

Based on the above, we revised the Thematic Guidelines, setting forth Development Goals, Intermediate Goals and Sub-Goals as below. Newly added items are listed in boldface.

Table: Revised Development Goals, Intermediate Goals and Sub-Goals

Development Strategy Goal	Intermediate Goal	Sub-Goal (proposal)
1. Improvement of ICT policy-making capacity	1-1 Establishment of ICT policy **1-2 Establishment of user protection policy**	1-1- 1Establishment of ICT policy **1-1- 2 Establishment of telecommunication business policy** **1-1- 3 Establishment of radio wave administration system** 1-2- **1 improvement of cyber security**
2.Development of human resources to support ICT	2- 1 Professional development of ICT engineers 2-2 Professional development of ICT policy practitioners 2-3 Improvement of ICT literacy	2-1-1 Professional development of SEs 2-1-2 Technology in ICT 2-2-1 Professional development of working-level government officials 2-3-1 Assistance for improvement of user literacy
3. Development of ICT	3- 1 Development of ICT	3-1-1 Assistance for development of backbone

infrastructure	infrastructure 3-2 Development of ICT base	network 3-2-2 Assistance for development of data center
4. Promotion of use and application of ICT	4- 1 Application of ICT to individual development issues 4-2 Effective use of JICA-Net 4-3 Improvement in efficiency and effect of cooperation using ICT	4-1-1 Promotion of use and application of ICT for improvement of governance capacity (i.e. e-governance) 4-1-2 Promotion of use and application of ICT in BHN field (education, health and rural development) 4-1-3 Promotion of use and application of ICT in environment protection and disaster prevention 4-1-4 Promotion of use and application of ICT in economic and industrial development 4-1-5 Promotion of use and application of ICT for cross-sectoral issues 4-2-1 Use of distant learnng technology and **expansion of opportunity** **4-2-2 Expansion of availability into broader range** 4-3-1 Diffusion and transfer of existing knowledge **4-3-2 Promotion and introduction of new technology** 4-3-3 Application of ICT in operation for project implementation

Chapter 5

Measures to strengthen internal and external collaboration

Firstly, we discuss collaborative measures to be taken within JICA. In JICA, each thematic department should take active approach. When promoting use and application of ICT, it is essential for each thematic department, which is the front desk of each project, and Transportation and ICT Group's Team 1, which accumulates professional knowledge on ICT, to collaborate inter-organizationally to exchange information. When implementing projects, departments in charge will be assumed depending on the subjects. Therefore, it may be addressed by other group of Infrastructure and Peacebuilding Department.

As shown below, we propose that each organization in JICA, while playing respective roles, manage project cycle connecting organically with each other. More precisely, we recommend that we make the flow that allows exchange of opinions and provision of appropriate assistance to happen in each aspect of operational process such as project formation (assessment of needs in developing countries and request), formulation of implementation plan (specification writing, public announcement, evaluation of proposal), project implementation, and maintenance.

To further promote use and application of ICT, it is desirable that specific information shown below be stored and organized as "repository" at overseas offices where project formation first takes place, as well as at each thematic department so that it can be utilized as usable examples. In order for that, the information on projects must be organized by development theme and properly updated.

Input of ICT availability in the phase of project approval review:
In technical cooperation projects, flagging of available ICT for individual case during the operational flow before project approval would be beneficial because it would provide department in charge beforehand with accumulated knowledge on possible, specific utilization of ICT to consider at project approval review session in JICA. In terms of quality

control, Transportation and ICT Group of Infrastructure and Peacebuilding Department primarily should provide input for any flagged project.

Inter-organizational collaboration in the phase of implementation planning:
During preparation and implementation planning phase, main task of JICA is to make PDM, based on request, together with implanting agency. It is important to judge whether the request is relevant in the light of the recipient country's plan, individual development theme and country-by-country project implementation plan set by JICA. In addition, availability of applicable method for use and application of ICT must be considered.

Inter-organizational collaboration in the phase of project implementation:
When implementing project, JICA's main task is to monitor contractors (i.e., consultants, vendors) and implementing agencies.

Day-to-day exchange of information on use and application of ICT within the organization:
Knowledge Management Network (KMN) on ICT installed in Infrastructure and Peacebuilding Department is useful to capture trends in various fields. Building a system that allows information exchange to happen appropriately in project formation at each thematic department, as well as in implementation process, would provide opportunity to think how ICT can be specifically used and applied on-site. In order to promote this idea, commitment from the management of JICA is also required.

Secondly, we discuss collaborative measures with research institutions in Japan. There has been collaboration with domestic research institution, Japan Science and Technology Agency (JST), through SATREPS. This effort is conducted through joint investment by JICA and JST to promote cooperation between Japanese research institutions and those in developing countries.

Aside from that, there is possibility of collaboration with the national government institutions through operations such as examination of new technology in developing

countries. One notable example is National Institute of Information and Communications Technology (NICT), who has developed new information communication technology such as formation of communication network for a time of disaster. It also takes charge of Japanese standard time and has various technologies including speech translation technology for multiple languages.

When considering concrete collaborative measures with such national institutions, we must first carefully review their specific technologies at thematic department level to determine what kind of technology is applicable in developing countries, then employ appropriate ones aggressively when technical cooperation is requested. Furthermore, it is also possible to formulate technical cooperation (plan) based on those available technologies, and make proposals to developing countries.

Thirdly, we discuss collaboration measures with private companies. Among JICA's public-private partnership project schemes, "Promotion of BOP Business" (in preparatory survey for cooperation,) "the Collaboration Program with the Private Sector for Disseminating Japanese Technology," and "the Scheme for Overseas Business Expansion of Medium-and Small Enterprises" have exemplary cases that utilized ICT. Although they targeted a broad range of issues including education, health, water resource and disaster prevention, transport, natural resource and energy, economic policy, agricultural and rural development, urban and regional development, the number of projects is quite limited. On the other hand, ICT-related companies in Japan show their willingness to examine feasibility of their business and to address social issues using and applying cutting-edge ICT. They have already conducted number of projects in fields such as transportation, disaster prevention and reduction, and agriculture. Such companies present proposals to JICA when they have the opportunity. In the field of ICT, it is difficult to develop and use specific ICT technology solely by JICA, and it is understood that it is necessary to receive input from private companies (i.e., ICT vendors) in many forms regardless of scale of the company. Nevertheless, those proposals do not always lead to realization of project and JICA still needs to seek the way to more effectively match proposal and project.

While JICA already undertakes multifaceted information gathering appropriately, it is also possible to establish a forum to discuss more directly with private companies on use and application of ICT in development assistance. For instance, we could host a community of practice (COP) with a theme such as "present situation of use and application of ICT in development assistance and its new direction", or forum with theme such as "ODA and utilization of ICT", encouraging participation of development consultants, ICT companies, as well as inviting companies in related fields.

Collaboration with international institutions and bilateral assistance institutions

In collaboration with multilateral development banks such as World Bank or Asian Development Bank, JICA shares projects with them according to the recipient country's valid ICT grand design (or master plan/road map. The name varies among countries), just as it does in sectors other than ICT. It may be possible to conduct technical cooperation (i.e., dispatch of experts) in conjunction with Assistance for ICT policy making (system building etc.), one of TAs (Technical Assistance) conducted by those multilateral development banks.

Since ITU-D has many projects in health sector, it may be beneficial to seek possibilities of cooperation focusing on this area. There are vendors in Japan who have technology to offer. Some of JICA's technical cooperation projects address health issues focusing on certain disease. The first step would be to determine whether ITU-D has tools to provide for such purpose.

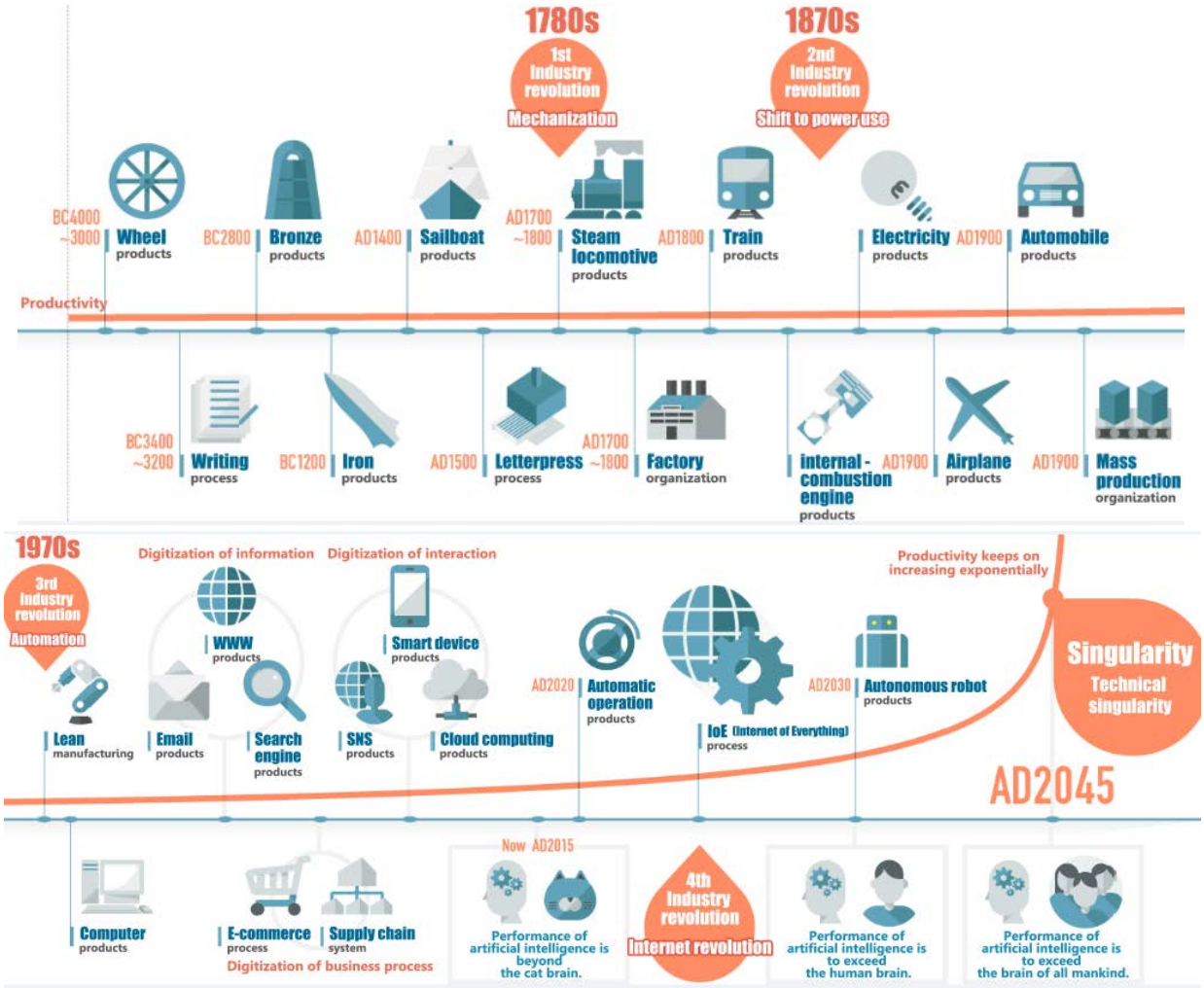
Bilateral assistance institutions: in some projects by bilateral assistance institutions such as USAID and DFID, ICT is used and applied by ICT vendors of respective countries. It is necessary to further consider what kind of collaborative measures could be taken.

Chapter 1
Prologue

1.1. The background of this research

The Information and Communication Technology (ICT) industry has experienced a major change since the dawn of industrial computing machines in the 1980s and the rise of personal computers in the 1990s. In the 2000s, individual work and efficiency improved due to the expansion of software, and computers became a common tool for knowledge and thought. Nowadays, human intelligence is reinforced with the expansion of the Internet and the mobile network, and it has become possible to establish new human networking and to put ICT into new business models derived from hands-on experience. For example, new businesses have developed using ICT in the health, education and agriculture fields.

The rapid technology development of ICT and its penetration in society is frequently called “the (arrival of the) fourth industrial revolution” by media. With the expectation of a “Singularity” arriving thirty years from now, which is the artificial intelligence that is expected to surpass human’s intelligence in 2045, every sphere of life is discussing the possibility of a rapid increase of the productivity curve, which is levered by ICT.



Source: The Nikkei online version (www.nikkei.com) – English translation by JICA

Figure 1.1: From the invention of the wheel to the fourth industrial revolution and Singularity.

The Ministry of Internal Affairs and Communications has started continual study groups and review meetings in order to discuss how to deal with the fast change of the relationship between ICT and society. Two groups are formed: 'Study Group on the future of rapidly advancing ICT' and 'Study group on the relationship between the digital fabrication equipment and society.'

Japan International Cooperation Agency (JICA) has been making ICT policy recommendations and providing development aid for ICT human resource training to improve economic infrastructure in developing countries. However, the sector-specific needs from developing countries have declined or dispersed. On the other hand, the need for cooperation to solve developmental problems, using rapidly improving and readily available ICT, is increasing dramatically.

Today, ICT infrastructure has become refined to a certain degree and ICT literacy is rapidly increasing in developing countries. ICT is recognized as a common infrastructure and an effective tool to help industrial and economic growth, and improve the livelihood of citizens. Thus, as mentioned earlier, the rapid technological development of ICT and its permeation in society has largely changed the position of ICT in overseas development.

After the war, Japan experienced miraculous reconstruction and a period of high growth. Now Japan is in a period of economic maturity, and is experiencing unprecedented low birth rates and an aging society. Japan is now a developed country with various social issues. The government and corporations have experimented with using ICT to help with issues like environment issues, the low birth rate in an aging society, prevention and reduction of natural disasters, and agriculture issues. During the Great East Japan Earthquake in 2011, Japan gained a lot of knowledge about rapidly applying ICT rebuilding information communication infrastructure, taking advantage of cloud computing[1].

In addition, Japan's ICT has been successfully used in many fields. In industry and finance there are banking systems that use biometric authentication using finger prints, venous and facial recognition, and smart grid. In the environment field there are smart city systems and early stage disaster alarm systems. In agriculture there are market information systems. In

transportation there are intelligent transportation systems (ITS), distribution systems using RFID[2] and customs systems. In the health and medical field there are remote medicine and electronic medical record systems. In the education field ICT has enabled online classes.

It is important to take advantage of Japan's experience based on the results for developmental aid. It is necessary to examine the requirements in the countries and regions where Japan provides aid. It is possible to introduce ICT to countries with zero-base or with no legacy technologies, thus, once ICT is introduced and has produced results, it may be possible to apply the model in other areas.

As mentioned above, the role of ICT has changed, so JICA has been taking new and different cooperation initiatives. There are examples of cooperation based on Japan's position as a developed country that has experience with issues. However, JICA does not have appropriate support policies for ICT to respond to a major short-term change so it needs to determine how to deal with drastic changes in ICT.

1 The concept of using software and data through a networking service on the Internet, or the technology to enable it. The merits include that maintenance is not required for users, it is possible to access the cloud from anywhere and from any devices as long as the service is provided through the website, and there is a cost reduction in human resources and time before using the system.

2 Radio Frequency Identifier. Information exchange system for short-distance wireless communication with tags that have information on them, using electromagnetic field and radio waves. It includes contactless IC cards such as Suica.

1.2. The purpose of this research

Based on the background above, this research will study the examples of ICT utilization by Japanese and/or other foreign aid organizations to enhance developmental efficiency in each development areas. From the point of view of how JICA should deal with the development and ICT issues, this research will examine the future ICT application and its implementation system. Based on this report, it is anticipated that JICA will recognize and become more aware of ICT utilization and then a proper review for ICT utilization will be developed.

1.3. The composition of this report

This report consists of two parts with the main report on the domestic research results on

the “Research on the nature of the application of information and communication technology in research projects in developing countries” and the Appendixes.

“Chapter 2: Current state and trend of ICT” reviews the leading trends of ICT development and studies the ICT utilization results for Japan, international organizations and dual country aid organizations. The study data is contained in the Appendixes.

“Chapter 3: Challenges to and prospects for ICT utilization” focuses on the predominant issues from the viewpoints of operation process and business implementation based on the trends analysis in Chapter 2. Then, ICT utilization in developing countries in 2025 is predicted and examined as to how ICT is applied to important issues.

“Chapter 4: Amending JICA’s ICT Thematic Guidelines and Development Strategic Targets” thematic guidelines and development of strategic objectives” suggests a draft for reorganizing “’information and communication technology’ thematic guidelines (revised in March, 2013)” as a way of implementing the corresponding side measures for the issues mentioned above.

“Chapter 5: Internal and External Cooperation Enhancement” suggests an idea how JICA can deal with future ICT utilization internally and externally. This idea also applies to solve the issues mentioned earlier.

Chapter 2
Current state and trend of ICT

2.1. The current state of ICT and trends

2.1.1. History and current state

It was in the 1990s when the ICT industry rapidly developed and its technology started to spread widely. Currently, ICT is implemented in various industries and operations such as manufacturing, finance, prevention of disaster, agriculture and transportation, and it has been established as a vital infrastructure for our economic activities. It has become inseparable from our lives.

The milestone for ICT is the popularization of personal computers (PC). Various manufacturers developed PCs in the 1980s. They were mainly used in offices and gradually introduced to households. The penetration rate of PCs for households was 10% in the late

1990s, it increased to 50% in 2001 and it exceeded 75% in 2011. It grew most between the late 1990s and 2000 [3].

Also, the spread of the Internet is important. Commercial service for the Internet started in the US in the late 1980s and it started in Japan in 1993. It immediately spread in the late 1990s and the population diffusion rate for the Internet surpassed 50% in 2002 [4]. These trends formed the base for ICT business.

Mobile phones became popular in the 2000s. Feature phones were mostly used around that time, but smartphones started to spread after the development of the iPhone by Apple in 2006. Also, Apple released the iPad in 2010 and tablet terminals started to circulate. The popularization of mobile phones [5] had an impact not just to terminal manufacturers, but also to many parts manufacturers in terms of technology and sales. Thus, many new ICT businesses were created with the increase of the terminal types in addition to the spread of the Internet.

[3] Shinichi Ogata, et al. *Technology Road Map 2015-2024 [ICT merged new industry version].* Hiroshi Asakura. First edition. Tokyo, Nikkei BP, 2014, p. 12.

[4] Shinichi Ogata, et al. *Technology Road Map 2015-2024 [ICT merged new industry version].* Hiroshi Asakura. First edition. Tokyo, Nikkei BP, 2014, p. 13.

[5] Portable communication devices and the communication methods. These devices are mainly feature phones, smartphones, tablet terminals and notebook computers.

Regarding broadcasting, there are some events that affected our lives in Japan. There was a spread of digital terrestrial television broadcasting. Since its delivery started in 2003, the penetration rate of the digital terrestrial broadcasting receiver increased to 94.9% in 2010 [6]. High-definition broadcasting began with the start of terrestrial digital broadcasting, and this also led to the increase in screen size. BS digital broadcasting and CS digital broadcasting contract numbers have seen soaring as well.

Also it should be noted that communication and broadcasting, which have each developed separately, have now became a merged service. With the spread of high-speed and high capacity Internet as mentioned above, various video distribution share services have emerged, and broadcasting stations started to deliver content through these services. For example, Japan Broadcasting Corporation (NHK) started an official channel on YouTube, the video distribution, sharing and uploading service, in 2008 [7]. Thus, it should be noticed in considering future ICT utilization that communication and broadcasting have merged nowadays and they are inseparable.

The appearance and spread of new ICT technology has had a significant impact on our work and life style. However, this does not apply to the entire world. It needs to be noted that the path that Japan and other developed countries have followed up to now and the path that developing countries have followed are not necessarily the same.

[6] Ministry of Internal Affairs and Communications. "Research on the Impact of the development of ICT infrastructure had on people's lifestyle and social environment and its relative relationship" (PDF version). Ministry of Internal Affairs and Communications website. P. 20-22. http://www.soumu.go.jp/johotsusintokei/linkdata/h23_06_houkoku.pdf. (July, 2015)

[7] Ministry of Internal Affairs and Communications. "Research on the Impact of the development of ICT infrastructure had on people's lifestyle and social environment and its relative relationship" (PDF version). Ministry of Internal Affairs and Communications website. P. 62. http://www.soumu.go.jp/johotsusintokei/linkdata/h23_06_houkoku.pdf. (July, 2015)

2.1.2. Future trends

In order to consider the future of ICT utilization, it is very important to think not only about the current technology, but what kind of technology is going to increase the use of ICT utilization in future, what combinations of technology will widen the use of ICT. In response to the experience of ICT in developed countries and developing countries so far, five interrelated concepts have been selected for discussion here: mobile, cloud, Internet of Things (IoT) [8], big data [9], and 3D printing. The expected use of each will be discussed. These can have a significant impact on industry, business and our lives in the future as a trend of the ICT industry.

(1) Mobile – collaboration with various technologies

Mobile widely may refer to a set of portable information terminals and information systems, but in recent years, it refers to consumer information terminals such as smartphones (mainly feature phones, smartphones, tablet PCs, and notebook computers) in particular.

These terminals are now widely used throughout the world and have become a foundation for providing various services. In particular, the spread of the mobile phone is remarkable in recent years. As mentioned earlier, the mobile phone (including both feature phones and smartphones), as a type of mobile terminal, has rapidly become widespread in recent years. Mobile phone penetration rates have significantly risen in developing countries. Penetration rates for mobile phones in 2012 are more than 75 percent in developing countries, and the worldwide rate is 89.5%. The total number of subscribers for mobile phones in the entire world in 2012 was about 20 times more than that of 2000 and the number of subscriptions for the Internet is also about 15 times more than that of 2000. Smartphone penetration is also progressing. The world shipments in 2013 showed an increase of 38.4 % compared to the previous year, and also the proportion of smartphones as a proportion of all mobile phones shipped year-round surpassed 50% for the first time [10].

With the spread of mobile terminals, versatile services designed for mobile terminals have come into existence and these have expanded the use of mobile terminals. For example, SNS (Social Networking Service), video phone applications and cloud services have increased the speed of information transmission, and it has contributed to the facilitation of communication and cost reduction. In addition, it has become easier to share and manage information about a specific person or thing, such as location or health information, by equipping wearable devices with a sensor or GPS. Currently, the use of these services can be seen not only in everyday life, but also in the business scene, so clearly the use of mobile terminal is expanding.

The use of mobile terminals is expected to expand further by combining with other technologies. For example, the smartphone app, "Suma Ho" to support safe driving of motor vehicles, released in 2012 by Mitsui Sumitomo Insurance Company, Ltd., diagnoses "driving ability" using the GPS and acceleration sensors mounted to the terminal. It provides information for users to look at one's own driving. This application has an example of mobile use, which is linked to the big data described below. It can accumulate large amounts of accident data collected across the country (the location information of the accident site) in the server, so it has a function to alert the driver when approaching an accident location by checking the location information transmitted from the terminal [11]. There are various usage examples other than combinations with big data.

[8] It is called the Internet of Things. Mainly, they are things other than communication devices, such as a computer, that are able to connect to and communicate with the Internet, and the totality of technology to allow it. By allowing all things to be able to connect to and communicate with the Internet, it became possible to control things in real-time, and retrieve information from a remote location.

[9] Huge amounts of data, the recording, storage and use of this data, and the technology to allow it. It is used to describe the concepts and the technology as a whole. Often it refers to those with real-time properties. The acquisition and analysis of vast and diverse information management was difficult previously, but it is expected that this can be used to solve business and society problems in future.

[10] Ministry of Internal Affairs and Communications. "2014 Information and Communications White Paper (PDF version)." Ministry of Internal Affairs and Communications website. p. 4. http://www.soumu.go.jp/johotsusintokei/whitepaper/ja/h26/pdf/26honpen.pdf (July, 2015)

[11] Nikkei Business Publications. *Enterprise mobile encyclopedia*. (original title is in Japanese) Nikkei Computer. Takeshi Nishimura. Tokyo, Nikkei Business Publications, 2015, p. 95.

The overview of the specifications for two typical smartphone models is shown in Table 2.1.1. The communication speed of the data exceeds 100Mbps, and it is equipped with a number of sensors. Faster communication speed of data improves access to the Internet, and the equipping with various sensors boosted the emergence of smartphone applications such as the "Suma Ho" application mentioned earlier.

In addition, along with improved access to the Internet by smartphones we have seen (1) PCs expand in the work area due to the spread of tablets and (2) wearable devices such as wristwatches, glasses and wristband types for hands-free communication and hands-free

input/output with quick recognition and data collaboration with the Internet. It should be noted that it is causing hands-free communication as well as hands-free input and output.

Table 2.1.1. Current smartphone specifications

Product name		iPhone 6S	Galaxy S6 edge SC-04G
Manufacturer		Apple	Samsung
OS		iOS	Android
Data communication speed (Max receiving/sending)		150Mbps	100Mbps/ 37.5Mbps
Sensors	GPS	○	○
	heart rate monitor		○
	barometer	○	○
	3-axis gyro	○	○
	acceleration	○	○
	closeness	○	○
	ambient light/illumination	○	
	terrestrial magnetism		○
	finger prints	○	○

Source: Manufacturer's website.

(2) Cloud computing - the use of services provided through the Internet

Similarly to the above-described "IoT" and "big data," the term "cloud" is used in a broad meaning. This includes the services provided through the Internet such as all layers (IaaS: Infrastructure as a Service, PaaS: Platform as a Service, SaaS: Software as a Service) including infrastructures, platforms and software that are available from terminals via the Internet. It may refer to new information systems that become possible by linking multiple

terminals or environments with services, or it may refer to to a concept of utilizing the services available via the Internet.

The current concept of the “cloud” has existed since the 1970 to 1980s, but the term “cloud computing” was used by Eric Schmidt, CEO of Google, for the first time. Since then to 2008, US large corporations started developing their cloud services and the concept of cloud was recognized widely. Some cloud services include Amazon EC2 by Amazon.com, Salesforce.com by Salesforce, Google App Engine by Google and Windows Azure by Microsoft.

In recent years, it has become more cost effective to use existing cloud services rather than developing something new. It became feasible to store data externally and use these services due to the development of security technology, thus cloud service is used more in business than before.

The linking between cloud and mobile is being seen more recently. Particularly, the rapid spread of mobile phones (including both feature phones and smartphones) enabled many people to use the Internet from their mobile phones, thus making it easier to access cloud services from smartphone terminals.

BOX 1 HTML5

There are operating systems (OS) in terminals (PCs and smartphones) and it was common to process data on the native application in the OS.

The penetration rate of Adobe’s Flash became almost 100% on personal computers in the early 2000s and it became a *de facto* standard, but vendor lock-in became a concern, thus a non-plugin in browsing solution was sought. Thus, Ajax (Asynchronous JavaScript +XML) was developed as the standard browser function and was loaded on Google Maps in 2005. It became widely recognized that “the browser does not just display information, but enables high operability comparable to a Windows application.”

The competition to increase JavaScript’s execution speed advanced. Browsers other than Internet Explore improved the execution speed (Google Chrome and so on), thus Ajax’s speed was improved.

Meanwhile, HTML specifications, the document language for browsers, have been updated. The HTML 5 final specification was established in October, 2014 which updated 4.01.

Therefore, the execution speed of a process depends on the huge processing power and

memory capabilities in the cloud, which is communicated to the browser through HTML and Ajax. These types of processes are increasing while native applications are becoming less common.

(3) Internet of Things (IoT)

IoT is an abbreviation for "Internet of things." IoT provides valuable services by networking everything. IoT is a concept, a technology or a mechanism to make operations effective. The term "things" is used to mean "things other than computers."

The idea to link things through the network existed a long time ago, but it is believed that it was in 1999 that the tern "IoT" started to be used. It was around 2010 that the concept started to be recognized in general. It was around 2014 that media started to pay attention to this concept and people started to pay more attention.

When the term "IoT" started to be used, there was a limit for built-in technology in equipment such as a sensor, and communication costs tended to be large so the targets of use were secure equipment or damaged equipment [12]. This limit was, however, lifted due to the advancement of technology around 2010 and it became possible to realize IoT. Nowadays, things that are connected to network are industry equipment such as medical or agricultural related, operational equipment such as office related equipment, and consumer equipment such as home appliances and household items. The concept of IoT is much more familiar to us now.

[12] Nomura Research Institute Foundation Solution Planning Section. IT Road Map 2015 version. *Information communication technology five years from now!* (original title is in Japanese) Tomoaki Watanabe. Tokyo. Toyo Keizai, 2015, p. 169.

The things linking to network have become diversified. It has become possible to receive real-time information in remote areas, to give added value to services or products, and improve efficiency of operations. For example, it became possible to obtain real-time soil conditions and temperature from sensors in agriculture, thus it became possible to to take the best response at the right time based on the obtained information and give added value to agricultural crops. In a disaster, it became possible to enhance the disaster response quality by getting rainfall and river water level data from sensors, thus it became possible to make appropriate decisions quickly. Moreover, in retail, there is an example of enhancing the retail business efficiency such as inventory by mounting an RFID tag on items.

It is expected that the information obtained from the IoT can be used to solve various issues,

but the key to realize this is mobile and cloud which were mentioned earlier, and big data which will be described below. For example, cloud services allow for vast accumulation of data and process execution of large data. When the process of data acquisition continues from a sensor equipped things, it receives vast amount of data, but in order to use this vast amount of data, it is necessary to store and analyze and requires a larger resource. The cloud can provide resources at low cost as an external resource. The IoT may allow for utilization of the enormous data collected from many things in combination with the cloud. This is not just limited to the cloud, but it is assumed that the number of such services, provided by a combination of mobile and big data analysis technology, will increase in future.

(4) Big data – take advantage of diverse and huge data usage

"Big data," a collection of diverse and wide variety of huge data. It is then possible to take advantage of this collection for various purposes. Big Data is used in a broad sense as the term to describe the whole technology to enable this use.

Information analysis technology has been used for the tabulation process of business system, but there were hardly any business application examples in the late 1980s. In addition, since the underlying technology was immature, the analysis processing and handling of data was limited. Information analysis began to be important in the 1990s, and databases dedicated to analysis, such as RDBMS (Relational DataBase Management System), was advanced. Data handling has been shifted from single data to structured data. Then, the amount of data to be handled by the information analysis technology increased which led to large-scale analysis on the server. RDBMS became an essential tool for analytical processing in the 2000s. The foundation of the concept of parallel processing and distributed processing technology and complex event processing (Complex Event Processing, CEP) was born around this time which led to a trend of large-scale and real-time analysis of information. This trend was growing in the 2010s. 2012 was called the first year of big data and smart business began to be noticed around this time. The trend to automate information analysis started [13]. Business applications of big data further continue to grow.

Big data has different aspects from the conventional ICT and client companies/users tend to lead. In order to decide how to use it, it is important for the client companies/users to clarify the purpose of usage. There are some examples of usage, but the current usage is mostly experimental with some exceptions.

The characteristic of analysis by big data is machine learning by artificial intelligence. Furthermore, deep learning has made learning possible without human involvement.

Currently, there are a number of applications suitable for machine learning. For example, fraud analysis and risk analysis for finance and insurance, log analysis and audience rating analysis for communication and broadcasting, promotion analysis for distribution and retail, quality analysis and demand analysis for manufacturing, meteorological and seismic data analysis, energy consumption analysis, crime prediction/prevention, route optimization (emergency vehicle delivery), intelligence for transportation systems and automatic operation of the transportation system for the public use and public benefit, natural language processing, character recognition/image recognition/voice recognition, and emotion recognition for human interface [14]. Social issues are expected to be solved by the use of big data.

Big data is not useful only by businesses. It can be used for match-making between women and men for marriage agencies, diagnosis and surgery or the like in the hospital, and predicting crime scene prediction by the police. The efforts to improve the quality of public services are seen everywhere. Big data usage is becoming more common in our lives and it is likely that it will get more attention.

Mobile and IoT will become important as a vast and diverse data acquisition source. Mobile is prevalent in the world now and it is a vast source of data. In particular, there are many smartphones equipped with diverse and sophisticated sensor terminals today that can be used to get a variety of information. For example, data such as text, photographs and location information through information sharing applications from mobile phones becomes the source for the analysis of the event in a specific area in order to find out what kind of weather is in the region, where an earthquake has happened and its damage. In Japan, NHK has a short news program in which interesting tweets from the information sharing application "Twitter" are analyzed and introduced. Thus, the use of big data is becoming more familiar in our lives. Further, it is anticipated that more information which was not available before can be used for analysis because the concept of IoT has made it possible to obtain information from various things.

[13] Nikkei Business Publications. *Enterprise mobile encyclopedia* (original title is in Japanese) Nikkei Business Publications, 2015, p. 4-7.

Thus, the similar concepts of mobile, cloud, Iot and big data introduced above are closely related and it is expected to continue to progress and multiply in the future. It is important to understand these trends in order to determine ICT usage for the future development.

(5) 3D printing – taking advantage of data in manufacturing

3D printing is a technology for creating a three-dimensional object by laminating resin or metal from three-dimensional data. The equipment is called 3D printer.

According to the "Survey report on the world market of 3D printers 2014" by the Yano Research Institute, the world market for 3D printers was 70,000 in 2013. The active progress of financial support of the Western government on the 3D printer with a focus on lowering prices, education for 3D printer use and modelling of the final products predicts average annual growth of 46.2% between 2013 and 2017 and the volume of shipments to expand to 32,000 in 2017. The advancement of 3D printers is remarkable, and production of social infrastructure such as bridges is being attempted recently.

3D printing has been said to be a revolutionary technology. It can shape a model immediately from a design without creating a mold, it can reduce the time of production, production cost and cost of manufacturing substantially, so there is the potential of making manufacturing drastically easier in developing countries.

In particular, FabLab (Fabrication Laboratory), which works together with 3D printers or laser cutters, is a revolutionary phenomenon. It has not only enabled production of things by individuals, but also it has enabled obtaining designs available publicly through FabLab from all over the world. This it is influencing trade as well.

3D printing is also one of the core technologies in the concept of open innovation because the user's point of view is further reflected to the goods that had been produced only by hand before.

[14] Hitachi. *The way for Big data2: The range of big data usage* (original title is in Japanese) Hitachi website. http://www.hitachi.co.jp/products/it/bigdata/column/column02.html, (March 2013)

Nomura Research Institute Foundation Solution Planning Section. IT Road Map 2015 version. *Information communication technology five years from now!* (original title is in Japanese) Tomoaki Watanabe. Tokyo. Toyo Keizai, 2015.

2.2 Utilization of ICT in Projects by Japan's assistance

In this chapter, the use of ICT in projects delivered by Japan's assistance by scheme (technical cooperation, grant aid, and loan assistance) will be discussed. The projects concerned are mainly those that started in year 2005 or later.

2.2.1. Technical Cooperation
(1) Selection of ICT-utilization-related projects

This research examines projects that have started in or after the year 2005 and are possibly ongoing and are regarded as ICT-related on the project overview chart (Refer to JICA Knowledge site [15]).

In the selection process, first, projects which had 'Information and Communication Technology' as their keyword in either Issue 1, Issue 2, or Issue 3 of the project overview chart were picked out. Some of those projects cannot be recognized since their subjects are set otherwise, although, they have the word in their descriptions. Therefore, subject titles that possibly contain ICT-related terms, e.g. information, data, database, web, network, server, GIS[16] (Geographic Information System), data analysis, remote sensing, simulation, mail, service, and terms or words that are frequently used in ICT discussions such as sharing, processing, system, management, assistance, design also needed to be searched through. The process is done by going through the concerned project overview chart or final evaluation reports in case more details are required.

The search was done cautiously in order to equally examine each field to avoid troubles in consideration of the overall inclination, as well as each issue field's characteristics of ICT utilization and tendency.

In addition, more practical information that can only come from the field was gained through audit of each program manager with their opinions for the department's approach or the project itself. The items from the audit are listed below, however, the wide range of information gained through the audit is not exclusive to this list. The audit was recorded as much as possible in the attached document.

Audit Items

1) Situation of ICT utilization
   - -How are you looking at the current situation of ICT utilization?
   - -How do you decide about ICT utilization for each project?
   - -Do you have any suggestion for a specific subject or issue that ICT should be used in/for?

2) ICT utilization assistance
   - -How do you respond when information necessary for ICT is lacking?
   - -Have you ever needed input from ICT specialists for its use? If so, what was the needed assistance or knowledge?

3) Software development
   - -Do you often use already existing software (general-purpose software and package)? Have you developed any necessary software from scratch?
   - -When you develop software, what do you do to make it adequate for the project?

15 JICA Knowledge Site http://gwweb.jica.go.jp/KM/KM_Frame.nsf/NaviIndex OpenNavigator.

16 Short for Geographic Information System. Via computer, GIS analyzes by accumulating spatial data and information about geographical positions, and it visualizes the resultant information for the user. The original inputs are acquired from satellite data and field study. Its use provides high-level analysis and makes high-speed judgment possible. Also, when a massive amount of data visually indicates the tendency or relativity of events, it is very useful for effective information sharing. It could be used in various venues such as geographic information management or urban planning. One of the most familiar examples of GIS is on car navigation systems.

(2) Research Result Overview

Since the content of technical cooperation varies widely due to difference in issue theme or environment in the project partner's country, the general situation of ICT utilization and its overview from several aspects will be discussed in this section.

ICT utilization situations by thematic issues will be covered in details in the latter part.

a) Overview of ICT Utilization in Thematic Issues

In many projects from thematic issues (e.g. water resources, disaster management, natural resources and energy, urban/regional development, environmental management) that have a relatively large technical aspect utilize ICT tools e.g. GIS.

In the disaster management field, there are many sensor network technology use examples such as satellite or distant real-time weather/environment observation. Also, in environment management, there are examples of monitoring and data maintenance of atmosphere, rain, water quality, and soil. In those highly technical projects, each area needs highly specialized techniques, and those consultant agencies or specialized practitioners already have knowledge in necessary ICTs.

Moreover, in thematic issues such as governance or economic policy, there is much ICT utilization for enhancing efficiency of administrative affairs which are related to business systems, e.g. accounting processing, asset management, statistical work, information sharing and dispatch depending on operational characteristics.

In healthcare and agricultural/rural development, there is much assistance with human resource development (hereafter referred to as HRD) of related medical practitioners and local administrators, e.g. database construction or information site construction for improvement in office functions, and information sharing. However, cases of distance medicine and medical information sharing via cell phones that are seen in e-Health or m-Health projects run by WHO, World Health Organization, or ITU, International Telecommunication Union, are scarce. Also, although the number is small, SATREPS[17] projects have some m-Health cases e.g. real-time (hereafter referred to as RT) report of possible infection disease to Health Ministry via cell phone SMS led to a quick response by competent health ministry manager and local surveillance officer.

Support for Japanese Small and Medium Enterprises (SMEs) Overseas Business Development, a proposal based program, has cases such as remote diagnosis or local healthcare information networks. It also has proving tests of distribution via the Internet and agricultural product data provision to retailers and consumers, which is a solution-oriented program that encourages a connection to the general public.

Assistance Utilizing Private-Sector Technologies, which is also a proposal-based program, has cases of transportation, agricultural/rural development, disaster prevention, urban/regional development. Also, preparatory survey (BOP business cooperation enhancement) has cases of education, natural resources and energy, agricultural/rural development.

b) Common ICT use across thematic issues

ICT use enhances information collection, storing, delivery, and sharing to aim an improvement in the project, and content and range of benefits. Yet, the level of ICT utilization varies even in cases with similar objectives. It could be used or not at all. It can be due to the difference in situation of the counterparts (C/P) in the concerned countries. However, to be aware of those differences is valuable in the continuation of ICT utilization.

17 SATREPS (Science and Technology Research Partnership for Sustainable Development): A 3-5 year-long joint program between JICA and JST, Japan Science and Technology Agency, for sustainable development solutions and future social implementation by Japan and researchers in developing countries. It is part of technical cooperation.

Department		Infrastructure and Peacebuilding Department		Human Development Department		Global Environment Department		Rural Development Department		Industrial Development and Public Policy Department		
Main Content (thematic issue)		Infrastructure	Peace-building/ Gender and Development	Education	Health and medicine	Water Resources/Disaster Management	Natural Environmental Conservation/management	Agricultural/ Rural Development	Fisheries	Private Sector Development	Natural Resources and Energy	Governance
ICT utilization situation		Urban development: dozen cases using geographical information e.g. map information collection, digital map development. Transportation: several aviation security projects. Of those, one traffic related case, e.g. pricing system with ITS, IC tag Urban development: dozen cases using geographical information e.g. map information collection, digital map development.	Peace-building: included in education, water resource, disaster prevention, natural resources and energy, urban/rural development GD: included in water resource, disaster prevention, governance (for the issues are usually categorized in Issue 2 or 3, and those in Issue 1 does not have ICT utilization cases)	Mainly ICT related engineer/instructor development assistance e.g. ICT engineer (higher, middle) development, IT curriculum development assistance, distance training system installation, distance learning assistance, IT technology exam system development	Mainly assistance for medical practitioners, e.g. Healthcare information provision, medical equipment management assistance, construction/maintenance of database for understanding medical service situation. Only few remote medicine cases	Mainly distance monitoring of tsunami, hydrometeorology parameters, volcano/crustal movement, earthquake, water resources. Early warning system is included for 'tsunami' and 'flood.' Also, relatively high number of map information collection and GIS database construction cases	Mainly understanding of natural environment and information provision e.g. Remote sensing for forest resources search, greenhouse gas reduction monitoring, Information transmission for forest fire prevention and early warning	Mainly information management, sharing, and provision, e.g. Agricultural statistics, collection/analysis of agriculture-related environmental information (meteorology, water resources, geographical features), production/distribution information provision Also, cultivation management	Statistical data collection for Fishery resources management	Intellectual property rights treatment, management, and information provision	Mainly Remote sensing, mineral resources database by GIS	A wide variety. e.g. Administrative affairs efficiency improvement, statistical information management, information disclosure, IT technical staff development Also, public system construction such as customs, bank, police
Main utilized ICT system example		Development management information system, Geographical information management database, GIS next generation aviation security system, digital highway base map, traffic fare pricing system, ITS, traffic jam information distribution	Included in other thematic issues	Distance learning	Medical equipment management, assistance network, medical service status management database, healthcare information system, perinatal distance medicine system, mobile CTG (Cardiotocogram) system	Tsunami early warning system, precipitation map, hydrometeorological data integration system, automated water quality monitoring system, volcanic earthquake/crustal movement monitoring system, advanced earthquake source analysis system, flood early alert/warning system, water resource information management system, database, GPSremote sensing, GIS	Forest/land monitoring system, remote sensing, hazard map, GIS, homepage construction, climate change information management, prediction modeling	Agricultural statistics system, information management system, agricultural production and distribution assistance application, remote sensing, database	Fishery statistics collection, GIS	Electronic application system, IP information search system	Geology remote sensing, resources database, satellite image analysis, GIS	Electronic government platform, customs information system, central bank system, automated fingerprint identification system, statistical data management, information management system, statistics database, GIS, database, Internet, SNS etc.
Advanced technology	Big data											
	IoT											
	Artificial intelligence											
	Cloud computing											
Operation system	e-Government											●
	Monitoring/regulation	●										
	Distance medicine				●							
	Distance monitoring/warning					●	●	●			●	
	Distance learning			●								
	Statistics management							●	●			●
	Geographical information	●				●	●		●		●	
	Other applications							●		●		●
Assistance tool	Satellite image processing					●	●				●	
	Biometric identification											●
	GPS, Global Positioning System					●						
	Computer assistance design					●						
	Simulation					●						
	IC tag	●										

Platform	Cyber security											
	Database	●		●	●	●	●	●	●	●	●	●
	Information security	●			●					●		●
	Internet				●		●	●		●		●
	e-mail											●
	SMS				●			●				
	SNS											●
Infrastructure	Communication line/network	●		●	●	●	●	●	●	●	●	●
	Computer (hardware, OS)	●		●	●	●	●	●	●	●	●	●
	Information device (PC, mobile device: tablet, smartphone, cell phone)	●		●	●	●	●	●	●		●	●

(3) Main Cases in Thematic Issues

Main ICT utilization cases by thematic issue are shown below.

Thematic issues (middle classification) are the ICT, education, health, water resources and disaster management, governance, peace-building, gender and development, transportation, natural resources and energy, economic policy, private sector development, agricultural and rural development, natural environmental conservation, fisheries, urban and regional development, and environmental management.

The cases are categorized by thematic issue. In the case of several issues indicated as themes on the project overview, the project will be treated based on the issue described as thematic issue 1. However, within thematic issue 'Education', cases where the ICT is the thematic issue 1 and education is thematic issue 2 or below will be considered as an education project.

- The order of thematic issues should follow the order on the JICA Knowledge site except the ICT.
- Cases are listed by small classification and by the project start year.
- For the cases that have been post-evaluated, overviews of the evaluation and on ICT utilization are noted.

Table 2.2.2 shows the overall number of projects by thematic issue and projects that utilized ICT. It also indicates the number of SATREPS cases and SMEs Overseas Business Development cases.

Table 2.2.2 Projects by Thematic Issue and Projects use ICT

Thematic Issue	Number of Project	Project using ICT	SATREPS project (included in the number on left)	Partnership with the Japanese private sector	Preparatory survey (BOP Business cooperation enhancement)	Diffusion and promotion of technologies from private sector
(a) ICT	15	15	-	-	-	-
(b) Education	241	17	-	1	5	-
(c) Health	355	16	2	4	-	-
(d) Water resources, disaster prevention	203	31	8	1	-	1
(e) Governance	138	16	-	-	-	-
(f) Peace-building, Gender and development	-	-	-	-	-	-
(g) Transportation	116	14	-	1	-	3
(h) Natural resources, energy	49	12	2	-	1	-
(i) Economic policy	70	7	-	1	-	-
(j) Private sector development	134	4	-	-	-	-
(k) Agricultural/rural development	216	11	-	1	1	2
(l) Natural environmental management	87	8	3	-	-	-
(m) Fisheries	43	2	-	-	-	-
(n) Urban/Regional development	50	20	-	-	-	1
(o) Environmental management	118	12	3	-	-	-
Total	1830	185	18	9	7	7

This research result shows a major difference in ICT utilization among thematic issues. Below, thematic issues are divided into three groups based on their ICT utilization ratio.

1) Water resources/Disaster prevention, natural resources and energy, urban/regional development: There is a certain ratio of ICT-utilization projects. There is a regular use of ICT in routines.
2) Governance, transportation, economic policy, natural environmental management, and environmental management: ICT-utilization projects are more than 10%. Routines to use ICT are not yet developed.
3) Education, health, private sector development, agriculture, and fisheries: There is a small amount of ICT utilization.

(a) ICT

There are 15 projects (including one development research and 5 independent projects) that have ICT as the thematic issue 1 (no other thematic issues are listed with it). All of them are ICT education/training related cases, and they are in mid-term objective '2-1 Engineer development'. The cases that fall under '4 ICT utilization promotion' are shown in a case whose stated thematic issue is ICT and some other. Those cases will be discussed later in 2) Education.

BOX 2 Case of ICT utilization

Promotion of radio communication system development and operation for local revitalization

IT utilization in human resource development project for local revitalization in Thailand(April 2009-November 2011)

While IT utilization in Thailand is rapidly increasing, IT network installation in northern and southern local areas is greatly behind compared to urban areas. There were many locations lacking access to IT services such as telephones or the Internet. In recent years, it has been recognized that a digital divide between urban and local areas is causing economic, educational, and social divides. Alleviation of this divide has become one of Thailand's priority issues to tackle.

This project is implemented by NECTEC, Thailand National Electronics and Computer Technology Center, which holds IT policy making and R&D as its main function. In order to work on the concerned problem, it has started to develop a suitable IT system for local areas, which have different geographical and climate characteristics from urban areas, and are testing application possibilities.

Content of the project is listed below (excerpted).

- OJT and domestic training for site plan and WiMAX system design
- Examine the radio communication system's working situation as well as usage situation of applications (Internet access, IP voice, video conference, e-learning, e-community).
- Examine and analyze the radio communication system model verification test result and develop 'the verification test result report' (including impact study)

Completed tower for WiMAX

Distance-learning software workshop

Cell phones could be used in rural parts of Thailand, although there was no more advanced communication service than that available. In order to ease the situation, having a WiMAX standard made communication service available even in low service

Refer to Attachment 1-1 for ICT utilization cases in the concerned field by minor classification.

(b) Education

Number of ICT utilization cases: five in higher education, seven in vocational training/industrial technology education, one or two in other minor classifications.
Content: HRD for ICT education or ICT utilization in education, e.g. ICT Engineer development, IT curriculum development assistance, distance training structure management, distance learning assistance etc.

Number of projects from the middle classification of the thematic issues or related to ICT utilization are shown below.

Table 2.2.3 Projects in Education and ICT Utilization

Minor classification	Project (number of projects)	ICT-utilization related (number of projects)
Elementary education	34	2 JICA Partnership Program
1st /2nd middle education	34	1
Higher education	34	5
Vocational training/ industrial technology education	102	7
Administrative education	11	1 (individual project <expert>)
Other education	26	1 (individual project <expert>)

Refer to Attachment 1-2 for ICT utilization cases in the concerned field by minor classification.

(c) Health and Medicine

The items will be categorized in minor classifications below.
ICT utilization cases: There are quite a lot in the healthcare system, although it is scarce in HIV/AIDS, infectious diseases, TB, malaria, vaccinations, MCH, and reproductive health.

Table 2.2.4 Projects in Health and ICT Utilization

Minor classification	Project (number of projects)	JICA Partnership Program (included in the number on left)	ICT-utilization related (number of projects)
Health and medicine system	89	46	10
HIV/AIDS, infectious diseases, TB, malaria, vaccinations	88	13	4
MCH, reproductive health	178	62	2

Below, ICT utilization cases are listed in order of healthcare system, infectious diseases, MCH, and reproductive health. Refer to Attachment 1-3 for ICT utilization cases in the concerned field by minor classification.

(i) Health and Medical System

Reinforcement of healthcare system includes working on infrastructure development (administrative/policy development, medical facility improvement, medical supply moderation, accurate medical information and its application, and finance and financial source management), public administration and service delivery. Main cases are: Assistance for medical practitioners e.g. Provision of health related information, medical equipment management assistance, database construction, maintenance for understanding medical service status.

(ii) Infectious Disease

Following JICA's basic principle, its infectious disease measure mainly works with national strategic planning, health information collection and analysis, prevention, testing, treatment service provision enhancement, and service access improvement. ICT utilization is scarce in health information collection and analysis.

Refer to Attachment 1-3 for four cases including two of SATREPS.

The two SATREPS cases are from projects with the disease warning system using a cell phone and epidemic early warning system based on climate prediction models.

(iii) Maternal and Child Health, Reproductive Health

While main ICT utilization for MCH and reproductive health by WHO and ITU is distance medicine, it is not the case in JICA operation. It is considered to be due to JICA mainly assisting with administration and having little direct assistance to citizens/patients. On the other hand, in distance medicine cases from SMCs Overseas Business Development scheme, there were two cases that had direct communication with patients.

A case from grassroots technical cooperation (based on a proposal from a community) scheme shows benefits of being proposal-based and implements a proven distance medical system that considers local needs. An audit was carried out on the problems, issues, and items to be noted for a possibility of implementation difficulty since there had been no other similar cases. The content is reported on Attachment 1-3.

(d) Water Resources, Disaster Prevention

JICA has been continuously assisting aiming an effective disaster prevention measure based on their disaster management cycle: Prevention-immediate emergency response to disasters-restoration/recovery-more prevention activities. In this assistance, hazard map development and early warning issuance including necessary information collection comprise the main ICT utilizaion cases.

There are many cases where it involves distance-monitoring the targets, e.g. tsunami, hydrometeorological parameters, volcanoes, crustal movement, earthquakes, water resources, and monitoring natural disaster possibilities. There are also cases that involve warning system for tsunami and floods. A unique matter is that many of those cases involve map information collection and GIS database construction. The main working system consists of such items as automated water quality monitoring, water resource information management, precipitation map, hydrometeorological data integration, volcano activity/crustal movement monitoring, advance seismic-origin analysis, tsunami early warning, and flood warnings. Remote sensing is a crucial technology for it. The concerned thematic issue has relatively large ICT usage. It should be for the implementing consultants and the competent specialists already have knowledge on the matter.

Also, in SATREPS projects, there are several cases in earthquakes, tsunami, wind and flood damage prevention.

The projects by thematic issue minor classification and ICT utilization are indicated below.

Table 2.2.5 Projects in Water Resources/Disaster Prevention and ICT Utilization

Minor classification	Project (number of projects)	ICT-utilization related (number of projects)
General water resource management, urban/rural water supply	77	7
Wind/flood damage prevention (water control), sediment disaster prevention	27	9
Seismic disaster prevention	24	8
General disaster prevention	31	4

Meteorology	13	3
Common, others related to: water resource/disaster prevention/water resource development (former)/disaster prevention (former)	31	0

Refer to Attachment 1-4 for ICT utilization cases in the concerned field by minor classification.

(e) Governance

In minor classifications, the ICT utilizaion research result was categorized under items: statistics, administrative underpinning, public safety, and local administration. In 'statistics', all cases involve either data managements or databases. Although there were ICT utilizaion cases in 'administrative underpinning' such as IT audit by the Board of Audit, information transmission base for public service improvement, and information management system for investment plan management, the details of the uses are unknown. 'Public security' only has a use in fingerprint identification. In 'local administration', many cases are from construction of the workflow for local development and related HRD. The specific details about ICT utilization are unknown.

The projects by thematic issue middle classification and ICT utilization are indicated below.

Chart 2.2.6 Projects in Governance and ICT Utilization

Minor classification	Project (number of projects)	ICT-utilization related (number of projects)
Statistics	10	10
Administrative underpinning	38	4
Public safety	33	2
Local administration	57	0

Refer to Attachment 1-5 for ICT utilization cases in the concerned field by minor classification.

(f) Peace-Building/Gender and Development

Peace-building/Gender and Development are usually not stated as thematic issue 1 but instead as 2 or 3. Therefore, the ICT utilization cases in the concerned field will be described under other thematic issues.

The cases from peace-building will be described in: Education, water resources/disaster prevention, natural resources and energy, or urban/regional development. Those from gender and development will be described in: Water resources/disaster prevention or governance.

(g) Transportation

HRD for adequate operation and management, structure reinforcement, and improvement of work efficiency in transportation infrastructure are highly important aspects of technical cooperation. Many of ICT utilization cases in transportation administration are database utilization for information management and sharing or systemizing the operation management. While there are several projects that require ICT utilization, e.g. aviation security system, ITS (Intelligent Transport Systems), pricing system that uses IC tags, the number is not high. ITS is a field where Japan is able to show its technical superiority overseas. It is expected to develop ITS projects taking the balance among technical cooperation, yen loans, and grant aid into consideration.

The projects by thematic issue minor classification and ICT utilization are indicated below.

Table 2.2.7 Projects in Transportation and ICT Use

Minor classification	Project (number of projects)	ICT-utilization related (number of projects)
Transportation administration	35	9
International transportation	16	1
National/urban/rural/other transportation	65	4

Refer to Attachment 1-6 for ICT utilization cases in the concerned field by minor classification.

BOX 3 ICT utilization case

IT technology from Kyoto remedies traffic jams in India

ITS distribution/ verification (distribution/verification operation based on a local proposal) in a major city, Gujarat, India (November 2013-March 2015)

The implementation company of this operation is Zero-Sum Ltd., a venture company from Kyoto, which established its local corporation in India in 2007 and has mainly been in mobile service businesses such as cell phone content distribution. Utilizing their knowledge, the enterprise held a verification test on ITS technology installation/application for acquisition and delivery of traffic information or route suggestion in Ahmedabad, one of the major cities in Gujarat province. The ITS receives GPS information from traffic information sensors in streets, taxis, and mobile devices and develops traffic jam information to deliver to the highway traffic boards and to mobile devices. By this method, the traffic jams in the city can be improved without having a new highway constructed. The latest IT technology that uses mobile lines for data transmissions and constructs the traffic control center on Cloud is used. This distribution/verification operation is already attracting second and third major cities in Gujarat and other provinces.

Development objective: Traffic jam alleviation and traffic accident prevention

*Due to population growth and great population increases in urban areas, urban traffic jams are getting more severe each year.
*Despite infrastructure development, e.g. annual objective of 7,000km road construction has been highly promoted, development is not catching up with the rapid car increase.
*Due to the high population density in the city and land limitations, infrastructure development alone would not resolve the problem.

Traffic boards installed in four city-locations for this operation
(Photo: Zero-Sum Ltd.)

Traffic board that indicates traffic information and route suggestions
(Source: Foreign Ministry of Japan, JICA homepage)

(h) Natural Resources and Energy

Securing a stable inexpensive and low carbon energy source is an extremely important development issue to tackle for socio-economic stability and sustainability. 'Renewable energy' e.g. Low carbon power source installation or 'energy conservation' e.g. effective use promotion for energy demands mainly have policy planning and HRD for its implementation, and ICT utilization cases are scarce. However, 'mining', which responds to resource development requests from countries with high resource potential, on the other hand, has many ICT utilization cases, e.g. geological remote sensing, satellite image analysis, GIS, construction of mineral resource database.

The projects in thematic issue 'natural resource and energy' by minor classification and ICT utilization are indicated below.

Table 2.2.8 Projects in Natural Resources and Energy and ICT Utilization

Minor classification	Project (number of projects)	ICT-utilization related (number of projects)
Renewable energy	16	2
Energy conservation	8	0
Energy supply	15	2 (Development planning survey based technical cooperation 1)
Mining	8	7
Common/Other energy	2	1

Refer to Attachment 1-7 for ICT utilization cases in the concerned field by minor classification.

(i) Economic Policy

JICA has been assisting national government and policy organizations, e.g. Ministry of Finance, with policy planning ability improvement, capacity development on legit and correct tax collection, management, and enforcement at tax collection organization. While ICT utilization cases are scarce, there are large-scale system cases such as a custom procedure computerization project and a central bank functional enhancement project.

The projects in the thematic issue by minor classification and ICT utilization are indicated below.

Table 2.2.9 Projects in Economic Policy and ICT Utilization

Minor classification	Project (number of projects)	ICT-related (number of projects)
Market economy, money and banking, other economic policies, macro economy management underpinning	44	4
Finance (Revenue), finance (expenditure, public expenditure management)	26	3

Refer to Attachment 1-8 for ICT utilization cases in the concerned field by minor classification.

BOX4 ICT utilization case

Central bank oversight capability enhancement by ICT

Bank of Mongolia, capability development project (technical cooperation project, combined with loan assistance)
(October 2007-February 2012)

The bank sector in Mongolia, experiencing a rapid expansion of operations, was facing numerous management issues. Specifically, commercial banks' corporate governance overall was at extremely low levels except some major banks, thus, BOM, Bank of Mongolia, which manages the banks, had a need to enhance their management. Internal audit system conditions in the commercial banks vary depending on their management scale, and in small-scale banks, the system control is insufficient. Especially, risk management concerning recent years' rapidly growing IT system use in the commercial banks is not sufficient. BOM is considering IT governance inspection as part of on-site audit in commercial banks, however, inspection standards or tools do not exist, therefore, it was under pressure to develop the system from scratch. Moreover, BOM does not own a system for storing and utilizing monthly financial information from each commercial bank, and it was causing a problem in holding effective and efficient off-site examinations, therefore, IT-MIS, Information Technology-Management Information System installation was a pressing task.

In this project, corporate governance regulations, guidelines, and IT test manual guidelines were drafted. Corporate governance guidelines were finalized, and monitoring based on the guidelines was done. Also, a BOM future activity plan was developed.

Also, IT-MIS system development was completed and is in operation. Requirement definitions were developed for expansion of the offices of monetary policy and international economics. Equipment, software, middleware, servers, and licenses were provided by Japan. (Source: Web site of JICA)

BOM exterior
This case can be referred to as one of technical cooperation projects that was provided with a work system, and local SEs have been involved in the operation.

(j) Private Sector Development

Aiming toward private enterprises' efficient business operation, JICA has been supporting business improvement through policy/institution development or HRD. JICA has following as their private-sector development fields: 'Trade/Investment Promotion', 'SME Promotion', and 'Local Economy/Industrial Promotion.' In this column, they are categorized as following, however, the overall ICT utilization in this thematic issue is scarce.

The projects in the thematic issue by minor classification and ICT utilization are indicated below.

Table 2.2.10 Projects in Private Sector Development and ICT Utilization

Minor classification	Project (number of projects)	ICT-related (number of projects)
SME development, supporting industry development	64	0
Trade/Investment promotion	21	2
Industrial technology	12	0
Industrial underpinning system	11	1
Tourism	10	1
Privatization, company banking/accounting, other private-sector development	16	0

Refer to Attachment 1-9 for ICT utilization cases in the concerned field by minor classification.

(k) Agricultural/Rural Development

This thematic issue has ICT utilization cases in information management/sharing and provision, e.g. collection and analysis of agricultural statistics and agriculture-related environmental information (meteorology, water resources, geographical features), provision of production and distribution information, and information provision through telecenter, and cultivation management. However, the cases are scarce considering the project numbers. On the other hand, grassroots technical cooperation projects (partnership-based) and preparatory surveys (BOP business cooperation) have been seeing some ICT trials for agricultural/rural development assistance, e.g. Access to agricultural information, strawberry cultivation, agricultural production/distribution assistance platform.

The projects in the thematic issue by minor classification and ICT utilization are indicated below.

Table 2.2.11 Projects in Agricultural/Rural Development and ICT Utilization

Minor classification	Project (number of projects)	ICT-utilization related (number of projects)
Agricultural policy, institutions	24	3
Agricultural development	100	5
Rural development	60	0
Common/Other agricultural/rural development	32	0

Refer to Attachment 1-10 for ICT utilization cases in the concerned field by minor classification.

(l) Nature and Environment Conservation

ICT utilization is seen in such items as remote sensing of forest resources search, greenhouse gas reduction monitoring via satellite, construction of a homepage that collects/transmits information for forest fire prevention/early warning, and geographical information management. SATREPS projects have high ICT utilization in a highly specialized fire prediction system, carbon emission evaluation system, carbon management system, forest inventory system, basic biology database (organism species list), and a gene database.

The projects in the thematic issue by minor classification and ICT utilization are indicated below.

Table 2.2.12 Projects in Nature and Environment Conservation and ICT Utilization

Minor classification	Project (number of projects)	ICT-utilization related (number of projects)
Sustainable natural resources use	42	2
Biodiversity conservation	30	2
Degraded land rehabilitation	9	2
Other natural environment conservation	6	2

Refer to Attachment 1-11 for ICT utilization cases in the concerned field by minor classification.

(m) Fisheries

There is a possibility of ICT utilization in fishery resources management, e.g. research result management, yet, evidently, ICT utilization cases are currently almost nil.

The projects in the thematic issue by minor classification and ICT utilization are indicated below. Refer to Attachment 1-12 for the ICT utilization cases.

Table 2.2.13 Projects in Fisheries and ICT Utilization

Minor classification	Project (number of projects)	ICT-utilization related (number of projects)
Fishery administration, fishery resources management	13	1
Fishing village development, fishery stock cultivation enhancement, other fisheries	30	1

(n) Urban/Regional Development

In order to respond to vast urban/regional development needs in developing countries, JICA has been assisting in a wide variety of venues, e.g. development plan development, implementation of the development according to the plan, and management/operation/maintenance of installed facilities. In this thematic issue, many cases of ICT utilization seen are geographical information related. It could be at different level: national, urban, local, however, the recognized ICT utilization is due to development planning needs, and collection of spatial information in the city, e.g. basic plan information such as population distribution or social situation, digital map development and storing all the information in an integrated fashion. Others are; construction of a website for information provision, and a daily management operation efficiency enhancement.

The projects in the thematic issue by minor classification and ICT utilization are indicated below.

Table 2.2.14 Projects in Urban/Rural Development and ICT Utilization

Minor classification	Project (number of projects)	ICT-utilization related (number of projects)
Urban development	17	6
Rural development	18	4
Geographical information	8	8
Common/Other urban development	7	2

Refer to Attachment 1-13 for ICT utilization cases in the concerned field by minor classification.

(o) Environmental Management

In order to tackle air pollution, acid rain, and water pollution, JICA has been focusing on prevention and enhancement of response capabilities for environmental issues, e.g.

promoting institutional development for environmental measures. Under the circumstances, many ICT utilizations seen in this thematic issue are for improvement of monitoring ability and management planning ability. In particular, environmental information monitoring and information management have several cases of ICT utilization.

Also, some SATREPS cases show an expectation for expansion of the effects though ICT utilization in cooperation with research organizations in developing countries.

The projects in environmental management by minor classification and ICT utilization in those projects are indicated below.

Table 2.2.15 Projects in Environmental Management and ICT Utilization

Minor classification	Project (number of projects)	ICT-utilization related (number of projects)
Air pollution, acid rain, water pollution, soil pollution	38	8
Mine pollution, general waste, Cleaner Production, Global warming etc.	80	4

Refer to Attachment 1-14 for ICT utilization cases in the concerned field by minor classification.

2.2.2 Grant aid capital assistance

Projects that use ICT among grant aid projects that are described on the JICA Knowledge site are shown in Table 2.2.16. From the years 2009 to 2011, 'The Project for Introduction of Clean Energy by Solar Electricity Generation System' was implemented in nine countries, and a solar electricity generation system was installed. Most ICT utilization in grant aid projects comes from this field.

The overall fields show a wide variety: In the health sector, each piece of medical equipment; in the peace-building sector, mine detector and removal systems; and in transportation sector, ITS equipment is provided.

All of them are for grant aid, therefore, in principle, all the provided materials and equipment need to be Japan-made. However, local procurement may be possible for smaller-scale projects.

Aside from equipment provision, there are also examples of collaboration with technical cooperation (see table 2.2.17). The form of collaboration is moderate. Generally, technical cooperation precedes, followed by equipment (ICT utilization) provision, and then, within the technical cooperation, familiarization to the equipment will be held.

Table 2.2.16 Grand Aid where ICT is utilized (1)

Country	Name of the project	Start year	End year	Description of ICT
Mongolia	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2009	2010	A set of solar electricity generation system (300kWp)
Marshall	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2009	2010	A set of solar electricity generation system (approximately 205kW)
Uruguay	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2009	2010	A set of solar electricity generation system (480kW), Data recording equipment etc.
Djibouti	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2009	2010	Interconnection type solar electricity generation facilities (300kW)
Palestine	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2009	2010	A set of interconnection type solar electricity generation system (more than450 kW)
Yemen	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2009	2010	300kW solar cell module etc.
Cambodia	The Project for Improvement of Equipment for Demining Activities (Phase 5)	2009	2011	Mine/metal detectors, high-depth buried objects detectors
Sri Lanka	The Project for Improvement of Anuradhapura Teaching Hospital (Phase 2)	2009	2011	Procurement of relevant medical equipment for the outpatient department etc.
Djibouti	The Project for Rehabilitation of Production Equipment for RTD	2009	2011	Improvement of broadcasting facilities and equipment of Radio Television
Fiji	The Project for the Construction of the University of the South Pacific Information and Communication Technology Center (Phase 2)	2009	2012	Sound system for the multi-purpose hall, video system for the multi-purpose hall
The Philippines	The Project for Improvement of the Meteorological Radar System	2009	2014	(unspecified)
Cambodia	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of interconnection type PV system with 488kWp
Laos	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of solar electricity generation system (236kW)
Laos	The Programme for Forest Information Management	2010	2010	PCs, satellite images, GIS soft etc.
Tajikistan	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of solar electricity generation system (140kW)
Georgia	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of solar electricity generation system (more than 347kW)
Maldives	The Project for Clean Energy Promotion in Male	2010	2010	Equipment related to interconnection type PV system (5 sites, total of approx. 395kWp)
Nepal	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of solar electricity generation system (350kWp)
Pakistan	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	(unspecified)
Afghanistan	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of solar electricity generation system (solar panels [power generation amount 250kWp, approx.400MWh/year] etc.)
Micronesia	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of solar electricity generation system (approx. 160kW)
Tonga	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	Equipment related to SHS type solar electricity generation system with 170Wp etc. (planned to be 512 sets)
Samoa	The Programme for Improving the Weather Forecasting System and Meteorological Warning Facilities	2010	2010	2 aviation weather observation systems, 3 aviation weather observation data display systems, 7 automated weather observation systems, 15 weather observation data communication systems, 1 central control system for the automated weather observation equipment, 1 GTS message switch system, MTSAT data receiving system etc.
Palau	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of solar electricity generation system (approx. 180kW)
Belize	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of solar electricity generation system (approx. 350kWp), and a set of data control and monitoring system etc.
Bolivia	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of solar electricity generation system (San Andrés University: 50kW, Viru Viru airport 315kW)
Burundi	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of solar electricity generation system (260kW)
Gabon	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of solar electricity generation system (200kW)
Ghana	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	Equipment related to interconnection type PV system with approx. 200kW
Malawi	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of solar electricity generation system (solar panels [450kW in total] etc.)
Syria	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	Installation of 170 solar power street lights in the districts along the highways
Egypt	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2010	A set of solar electricity generation system (420kW)
East Timor	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2010	2011	A set of solar electricity generation system (approx. 200kW/h)
Indonesia	The Project for Airport Security System Improvement	2010	2012	(unspecified)
Vietnam	The Project for Improvement of Equipment in the National Hospital for Obstetrics and Gynecology	2010	2012	Medical equipment (automated dyeing apparatus for the cellular gene dept., automated blood cell analysis instrument for the hematology dept., ventilator and patient monitoring system for the neonate dept. etc.), procurement of the educational equipment (delivery simulator for the training center etc.)
India	The Project for Strengthening of Electronic Media Production Centre in Indira Gandhi National Open University	2010	2012	Video equipment, production studio equipment, outdoor recording system, protection switch system, DVD duplication system, video server system, computer graphic system, analog/digital format convert system etc.

Tuvalu	The Project for Improvement of Medium Wave Radio Broadcasting Network and Disaster Prevention	2010	2012	Broadcasting facilities/equipment (1 set of medium wave antenna system, 1 set of 10 kW medium wave transmitter etc.)
Panama	El Proyecto para el Mejoramiento de Equipos de Aprendizaje de Idioma Japonés de la Universidad de Panamá (The project for the improvement of the equipment of Japanese language study in Panama University)	2010	2012	Improvement of LL systems
Argentina	The Project for the Improvement of TV Programs and Production Equipment of National Public Broadcasting System	2010	2012	Japan's quality programs software of education and culture that correspond digital broadcasting standard. Improvement of the equipment to create programs
Indonesia	The Project for Enhancement of Vessel Traffic System in Malacca and Singapore Straits (Term 2 of 2)	2010	2013	(unspecified)
Uzbekistan	The Project for the Installation of X-ray Scanning Equipment at the Check Points of Uzbekistan Borders with the Neighboring Countries (Phase 2)	2010	2013	Procurement and installation of 2 in-car X-ray scanning equipment for large cargoes and 1 X-ray scanning equipment for the large rail cargoes
Sri Lanka	The Project for the Improvement of Central Functions of Jaffna Teaching Hospital	2010	2013	Procurement of medical equipment necessary for the central operation dept., IC dept., central lavatory dept., central image diagnosis dept.
Lesotho	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2011	2011	A set of interconnection type solar electricity generation system (more than 200 kW in total) etc.
Sri Lanka	The Project for the Improvement of TV Production Equipment of Sri Lanka Rupavahini Corporation	2011	2012	Improvement of equipment for the creation of animation programs
Moldova	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2011	2012	A set of solar electricity generation system (more than 250kW)
Cambodia	The Project for improvement of Equipment for Demining Activities (Phase 6)	2011	2013	Mine detectors
Afghanistan	The Project for Construction of Hospital for Communicable Disease	2011	2013	【Equipment】 hospital ward 428 items, outpatient dept. 94 items, central medical treatment dept.68 items, others.
Solomon	The Project for the Improvement of Radio Broadcasting Network for Administration of Disaster Prevention	2011	2013	A set of shortwave transmitter system, a set of shortwave antenna system, a set of electric power source for the transmitters, a set of communication system for the emergency and disaster prevention, a set of equipment to broadcast programs etc.
Costa Rica	El Proyecto para el Mejoramiento de Equipos de Aprendizaje del Idioma Japonés de la Universidad de Costa Rica (The project for the improvement of the equipment of Japanese language study in Costa Rica University)	2011	2013	Procurement of LL systems for 30 people (2 sets) and study materials of Japanese language

Table 2.2.16 Grand Aid where ICT is utilized (2)

Country	Name of the project	Start year	End year	Description of ICT
Jamaica	The Project for the Improvement of Japanese Language Learning Equipment of the University of the West Indies, Mona Campus	2011	2013	Improvement of LL systems and study materials of Japanese language
Malawi	The Project for the Replacement of Air Navigation System at Kamuzu International Airport	2011	2013	Renewal of the aviation security facilities and related equipment such as instrument landing system etc.
Cambodia	The Project for the Improvement of Educational Equipment of the Department of Geo-Resources and Geotechnical Engineering of the Institute of Technology of Cambodia	2011	2014	(unspecified)
Cambodia	The Project for Replacement and Expansion of Water Distribution Systems in Provincial Capitals	2011	2014	Supervision system for the amount of water distribution (flowmeter, communication device, central monitor etc.)
Pakistan	The Project for Strengthening of DAE Mechanical & Architecture Departments in GCT Railway Road of Punjab Province	2011	2014	Equipment of the mechanics department (metal processing machines such as computer numerical controlled machine tool, measuring instruments, examination instruments etc.)
Colombia	Proyecto para el Mejoramiento de Equipos de Producción de Programas de Emisoras Comunitarias e Indígenas (Project for the improvement of equipment for the program productions of the radio station of immigrants communities and the indigenous)	2011	2014	Recording equipment of the radio programs and the equipment in the editing studio
Morocco	The Project for Flood Forecasting and Warning System in High Atlas Area	2011	2014	Hydrological observation/data collection subsystem, data analysis/flood information distribution subsystem, warning issuing/distributing system (total of 42 items)
The Philippines	The Project for Improvement of Equipment for Disaster Risk Management	2012	2012	(unspecified)
Afghanistan	The Project for Improvement of existing Bamyan Airport	2012	2012	【Equipment】Precision Approach Path Indicator (PAPI), wireless facility, aviation security facility etc.
Fiji	The Project for Improvement of Equipment for Disaster Risk Management	2012	2012	Improve observation instruments for the earthquake and tsunami such as seismographs and tide indicators by using the technologies that Japan has comparative advantage
Vanuatu	The Project for Improvement of Equipment for Disaster Risk Management	2012	2012	Support the improvement of disaster prevention equipment. For instance, observation instruments for the earthquake/tsunami such as seismographs and tide indicators and the forecast/alert systems.
El Salvador	The Project for Improvement of Equipment for Disaster Risk Management	2012	2013	Improvement of observation instruments such as seismographs and tide indicators
Nigeria	The Project for Introduction of Clean Energy by Solar Electricity Generation System	2012	2013	Improvement of solar electricity generation system connected to the electric power system of Umaru Musa Yar'adua University of Katsina State
Cambodia	The Project for Improvement of Medical Equipment in National, Municipal and Provincial Referral Hospitals	2012 0122	2014	Procurement of 14 standard X-ray machines, 39 patient monitoring systems, 16 ultrasonography equipment
Laos	The Project for Supporting Unexploded Ordnance Clearance in Surrounding Areas of Main Roads	2012	2014	Equipment (metal detectors, communication devices, detective GPS, vehicles, PC for the data management etc.)
Vietnam	The Project for Development of Traffic Control System for Expressway in Hanoi	2012	2014	ITS equipment (information board, roadside devices [CCTV etc.]), Central equipment (system to create the information to offer, CCTV server, traffic monitors) etc.
Sri Lanka	The Project for the Improvement of Japanese Language Learning Equipment of the University of Kelaniya and Sabaragamuwa University	2012	2014	Improvement of the LL system, audiovisual equipment, and the study materials of Japanese language
Vietnam	The Project for E-Customs and National Single Window for Customs Modernization	2012	2015	Development of software using the technology of Nippon Automated Cargo and Port Consolidated System (NACCS) and Customs Intelligence Database System (CIS)
Pakistan	The Project for the Improvement of Child Health Institute in Karachi	2012	2015	Anesthetic apparatus, automated biochemical analyzer, patient monitoring system for operation rooms etc. Grant of approx. 140 items in total
Pakistan	The Project for Rehabilitation of Medium Wave Radio Broadcasting Network	2012	2015	Renewal of transmitter in the Phakirabad transmitter station of PBC, renewal of equipment in the master control room of the PBC main broadcasting station in Islamabad, renewal of equipment in the studios of the PBC main broadcasting station in Islamabad,
Swaziland	The Project for Strengthening National and Community Systems for Effective Disaster Risk Management	2013	2013	Grant equipment and technical supports for the early warning, anti-disaster measures and the improvement of coping ability
Indonesia	The Project for Improvement of Equipment for Disaster Risk Management	2013	2014	(unspecified)
Cambodia	The Project for Improvement of Facility and Laboratory Equipment in the Institute of Technology of Cambodia	2013	2015	Procurement of equipment for the experiments/practical training. Construction of facilities
Bangladesh	The Project for Ground Water Investigation and Development of Deep Ground Water Source in Urban and Rural Areas	2013	2015	2 sets of search equipment (electric search equipment and analysis software). Provide instructions regarding the geophysical technology (search plan, on-site search technology, data analyses, analyses from the perspective of hydraulic geology, operation and maintenance of equipment)
Sri Lanka	The Project for the Development of Intelligent Transport System for Expressways in Sri Lanka	2013	2015	Data collection equipment (traffic counter etc.), a set of information processing equipment (administrative server, control monitor etc.), information providing equipment (variable information board) and installation works of them. Equipment such as variable information boards shall be procured from Japan, and construction materials such as beacon poles shall be procured locally.
Peru	The Project for Improvement of Equipment for Disaster Risk Management	2014	2015	Install tide indicators for the Tsunami observation in 8 more locations. Install terrestrial broadcasting equipment of Japanese method (ISDB-T) in 8 locations which are the base of disaster prevention.

Table 2.2.17 Interaction between Grand Aid and Technical Cooperation

Country	Grant Aid	Technical Cooperation
Laos	The Programme for Forest Information Management (2010)	Forestry Sector Capacity Development Project (FSCAP, 2010-14) Participatory Land and Forest Management Project for Reducing Deforestation (PAREDD, 2009-14)
India	The Project for Strengthening of Electronic Media Production Centre in Indira Gandhi National Open University (2010-12)	Follow-up Cooperation for the Project for Improvement of Educational Media Production Facilities of Indira Gandhi National Open University (2004-05, this follow-up comes first)
Afghanistan	The Project for Construction of Hospital for Communicable Disease (2011-13)	Tuberculosis Control Project in Afghanistan Phase 2 (2009-15)
Cambodia	The Project for Improvement of Equipment for Demining Activities (Phase 5 / 2009-11, Phase 6/ 2011-13)	The Project of Strengthening CMAC's Function for Human Security Realization (2008-10)
Cambodia	The Project for Replacement and Expansion of Water Distribution Systems in Provincial Capitals (2011-14)	Project on Capacity Building for Urban Water Supply System in Cambodia Phase 3 (2012-17)
Pakistan	The Project for Strengthening of DAE Mechanical & Architecture Departments in GCT Railway Road of Punjab Province (2011-14)	The Project for Development of Center of Excellence (CoE) for Technical Education (2008-13)
Cambodia	The Project for the Improvement of Educational Equipment of the Department of Geo-Resources and Geotechnical Engineering of the Institute of Technology of Cambodia (2011-14) The Project for Improvement of Facility and Laboratory Equipment in the Institute of Technology of Cambodia (2013-15)	Project for Educational Capacity Development of Institute of Technology of Cambodia (2011-15)
The Philippines	The Project for Improvement of Equipment for Disaster Risk Management (2012)	Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information in the Philippines (SATREPS, 2010-15)
Laos	The Project for Supporting Unexploded Ordnance Clearance in Surrounding Areas of Main Roads (2012-14)	Project for Strengthening Management Capacity of UXO Lao (2015-18)
Vietnam	The Project for E-Customs and National Single Window for Customs Modernization (2012-15)	Project for promoting E-customs in Vietnam (2012-15)
Indonesia	The Project for Improvement of Equipment for Disaster Risk Management (2013-14)	Project on Capacity Development for National Center of Indonesian Tsunami Early Warning System (2007-09, the equipment was supposed to be provided by Germany at that time)

2.2.3. Loan assistance

Out of the loan assistance projects contracted after 2005, the Table 2.2.218 shows the projects where ICT is the immediate target (4 projects of communication sector) as well as the projects where the utilization of ICT is predominant (the rest, 3 projects).

Table 2.2.18 Related Projects of Loan Assistance

Country	Name of the Project	Sector	Special Yen loan / STEP	Year of the Loan Agreement	Amount of Loan Agreement (million yen)
Bangladesh	Telecommunication Network Development Project	Communications		2006	8,040
Indonesia	ICT Utilization for Educational Quality Enhancement in DIY	Social Service		2007	2,911
Indonesia	National Geo-Spatial Data infrastructure Development Project	Social Service	STEP	2007	6,373
Vietnam	Implementation of the Support to Expansion of Rural Internet Users Project	Communications		2007	3,602
Vietnam	Project for Disaster and Climate Change Countermeasures Using Earth Observation Satellite (1)	Other	STEP	2011	7,227
Iraq	Communications Network Development Project for Major Cities	Communications		2012	11,674
Myanmar	Communication Network Improvement Project	Communications		2015	10,500

Source: JICA HP

The main contents of the 4 projects for the communication sector are as follows.

Bangladesh, Telecommunication Network Development Project: Install more land-line/mobile phones interconnection equipment and the international switches. Expand the core transmission facilities.

Vietnam, Implementation of the Support to Expansion of Rural Internet Users Project: Provide materials and equipment necessary for the broadband communication and to establish an e-government in Hoà Bình Province. Develop media contents intended to the residents in the rural areas (information about health, hygiene and agricultural management). Foster human resources for the ICT field.

Iraq, Communications Network Development Project for Major Cities: Civil engineering work to prepare subscriber networks, procurement of equipment.

Myanmar, Communication Network Improvement Project: In 3 major cities (Yangon [including Thilawa area], Naypyidaw and Mandalay), 1) Strengthen the core intercity communication network 2) Expand and enrich communication networks in Yangon city 3) Strengthen the international gateway offices 4) Improve the Internet connection environment and provide countermeasures against the shortage of IP addresses 5) Expand and enrich communication networks in Thilawa area and provide relevant consulting services.

All the projects are highly-public infrastructure constructions with all the telecommunication entities belonging to the public sector.

The contents of the 3 projects, where ICT utilization bears the major function, are as follows.

Indonesia, ICT Utilization for Educational Quality Enhancement in DIY: As a model project of ICT utilization in the field of basic education, make a procurement of necessary materials and equipment such as PCs for the elementary and middle schools.

Indonesia, National Geo-Spatial Data infrastructure Development Project: Sumatra as a target, where the basic map preparation is behind, develop data of these basic maps as well as the network system to share the various Geo-spatial data of the country.

Vietnam, Project for Disaster and Climate Change Countermeasures Using Earth Observation Satellite (1): Procure earth observatory satellites (including the launching cost and the insurance, 2 satellites with synthetic aperture radar). Develop facilities and introduce equipment (construction of the national satellite center [9ha], fostering of human resources).

Out of these 3 projects, 2 except for the one in Yogyakarta (DIY) are STEP, therefore the procurement is to come from Japan.

ICT is utilized in many other infrastructure projects in order to operate the respective facilities, however, the details such as specifications are unknown. For example, in the projects of railways, water supply and sewerage systems, power stations and dams, the main activity is the construction of the facilities, yet the ICT technologies are assumed to be used in their operations.

2.3. Actual performance of ICT utilization in the assistance by international institutions and bilateral assistance institutions

2.3.1. The World Bank

(1) Summary and Strategies

The World Bank Group has provided abundant assistance in the field of communications and broadcasting.

In 2002, the World Bank prepared ICT Strategy Paper and sought the ICT leverage for the reduction of poverty and the empowerment. However, the methods to utilize ICT were limited to the conventional approaches [18] as the communication infrastructures in rural areas were vulnerable.

On the other hand, since around the late 1990s, institutions including ITU, USAID, IDRC (Canada) and UNESCO have developed pilot-like projects in various locations putting a high value on the role of “multi-purpose regional information center”. Also the private-sector NPOs and corporations have been planning and practicing various models of new Kiosks to offer local information. Thanks to these, private-run cyber cafés and telephone

shops as well as publicly-run multi-purpose regional tele-centers developed through the 2000s, but the sustainability of the latter was low [19].

18 Traditional communication policies, infrastructures (private projects), computerization projects of the central government, and investments toward the
contents industry from private entities over recent periods.
19 See Motoo KUSAKABE. (2002). Roles of Regional Information Center for the Reduction of Poverty.

In 2000s, the World Bank provided assistance in the fields described in the below figure. The utilization rate of ICT in the fields other than ICT reaches 74% and it is indicated that ICT technology is used in 1,300 projects in some form.

<table>
<tr><td colspan="4">ICT Sector
World Bank: $875 million in investment lending (36 projects) + 59 Development Policy Operations
IFC: $2.7 billion (100 projects)
MIGA: $550 million (12 projects)</td></tr>
<tr><td>Infrastructure and networks

World Bank: $506 million (45 operations)
IFC: $2.3 billion (61 projects)
MIGA: $550 million (12 projects)</td><td>Information technology and media

World Bank: $89 million (11 operations)
IFC: $407 million (39 projects)</td><td>Regulatory and policy framework

World Bank: $212 million in investment lending (27 projects) + 57 Development Policy Operations</td><td>Human capacity

World Bank: $68 million in ICT sector investment lending (7 projects)</td></tr>
<tr><td>Telecommunications (Internet/broadband)

World Bank: $118 million in investment lending (24 projects) + 8 Development Policy Operations (access for the poor); $375 million (4 projects for backbones)
IFC: $2.3 billion (61 projects)
MIGA: $550 million (12 projects)

Postal

World Bank: $13 million in investment lending (6 projects) + 3 Development Policy Operations</td><td>Hardware, software applications and IT-enabled services

World Bank: $89 million (11 projects: IT/IYES matching grants, IT parks, incubators, and so on)
IFC: $314 million (35 projects)

Broadcasting (TV and radio)

IFC: $93 million (4 projects)</td><td>Competition
Licensing $ spectrum standards
Consumer protection

World Bank: $212 million in investment lending (27 projects) + 57 Development Policy Operations</td><td>Skills to use, adapt, develop, install, and maintain ICT

World Bank: $68 million (7 projects) + components in education sector (5 projects)</td></tr>
<tr><td colspan="4">ICT Applications in Other Sectors
World Bank: 1,300 projects (74 percent of all investment lending)
IFC: $119 million (15 projects)
MIGA: $12.5 million (5 projects)</td></tr>
<tr><td colspan="4">Integrated financial management systems – e-procurement – Computers for education – Computerized land information systems – m-banking – Health surveillance systems – Electronic withdrawals for social programs – Traffic and road information systems – Mobile telephony for disaster relief</td></tr>
</table>

Source: ICT for Greater Development Impact (WB)

Figure 2.3.1 Actual performance of the World Bank in the ICT sector (FY 2003-2010)

In 2012, ICT for Greater Development Impact was amended and 3 Pillars were established.

- Transform Pillar: Public-private/inter-ministerial service provision as well as the accountability innovation.
  Policy improvement. (WB, IFC)
- Innovate Pillar: Provision of the capital and the know-hows for the ICT development.

(WB, IFC)

- Connect Pillar: Preparation of the capital and guarantees in order to improve the broadband (WB, IFC, MIGA)

BOX 5 World Development Report 2016

The main theme of "World Development Report (WDR) 2016", which is currently being prepared by the World Bank, was set as "Internet for Development", but later changed to "Digital Dividends". The upcoming WDR 2016 is to be published at the end of 2015.

According to the concept note (September, 2014), the WDR 2016 is assumed to examine if the internet can be the power of development especially for the poor in the developing countries, and if it can have impacts on the economic growths, social or economic opportunities, and efficiency of the public service provision.

The context to select this theme includes the fact that the life of the poor in the developing countries are dramatically changing as cell phones and the Internet came into wide use, but the impact of the Internet on the economy has not been systematically surveyed yet. The WDR 2016 therefore will argue that "the Internet has made the world smaller and the world economy bigger but that it also risks making societies more unequal and life more intrusive" (Concept note p.3).

With this concept, the WDR 2016 is going to examine how the Internet, which has started to perform an important role for the economic development of the poor in the developing countries, can change the provision of public services. Furthermore, it will also examine how the public policies should function in order to mitigate the negative aspects of Internet (widening disparity, change of occupations, information overload, loss of privacy, threat of data thefts etc.).

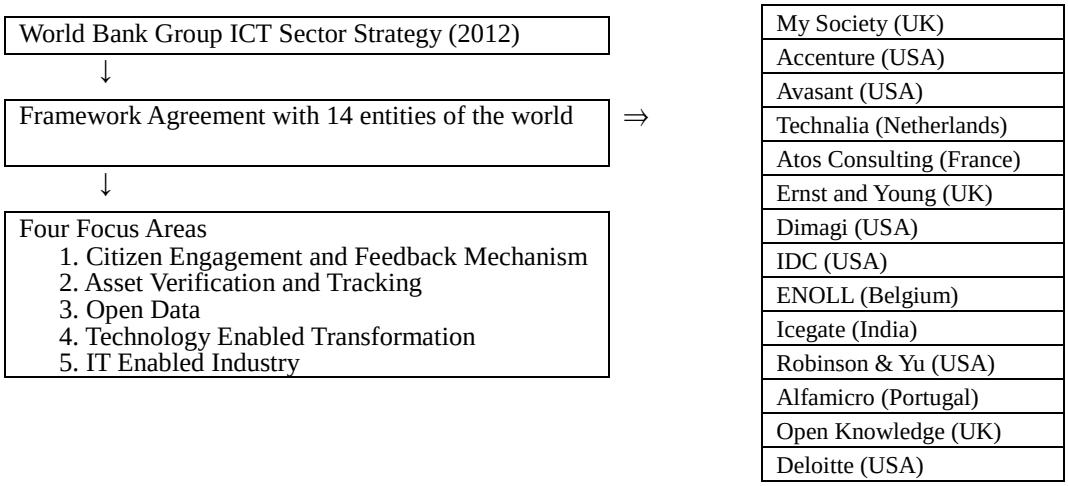
(2) Approach

The 2 approaches, being implemented by the World Bank in order to practice the above mentioned strategies, shall be shown here. One is Framework Agreement and the other is the tool development with ICT.

(a) "Framework Agreement"

"Framework Agreement for Accessing Global Expertise: Information and Communication Technologies" is an advisory support to streamline the contract projects with the World Bank by concluding comprehensive agreements between the World Bank and the 14 private entities (top right of the next figure). It has been in operation since 2013 and the selection is going to be reviewed every several years. Among the selected 14 entities are management consultant firms and IT companies and they are from wide range of fields, but 13 out of 14 are either European or American. With regard to this agreement, the shortlists based on the EOI are omitted and injections by contract are made as needed basis, thus the responses are quite flexible according to the circumstances, rather than determining precise project details in advance. In the event that the World Bank seeks to introduce new ICT

technology in the course of assisting many countries in the world, these channels enable the World Bank to examine and verify the projects efficiently without having to have an advisory contract for each project.



In specific, the evaluations are made on the following matters in regard to consulting, training, technological output and approaches.

1. Citizen Engagement and Feedback Mechanism
   - 1.1 Participatory Decision-Making/Policy Crowd-Sourcing
   - 1.2 Citizen Feedback on Public Service Delivery
   - 1.3 Third party monitoring
2. Asset Verification and Tracking
   - 1.4 Infrastructure control
3. Open Data
   - 1.5 Utilization of open data by the governments
4. Technology Enabled Transformation
   - 1.6 IT strategies, policies, laws and regulations, institutional design, IT architecture, business applications/solutions etc.
5. IT Enabled Industry
   - "Impact Sourcing" Offer job opportunities to the poor by the Business Process outsourcing (BPO)
   - "Microwork" Segmentalized works
   - Etc.

Source: WB material

Figure 2.3.2 Actions in the ICT sector by the Framework Agreement of the World Bank

(b) Development of ICT tools

Since the amount of data collected by the World Bank is tremendous, the Bank is providing various tools to utilize them at no charge.

(i) Mobile Data Apps

Data Finder Apps: A tool to see the World Bank's various data (Development Indicators) on iOS or Android, which was started after Open Data Initiative of 2010. Coordinated with Cross Platform, multiple languages and SNS.

ATLAS: Visualization by utilizing data of the World Bank.

(2) ADePT

A tool to automate the economic analyses by utilizing the data of the World Bank. It enables a household survey or a census to be exported to Excel or Stata. It is a tool on Windows.

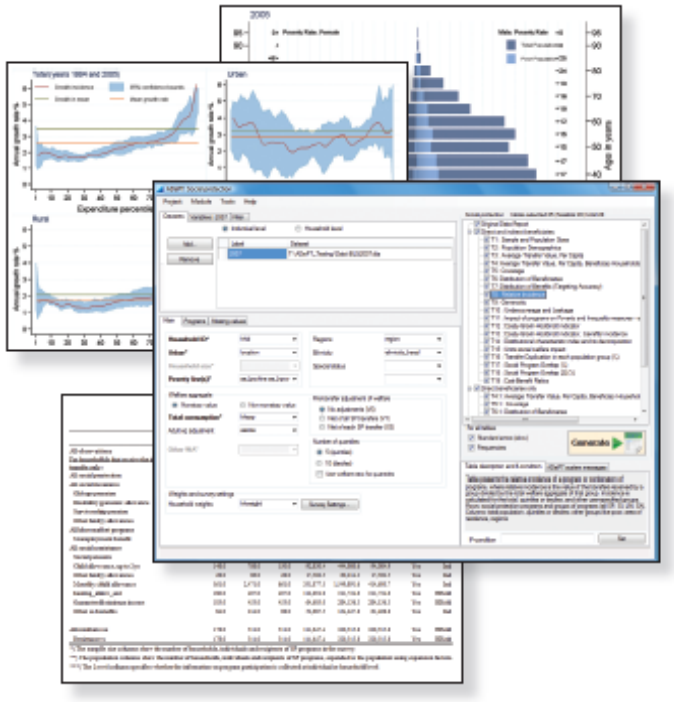


Figure 2.3.3 The screen of ADePT

(iii) SimulateADePT

A simulator of macro-economic analysis. It provides web-based interface.

https://isimulate.worldbank.org/

(iv) PovcalNet

It visualizes the World Bank poverty measurements and researches. It allows you to understand the number of people in each poverty class and their percentage by nation and by year. It provides web-based interface.

(v) PovMap

PovMap 2.0 is provided as a software on Windows. It maps the above mentioned PovcalNet.

(vi) CAPI (Computer Assisted Personal Interviews)

A complete paperless solution for the surveys with question sheets to be used for the household surveys, business surveys and censuses. The researchers interview the targeted people with a tablet. It has been already implemented in many countries for censuses etc. The World Bank provides the application and the person who prepares the questions can freely design the style of questionnaire and its contents. It aims at a dramatic reduction of survey costs and the improvement of the data quality.

It has been used for more than 50 surveys and in more than 30 countries. The largest number submitted is 200,000 (Malawi) and the largest number of the questions is 3,000 (Tanzania). It is multilingual. Currently, Survey Solutions 4.4 is being provided and it can be characterized by the fact that the source code is not disclosed and it is provided for free of charge.

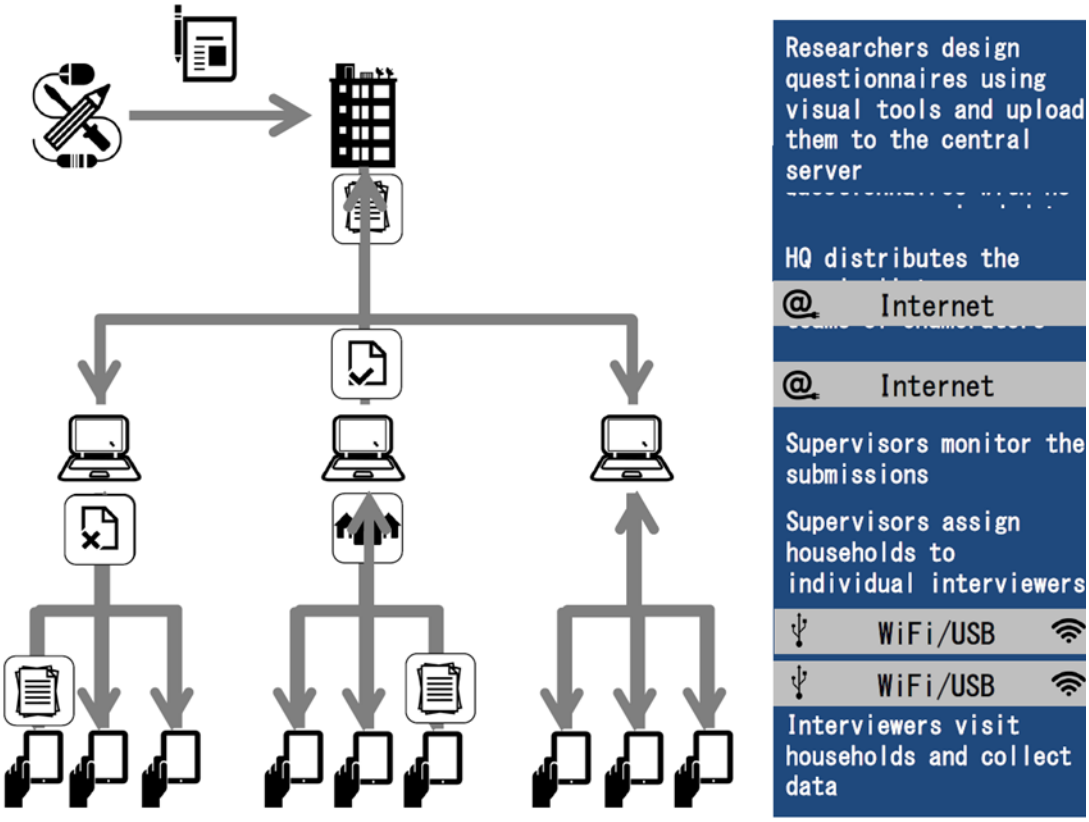


Figure 2.3.4 Data Flow of the survey by CAPI

BOX 6 The first "WBG Big Data Innovation Challenge"

The actions toward the big data by the World Bank have just got on track. In December, 2014, the World Bank selected the winners (14 people) of the first "WBG Big Data Innovation Challenge" from the finalists (31 people). The total number of entries reached as high as 130. The 14 winners collectively received $1.5m in seed and growth funding to realize their ideas, with individual awards ranging between $30k and $150k. These are the research proposals in which big data are to be utilized, and the winners receive the award (special budgetary allocation of project budget). Also, the finalists can receive supports with the world-class scientific expertise as well as the supports from Bill & Melinda Gates Foundation, USAID, Hewlett-Packard and the UN Global Pulse.

As to the categories of the 14 winners' research topics, 3 proposals are for Transport and ICT, 2 for Governance, and 1 each for Agriculture, Development Economics, Education, Energy and Extractives, IFC, Macroeconomics and Fiscal Management, Poverty, Trade and Competitiveness, and Urban, Rural and Social Development.

The definition of data varies from proposal to proposal and the utilization of big data comes in many forms;
by using the public data accumulated and owned by the implementing agencies of the borrower nation (client) , make an analysis on behalf of the client as a technical assistance (Colombia etc.), utilize the data specifically pooled through SNS for the past 1 year (Brazil etc.), make an attempt to improve the electrification monitoring in a particular region by analyzing the satellite images which have been recorded every night for more than 20 years (India). They are not always conducting the sort of big data analyses that developed countries do, where the latest cloud computing comes bundled with the data scientists. In other words, the concept of this contest was how to evolve the traditional analyses of the accumulated data into "big data-like" analyses and link them with the problem solving.

Soliciting the ideas is beneficial when there are no established strategies regarding the ways to utilize new ICT technologies

(3) Projects

There are 74 cases of ICT-based projects, specifically General information and communications sector, which have been approved between 2005 and 2015. (See attachment 2-1)

As a case study, the following three projects characteristic of World Bank will be reviewed. The Rwanda project promoted comprehensive ICT utilization in a relatively small-scale nation's administration; Bangladesh project introduced solutions to the nation's core system, the Ghana project was involved heavily with the nation's finance. All of these projects will be categorized in Japan as part of governance. By getting involved with each country's governance, then offer ICT as a solution. The following examples of projects illustrate the characteristics of World Bank.

(a) e-Rwanda Project of the Republic of Rwanda (P098926)

World Bank's e-Rwanda Project was conducted between 2006 and 2010, with the credit line of 10 million dollars. Project aim was to push further ICT utilization centered on the government departments as part of the National Information and Communication Infrastructure (NICI) II Plan. It included the following components.

Component 1: Strengthening the government's effectiveness and efficiency (3.8 million dollars). Developing ministries/agencies and local government systems. Connecting central and local governments via intranet. Creating government's portal sites to simplify access to application to government and information services.

Component 2: Improving services offered to Citizen/Private Sectors (3.5 million dollars)

Developing service application in areas as health, agriculture, environment, education. Establishing TeleCenter (public access point), and conducting ICT training.

Component 3: Improving access services by strengthening energy and telecommunication infrastructure (820 thousand dollars). Improve local networking.

Component 4: Project management (1.47 million dollars). Project management, M&E implementation system.

(b) ID System (IDEA) Project to enhance access to Services of the People's Republic of Bangladesh

To facilitate better administrative services, it is necessary to isolate beneficiaries. Therefore assigning personal numbers and publishing official ID card are widely practiced in developing countries more so than Japan. Bangladesh is a case in point and the paper-based ID cards have been used.

To enhance access to Bangladesh nation's services, the ID systems project BD Identification System for Enhancing Access to Services (IDEA) Project, P121528 was slated for period between 2011 to 2016 (planned), with the initial confirmed amount of 219 million dollars.

The purpose of the project is to develop a safe, accurate, and reliable national ID system to enable efficient and transparent services. Thus the project will offer citizens the National ID card (NID) with IC chip embedded by choosing names from the voter

committee's list and create ID cards for distribution. This would work as the virtual national ID, and ICT is used in areas such as data management, put into practice in local areas, and preventing forgery. Smart NID (IC chip preinstalled) creation was awarded to Oberthur Technologies (French company) for 20 million dollars.

The project components are listed below.

Component 1 : Developing a regulatory framework to improve the national ID systems and service provision (9.06 million dollars)

Component 2 : Building operational systems to administer national ID systems (145.97 million dollars)

System compilation, data center, delivery of new cards (specs to be determined), etc.

Component 3 : Capacity development, project administration (39.96 million dollars)

(c) e-Ghana Project of the Republic of Ghana

e-Ghana Project (P093610, 2006-2014 with initial confirmed amount of 40. Million dollars) is consisted of the following components.

Component 1 : Enabling environment: (9.37 million dollars) policy system reform.

Component 2 : Support to ITES and ICT SMEs: (17.60 million dollars) support for IT industries.

Component 3 : E-Government: (31 million dollars) adoption of IT in government procurements and national taxes etc.

Component 4 : GIFMIS: (28.44 million dollars) Ghana Integrated Financial Management Information System (Ghana general budget control system)

This has resulted in total of over 86 million dollar project, and thus has brought a huge impact as initially expected (Implementation Status & Results Report). Commenting on the component contents, emphasis was placed on procuring hire manpower/services rather than goods which resulted in 65 procurement contract agreement signed during the eight years. As to immigration control and revenue systems procurement were noteworthy that they were conducted in an international competitive bidding, narrowed down to in sole comprehensive procurement contract agreement to cover the entire process from designing, delivery of goods/equipment, supporting the system introduction.

2.3.2. Asian Development Bank (ADB)

(1) Overview and strategies

ADB, similar to the World Bank, regularly has been giving aid to information communication and broadcasting fields. In 2003, ADB drawn up a ICT strategy called "Toward E-Development in Asia and the Pacific: A Strategic Approach for

Information and Communication Technology" and implemented the following three goals: (1) Developing an environment to enable policy/systemic enhancement; (2) Providing infrastructure; (3) Developing human resources to enhance ICT literacy and job skills.

Between 2000 and 2013, ADB supported 547 cases of ICT related projects and technical assistance valuing 17.67 billion dollars.ADB's main areas of support are listed below.

- ICT infrastructure (e.g. communication network, mobile and wireless network, broadband, broadband cable network, data centers, last mile internet connections)
- ICT industries (e.g. research centers, research/computer laboratory, other industries ICT enabled them---business process outsourcing, knowledge process outsourcing, software park,ICT incubators etc.
- ICT support services (using ICT to areas of governance, education, health, finance)
- ICT policies, strategies, and personal development (e.g. ICT policies and strategies, communications policy reform, universal access services, national and local road map, ICT regulations and laws, ICT skill training, capacity building).

(2) Projects

Attachment 2-2 shows the projects approved for loans after the mid-2000--- for those ICT are used for the main or sub sectors. The area where ADB differs from World Bank is that ADB has more TA (Technical Assistance) projects. Most cases seem to start with the RETA (Regional TA, Multilateral TA), followed by building consensus among regional areas of GM and CAREC. Then conduct TA in countries with higher development needs and draw up a master plan.

ICT in areas of education, governance, health, agriculture, and finance is proactively incorporated.

Education: Including improving education in remote and impoverished areas.

Governance: Capacity development in introducing programs to increase efficiency of government affairs.

Health: Distribution of health information, standardizing deviating medical technologies among the hospitals, strengthening monitoring abilities on disease and other problems, increasing efficiency in health administration, etc.

Agriculture: Providing useful information to producers, selecting strategic information, minimizing damages from natural disaster. In this paragraph, the following two projects are illustrated.

(a) ICT in basic education project of the Republic of Uzbekistan

The Uzbekistan's Basic Education ICT Project (Informtion and Communications Technology in Basic Education Project, 37698-013, 2005-201, with initial confirmed amount of 43 million dollar, is consisted of the following components.

Component 1: Constructing, installing, and ensuring its functionality of network of cluster schools.

Component 2 : Enhancing staff's ability to use ICT in education, learning, and

increased school administration.

Component 3：Developing learning materials

Component 4：Ensuring the project's sustainability and efficacy.

In Component 1, 860 ICT equipment and furniture for CLSs (Cluster Leader Schools) were procured in two separate terms. This was basically a procurement of goods, and used a combined bidding of International Competitive Bidding (ICB) and National competitive Bidding (NCB). This component has brought benefit to 540,000 pupils in the remote areas.

(b) ICT development project of the Republic of Maldives

The Maldives' ICT Development Project (Information Technology Development Project, 34276, 2002-2011, with initial confirmed amount of 12.57 million dollars) was consisted of the following five components.

Component 1：Communication network of the government agencies

For Male, nation's capital city, 106 government agencies were connected with GNM (Government Network of Maldives). Seventy nine of them were connected with optical fiber, and 27 were with ADSL. The nation's 20 atolls were also connected with the network. Four of the 20 atolls will be connected via microwave link of a private mobile phone operator. Other 16 atolls' infrastructure was developed (NCIT) and had a data center built inside of the National Center of Information Technology building.

Component 2：Introduction of IT to government affairs

Data organization, web portals, conversion of existing documents, process of licenses, etc. at NCIT.

Component 3：Constructing the National Center of Information Technology (NCIT)

Component 4：Internet Kiosk

Twenty kiosks were built as planned. Four atolls were connected with a private mobile phone operator's microwave link. Currently its speed is at 128kbps but it is expected to increase its speed in the future. The remaining 16 atolls are under construction.

Component 5： Reform of the telecommunication sector

Restructuring of the regulatory agencies.

2.3.3. Inter-American Development Bank (IDB)

(1) Summary and strategies

Inter-American Development Bank has established the Institutional Strategy 2010-2020 and has updated it in 2015. It has four sectors strategies; in one of the sector, Sector Strategy Institutions for Growth and Social Welfare, approved in March 2011, ICT area is explained as below.

"On a supply side of ICT, specifically broadband, IDB will assist to analyze which technology is best suited and to develop the infrastructure to support it. For the

demand side, wide range of adaptation and use of the afore-mentioned technology and the services will be promoted. To this end the emphasis will be placed designing and adoption of adequate regulatory policies related to competition and implementation. (Paragraph 5.21 of the same Sector Strategy) IDB will promote the design and implementation of various areas digital agendas, such as education, commerce, health, e-Government, to bring about competitiveness and social integration.

(2) Projects

Actual implementation cases of projects focused on e-learning of education sector. In Chile, under the Personalized Learning Environment, providing personalized learning environment according to each student's level of understanding was examined (Project CH-T1118). Actual implementation is labeled as its second phase and is planned to be executed as a separate project. For technical trainings e-learning is also incorporated; in Peru engineers of mining, petroleum, energy, communication living in mid-sized cities through local areas received necessary technical training (Project TC0005056).

Also in Haiti, a pilot project (Project HA-T1093) was conducted in conjunction with One Laptop Per Child (OLPC) Foundation.

2.3.4. United Nations Development Programme (UNDP)

(1) Summary and strategies

At the time of initial establishment of the United Nations Development Program (UNDP), there were hardly any mention of IT, however, the realization of importance of ICT plays in development assistance has gradually increased. By early 1990 all levels—international, national, or regional—have seen ICT related assistance. During this time, there were many assistance programs such as ICT-based individual projects and initiatives, and ICT component introduction at the state level. In 2000, UNDP's assistance policies have changed from supporting individual projects and programs to more comprehensive strategies and policy related assistance. This transition expanded ICT utilization in not only providing services but more policy approaches in national and international levels. Also, the key assistance areas, based on the institutional policy, currently focus on Poverty Reduction through Sustainable Development, Democratic Governance, Climate Change and Disaster Resiliency. In the next clause, UNDP's recent primary approaches—based on these strategies—will be introduced. The attachment 2-3 will show a list of UNDP's recent approaches in those areas.

(2) Approaches

(a) Poverty reduction through sustainable development

As one of the key approaches, UNDP works to reduce poverty through the use of ICT for social economic development. In Syria, their government is targeting to develop its infrastructure and knowledge-based society through legal systems. In conjunction with this ICT policy, UNDP has approached both government/private sectors to improve ICT abilities. Specifically, this project conducts policy recommendation to the government and capacity building, as well as attempts to bring benefits to the citizens by establishing access centers and providing locally oriented contents.

In Ethiopian approach it is aiming for expanded access and increased income for landed and tenant farmers and women through market information system. This approach is aiming to eliminate unfair price selling/buying by providing them of means to access international market prices; the means include toll-free mobile phones, regular transmission to SMS, electronic bulletin board (setting up 83 in the rural farming villages), web sites, and multiple access means.

All of these were realized by combined efforts of Ethiopian government, US Agency for International Development (USAID), Swedish International Development Cooperation Agency (Sida), and European Union (EU).

In the e-Employment project conducted since 2008 in the Republic of Congo, it provides employment information and ICT trainings to unemployed youth and students seeking jobs. This was also made available with the cooperation with the government agencies.

(b) Democratic governance

UNDP works at several projects for e-Governance and e-Government, and places special focus on benefits for the poor by improving the public services. India's Lokvani Project made available online public services accessible via mobile phones and from the Internet cafes. The project also created a platform that enables people to send online grievances and petitions to their government administration, subsequently able to keep track of the process until the problems are solved. With this system, citizens can get involved with the local government without actually visiting the offices, at the same time it also could function as monitoring the government's performance. Kenya's Huduma Platform and Kosovo's Kallxo.com also work in a similar way as to bring about government transparency and accountability by strengthening and giving the citizen the voice and the means of monitoring their government. The former focuses on improvement of the administrative services, and the latter focuses on elimination of fraud and corruption. Both projects have the each subject government partner with the Ushahidi.

UNDP also works based on the idea that such services as information, knowledge, and telecommunication services should be made available with ease and fairness to citizens. As an example, in Bulgaria we work in cooperation with the government agencies providing services such as Internet free use and education/training. Information disclosure related regulation amendment is also being worked in several countries.

(c) Climate change and disaster resiliency

Climate change and environmental issues, disaster preparedness and response are UNDP's recent focus areas and we have a track record in Kyrgyzstan, Bosnia-Herzegovina, Nepal, etc. Specifically, Kyrgyzstan received satellite communication system. With this system, real-time digital images of disasters can be obtained, thereby creating an environment enabling speedy and concreate response plans. Kyrgyzstan also had new regulations and standards drawn developed and had monitoring system introduced targeting energy usage and greenhouse gas emission.

For Uzbekistan, UNDP supported a strategic planning for control of water source

and land, as well as introducing a state-of-the-art ICT system to monitor climate change and the water sources. The entire system including the hardware and software is donated to the Uzbekistan government.

In Bosnia-Herzegovina, UNDP approached from comprehensive policy aspects—such as supporting to draw up plans to cope with climate change, developing legislative and legal framework, and setting up a website on climate change.

2.3.5. Department For International Development (DFID)

(1) Overview and strategies

The Department for International Development (DFID) is a United Kingdom ministerial department, established in 1997, is responsible for international assistance from policymaking through its implementation under the Secretary of States. Following the International Development Act of 2002, DFID aims to reduce poverty by providing assistance to sustainable development and people's happiness. [20] To that end, the action guideline identifies seven priorities below.[21]

[20] The National Archives. "International Development Act 2002". Legislation.gov.uk. 2015. http://www.legislation.gov.uk/ukpga/2002/1/section/1. (See July 2015).

[21] Department for International Development. "About Us". Department for International Development homepage. 2015. https://www.gov.uk/government/organisations/department-for-international-development/about. (See July,2015).

- Support to obtaining Millennium Development Goals (MDGs)
- Effective aid based on transparency and openness
- Assistance to nurturing economic growth and creating wealth
- Assistance for vulnerable or troubled nations
- Improved living standards for girls and women through better education and family planning
- Eliminating violence against women
- Promoting climate change measures and low-carbon society

Below reasons demonstrate the importance of ICT utilization in development assistance programs. [22]

- Knowledge acquisition and utilization is essential in the process of development;
- Enhanced access to information and communication is an important element to economic advancement and departure from poverty;
- ICT plays an important role in the processes of securing transparency in public sectors, reinforcing private sectors, and citizen's community participation;
- ICT could become means to support MDGs achievement.

Based on these views, DFID advocated the use of ICT in approaches such as establishing and implementing drastic approach toward poverty reduction, policy improvement and partnering with civil society and private sectors. Further, importance

in each approach is listed:

Securing universal access, providing services that meet local needs using a existing system, attainable practical ICT usage, and capacity building. Accordingly, next paragraph shows some of the past DFIF achievements.

(2) Approches

The attachment 2-4 contains a list showing DFID's many recent ICT related approaches. As apparent from the list while you would see cases covering wide areas of Asia and Africa, it is apparent that more cases were targeting to develop policies and to bring benefit to the poor.

For example, the InfoDev Core Contribution initiative, intended for mid-to-low income states, promoted to CT-friendly policy and reform as well as to establish ICT oriented businesses. In the St. Helena Information and Communication Technology Strategy 2011-14, DFID supported the St Helena Government ICT Department to establish ICT strategies to enhance the efficiency and effectiveness of the government services. This also provided training and equipment toward implementing the planned strategies.

As a DFID characteristic, an approach of ICT utilization designed for aid personnel is also present. For example, The Agfax II and New Agriculturist project, DFID has provided the most up-to-date information on agriculture and sustainable development to the participants of the African development to help them with their decision making. In another, the "BBC (British Broadcasting Corporation) Media Action Research and Policy Programme: the role of the media and communication in development" project worked to promote democracy and achieve the MDGs, and to encourage the use of media and communication by the aid participants.

[22] Dylan Winder. "DFID's Approach to Information and Communication for Development". ICD Team, DFID. n.d.

DFID's another characteristic is that there are some cases existing without any content of approach is being specified. Namely, the "Mobile for Development (M4D) Utilities" case states that by supporting to create innovative business model through new technology or mobile telephone industry, improved electricity and water supply services in the remote agricultural regions. This project is to be implemented through 2020, donation of £4,100,000 is being approved for the first two years, and however, no specific means are not being decided at the start of the case. Only thing being certain is that ideas are to be chosen through competitive selection process with funds made available to the winners to conduct business trials in research and prospective technologies. The "Information Communication Technology (ICT) for Development (ICT4D)" case targets only work toward African's poverty reduction via an effective use of ICT but no specific means are mentioned.

In addition, DFID is a member country of the International Humanitarian Partnership (IHP) and has dispatched a ICT module within the same framework in the past. The IHP has contributed by providing ICT, such as Wi-Fi, to the disaster stricken nations and humanitarian aid organizations immediately after the disaster, therefore it has know-how on ICT usage for emergency relief activities.

2.3.6. U.S. Agency For International Development (USAID)

(1) OVERVIEW AND STRATEGIES

U.S. Agency for International Development (USAID) identified the following main action purposes.

- Far-reaching Economic Prosperity
- Fortifying Democracy and Governance
- Human Rights Protection
- Improving Medical Health
- Promoting Food Safety and Security and Agriculture
- Sustainable Environment
- Promoting Education
- Prevention of and Recovery from Conflict
- Humanitarian Aid in Natural and Man-made Disasters

USAID has started to offer Information Communication Technology (ICT) to assist developing countries in the 1970s, and with the 1990's rise of the information revolution, USAID has placed special focus on the technology.[23] Assistance projects around that time were centered around improving the infrastructure such as telecommunication and capacity building to utilize the system. A typical example of activities was developing the Internet environment—the Leland Initiative that started in 1995 and eventually implemented in 22 African nations is one such example, and the Internet for Economic Development Initiative from 1996 for 21 developing countries.

By 200s, ICT usage has expanded greatly along with technical assistance to the sector, ICT has been applied to various fields of assistance. To cope with the trend, USAID has identified the five priorities in the strategic use of ICT. They are:

1. Establishing and improvement of policy and regulation of telecommunications;
2. Enhancing access to so-called Last Mile zones without economically and geographically disadvantaged;
3. ICT capacity building for organizations and individuals;
4. Use of ICT in various USAID assistance program;
5. Partner with other agencies to supplement financial and technical resources.

These strategies are thought to be basically having been inherited till now. In the next paragraph some typical approaches would be illustrated in details.

[23] U.S.AgencyforInternationalDevelopment."InformationandCommunicationTechnologyforDevelopment: USAID's Worldwide Program" (PDF). USAID. 2004.

(2) Approaches

(a) Access enhancement through infrastructure development

AS the communication aspects of the technological advancement in the Internet environment at the national level, USAID's focus on the ICT infrastructure enhancement has shifted to fill the gap between the city and the rural areas to aim toward solving the digital divide by developing a universal broadband infrastructure.[24] The Global Broadband and Innovations Program (GBI) has succeeded the aforementioned Leland Initiative and the Last Mile Initiative (LMI), which aim to provide communication means to the rural areas and deprived regions. This program, launched in 2010 to comply with the dramatic changes in the ICT fields, such as mobile phones and internet access spreading to farming villages in the developing countries, as well as expanding cloud-based services. Other points of interest in this program are that this is not only a simple infrastructure development but is a far-reaching approach with socio-economic development in view. For instance, provision of laws and regulations ICT training generated by cooperation between government agencies and enterprises, promotion of provision of information by the government, sustainability and environmental consciousness for using solar or wind powers generation, and further ICT utilization promotion by integrating with other USAID projects,. These are the activities conducted with capacity building and partnership at the basis.[25]

(b) Utilizing ICT

Appendix 2-5 contains a list that summarizes the USAID's assistance cases that utilizes ICT. It is apparent from the list that the USAID's target areas are centered on India despite the fact that ICT is widely used as part of development assistance by USAID. While this fact reflect the success of ICT introduction to various sectors, this success could also be interpreted as the ICT utilization is "limited" to fit the region's capacity or otherwise there were no other choice. Remarkable approach in the list is the mobile telephone use, economic and industry development through job opportunity creation or business support, etc.

In the India's case, "Increasing Rural Incomes by Expanding Access to Agricultural Price Information", farmers are informed of the market price of their produce via mobiles' SMS. This enables the farmers to determine accurately the time to harvest or to sell, and to prevent exploitation through a unfair price set by middleman, resulting in increased income. In the medical health sector's the Scaling COMMCARE for Community Health Workers project utilizing cellular phones. This project enables mothers to use the phones as a health education tool and to collect medical health related data. While job opportunity creation and industry assistance, trainings were provided by using ICT, information sharing and exchange, human resources utilization were implemented through network development.

(e.g. Egypt's "Employment through Technology and Innovation", Armenia's "Microsoft Innovation Center, GDA", India's "Be! An Entrepreneur" and "Millennium Alliance" etc.) In environment sector, ICT is utilized to enhance efficiency of smart grid or water supply management.

[24] U.S. Agency for International Development. "Information Communication Technology for Development". USAID homepage. 2015.
http://www.usaid.gov/what-we-do/economic-growth-and-trade/infrastructure/information-communication-technology-development. (See July,2015).

[25] U.S. Agency for International Development. "Global Broadband and Innovations (GBI) Program: Overview and Services" (PDF). USAID. n.d.

(c) Partnerships

Recent partnerships with other organizations tended to be more with private sectors. USAID created a business partnership program, the "Global Development Alliance (GDA)", with public-private cooperation to effectively aid the developing countries.[26], [27] This program's characteristics, for example, are cooperation between USAID and private enterprises from the initial stage of project exploration, and sharing necessary resources, result of efforts or damages incurred in its implementation. So far under this arrangement, more than 1,500 cooperation with more than 3,500 partners were realized garnering 20 billion dollar investment toward projects.

Cooperation with ICT related US enterprises include names large companies such as Intel Corporation, Cisco Systems Inc., Microsoft Corporation among others. With Intel USAID concluded more than 20 partnerships to work in such wide areas as livelihood supporting women, broadband network development, strengthening education, supporting entrepreneurs and small-and-mid size industries, supporting USAID actions in areas of medical health and climate change. Both Cisco Systems and Microsoft provided education and training; in addition while USAID partner with the former company to offer entrepreneur support, with the latter, HIV measures etc. As seen in Microsoft's work with USAID in constructing the previously mentioned Armenia's "Microsoft Innovation Centre", it is one of an example of joint business expansion to a local area.

(3) Future Development

As a material used to predict a future development, 2015 USAID press release was used. There was not enough ICT-related news item in it to render any clear pictures at a pre-implementation stage, however, two noticeable tendencies were noted. Further explanations will be given in the next paragraph.

(a) Utilizing data

First tendency mentions that the programs that aim to data utilizing have begun already. For example, "Global Health Supply Chain Program" aims to realize streamlining a supply chain by integrating the USAID health sector's supply/procurement/distribution related projects.[28] USAID expects to realize lower price and speedy delivery of pharmaceutical so that additional several million patients could be supported without increasing the level of the resources needed. In the medical health sector, USAID announced policies to strengthen the data-driven approach to work with World Band and WHO.[29] In this approach, by strengthening data utilization we hope to discover resources that contribute to identifying threats and its quick and effective solutions. The concept of Big data and Open Data is a

representative of growing global trend and interests in ICT sector. Taking this into consideration, UDAID seems to trying to incorporate this "trend" into their development assistance.

[26] U.S. Agency for International Development. "Global Development Alliances". USAID homepage. 2015. http://www.usaid.gov/gda. (See July, 2015).

[27] Ministry of Economy, Trade and Industry, Trade and Economic Cooperation Bureau, Trade Financial and Economic Cooperation Div. "BOP Business Policy Support and Comprehensive Approach??". 2010

[28] U.S. Agency for International Development. "New Global Health Approach to Reach Millions More People with Lifesaving Medicines". USAID Press Releases. 2015.
http://www.usaid.gov/news-information/press-releases/apr-17-2015-new-global-health-approach-reach-millions-more-people-lifesaving. (See July, 2015).

[29] U.S. Agency for International Development. "USAID, World Bank, and WHO Committo Strengthen Data-Driven Approach to Global Health". USAID Press Releases. 2015.
http://www.usaid.gov/news-information/press-releases/june-9-2015-usaid-world-bank-and-who-commit-strengthen-data-driven-approach. (See July, 2015).

[30] Open Data is the idea that some data should be freely available to everyone to use and republish as they wish, without restrictions from patents. Secondary use of the data is permitted with the requirements for machine readable data format.

(b) Seeking Innovative ideas from the public

Other noteworthy activity is to publicly advertise to seek ideas and utilizing them. This entails seeking innovative ICT oriented solutions from the public for various sectors such as Education, Medical Health, Agriculture, Business, and Environment. This will be announced, and collected the responses, mainly through the Internet, and finally to choose a winner with innovative idea. The prize money will be provided and support for the idea to become a true project will follow. (World Bank's approach will be shown in Page 32, "BOX6 The First Challenge to the Big Data Technology Reform".) The popularization of the Internet has made it easier for innovative idea to come out from developing countries. This type of approach is based on the view that it is desirable to seek solutions suitable to the specific area and generated by human resources based locally, and the developing country-derived solutions are expected to continue to increase in the future.

2.3.7 International Telecommunication Union Development (ITU-D)

(1) Overview and key activity regions

The International Telecommunication Union (ITU) is a United Nations specialized agency to develop international standards mainly of telecommunication and broadcast related technologies. ITU Telecommunication Development Sector (ITU-D) conducts dual responsibility as a United Nations specialized agency and executing agency for implementing projects under the United Nations development system or other funding arrangements, so as to facilitate and enhance telecommunication development by offering, organizing and coordinating technical cooperation and assistance activities.

(2) Projects

Table 2.3.1 shows the ITU-D project's Areas of Action and number of

Implementation (completed/incomplete)

Following the ITU_D Website reorganization, 193[31] (including 56 incomplete cases[32]) projects implemented since 2007 were studied with specific emphasis on the Areas of Action's ICT usages.

In the Areas of Action, we focused on ICT applications, Cybersecurity, Emergency Communications, and Climate Change.

ICT Applications project showed 12 cases, which is not too numerous, but more than half of the cases were Medical health sector, such as Telemedicine and m-Health. Other cases included e-CabinetDocumentationCenter (CDN) project.

Cybersecurity listed 17 cases that are related to the construction of national CIRT and Governmental CIRT.

Emergency Communications had 8 cases registered, but very few specific systems construction such as early warning system was found.

[31] The total number of project tallies 234, not 193; the former figure is thought to include those implemented before 2007.

[32] The budget total for uncompleted project is 63 million dollars.

Table 2.3.1 ITU-D areas of action and number of projects

Areas of Action	Aim	Number of Projects
Technology and network development	Facilitating the adoption of efficient technological solutions for ICT infrastructure development.	70
Capacity building	Strengthening human & institutional capacities to seize the opportunities of the information society.	50
Reguratory and market environment	Generating and maintaining regulations and market environment essential for the promotion of ICTs.	44
Digital inclusion	Enhancing ICTs access, use and knowledge among disadvantaged groups.	26
Cybersecurity	Fostering the integrity of ICT systems that is essential for their continued development.	17
ICT applications	Extending the use of ICT-based networks, services and applications among developing countries.	12
Emercency telecommunications	Maximizing the contribution of ICTs to disaster risk preparedness and response.	8

Least developed countries and SIDS	Targeted and differentiated assistance to LDCs and SIDS in key priority areas.	2
Spectrum management and digital broadcasting	Providing assistance in various aspects of spectrum management and broadcasting including transition from analogue to digital terrestrial TV broadcasting.	5

Attachment 2-6 shows the ITU-D projects using ICT.

"ICT APPLICATIONS" in areas of action of the ITU projects, health & medicine related usages were prominent. There is a repository called Global eHealth Projects Repository developed in conjunction with International Telecommunication Union (ITU) and World Health Organization (WHO) for sharing information as part of effective use of ICT.

This initiative garnered many grass-roots and corporate activities cases uploaded and made open to public view; these activities cases are expected to expand further by being shared by the public. Currently the initiative is focusing on e-Health projects for women and children's health, but later other areas in e–Health information will be collected.

e-Health related applications include Information/Services Access, Decision Support System, Computer-Aided Diagnosis, Medical Record System, Aiding in Emergency Humanitarian Support, Health Information System (HIS), Health Promotion, Health Survey, Health Management, Patient Monitoring, Remote Health/Medicine, etc.

Attachment 2-7 shows Remote Health/Medicine which has many cases using ICT.

Chapter 3
Challenges to and prospects for ICT utilization

In Chapter 2, the current situation of the projects using the Information and Communication Technology (ICT) was discussed. In Chapter 3, after analyzing the trends of the project from an interdisciplinary perspective, priority issues in JICA's utilization of ICT in the project will be clarified, and where ICT might be going and the instances of ICT utilization will be described.

3.1 Tendency of ICT utilization in the projects

ICT has found its way into everyday life of not only Japanese people but people in developing countries. There is not much difference between Japan and developing countries in ICT utilization in the use of ready-made applications for email, LINE, Facebook or Twitter.

There is, however, a big difference between Japan and developing countries in the method of applying ICT and its development capabilities. Moreover, the cellphone is more popular in developing countries than in Japan. Since ICT is developing in a different way in Japan and developing countries, ICT cannot be necessarily utilized in developing countries on the same footing as in Japan.

This is same in ICT utilization in JICA's projects. Machines such as personal computers, and technology and applications for email are in common while simple programing or network configuration are big hurdles.

ICT is the fundamentals that have already spread among the people as social infrastructure including the Internet. With the diffusion of the Internet, social media, and the cellphone as the background, ICT has been incorporated into the implementation of JICA's projects. Nowadays, it is difficult to clearly distinguish between an "ICT project" and a "non-ICT project" as before.

3.1.1 Trend analysis of JICA's ICT utilization

In this section, examples of projects which ICT utilization has been incorporated will be analyzed. Also, the trends of ICT utilization which can be seen in the examples and important points to keep in mind when promoting ICT utilization in the future will be described. Upon analysis, how ICT was utilized on development challenges and how the results were evaluated were attempted as well as the surrounding environment at the time of implementation of a project. Also, some examples of international institutions and bilateral assistance institutions were referred, as well as JICA's projects.

(1) Quantitative value and analysis of ICT utilization projects

As shown in Table 3.1.1, the ICT utilization projects account for about 10% of the total number of JICA's projects (185 out of 1830 projects). The table shows wide variations in the percentage of ICT utilization (Number of ICT utilization cases/number of projects

(%)), which is 5% to 40%, depending on the thematic issue. It is useful to know the above figures as a general trend for thinking about future ICT utilization.

Also, some figures indicate which ICT tools are used in ICT utilization projects. According to basic information on ICT utilization projects, database is used in 62 projects out of 185 ICT utilization projects shown in Table 3.1.1, which account for about 33%, the highest utilization rate. Geographic Information System (GIS) is used in 35 projects, representing 19%, monitoring system in 18 projects, representing 10%, Web in 13 projects, representing 7% and simulation in 11 projects, representing 6%. It can be said that a database is an ICT tool used regardless of the thematic issue as a foundation of information storage. ICT finds extensive application: for example, a database is used only to store collected data, the Web is built to share or transmit stored information, and a database is connected to various business systems. On the other hand, it can be said that Geographic Information System (GIS), monitoring, and simulation have a relationship with a specific thematic issue.

The above figures possess great significance as reference information in thinking about future ICT utilization.

Specific ICT tools are frequently used in the thematic issues such as urban development, water resources/disaster prevention, and natural resources/energy. The ICT utilization rate in these thematic issues is as high as 15% to 40%. As discussed above, when ICT is used in specific thematic issues, the ICT utilization rate in these thematic issues tends to be high.

The ICT utilization rate of 40% in urban/regional development is far higher than that in other thematic issues and this is due to the high utilization rate of Geographic Information System (GIS). It can be said that GIS is in widespread use because GIS has reached a high degree of perfection as an ICT tool and counterparts often possess its utilization technology. In other thematic issues such as water resources/disaster management and natural resources/energy, Geographic Information System, monitoring system, remote sensing, and other technologies are used in many cases. As described above, in a specific ICT tool utilization project, ICT is used within the bounds of dispatched experts' knowledge. For this reason, although the ICT utilization range is rather limited, it seems that the objective of the project can be achieved without causing a major problem. This may be the reason why there are many cases where a specific tool is utilized.

On the other hand, in the thematic issues other than the above such as governance, transportation/traffic, economic policy, environmental management, education, healthcare, private sector development, agricultural/rural development, fisheries, and natural environment conservation, the ICT utilization rate is 5% to 12%. In these thematic issues, a specific ICT tool is not used frequently, but there are many cases where a job-oriented system with a certain degree of software development accompanied is used under individual work specifications.

Table 3.1.1 Number of projects by thematic issue and percentage of ICT utilization projects

Thematic issue	Number of projects	Number of ICT utilization projects	Number of ICT utilization projects/Number of projects (%)	Number of ICT utilization projects/Total number of ICT utilization projects (%)
(a) ICT	15	15	100	8
(b) Education	241	17	7	9
(c) Health	355	16	5	9
(d) Water resources, disaster prevention	203	31	15	15
(e) Governance	138	16	12	9
(f) Peace-building, Gender and development	-	-	-	-
(g) Transportation	116	14	12	8
(h) Natural resources, energy	49	12	24	6
(i) Economic policy	70	7	10	4
(j) Private sector development	134	4	5	3
(k) Agricultural/rural development	216	11	9	6
(l) Natural environmental management	87	8	5	4
(m) Fisheries	43	2	5	1
(n) Urban/Regional development	50	20	40	11
(o) Environmental management	118	12	10	6
Total	1830	185	-	-

Remarks 1. Number of projects: The number of projects registered in thematic issue 1. (In and after 2005)

2. Number of ICT utilization projects: The number of projects in which ICT utilization was confirmed.

(Based on ICT-related key words in the project summary table and related documents)

(2) Information and Communication Technology seen in basic project information "thematic issue"

Search for information on an individual project in JICA Knowledge Site. Out of 185 ICT projects shown in Table 3.1.1, the number of projects which contain the word "Information and Communication Technology" in Thematic Issues 1 to 3 described in the basic project information is 66, which accounts for 34% of the total ICT projects. That is, among all projects in which ICT utilization was confirmed, approximately two thirds of the projects make no mention of "Information and Communication Technology" in Thematic Issues 1 to 3. Therefore, whether ICT is utilized or not in a project cannot be judged only from whether "Information and Communication Technology" is selected or not in Thematic Issues 1 to 3. The objective of each project

is to solve development problems and ICT is utilized in each project to improve productivity and eventually yield good results. Since each department in corresponding subject plans to utilize ICT in this context, "Information and Communication Technology" is not necessarily selected for a thematic issue in a case where ICT is utilized. If interest in ICT utilization increases in the future, a request for data for ICT utilization will be made. If "Information and Communication Technology" is selected in line with the current circumstances, a change in ICT utilization can be easily detected, which may lead to the promotion of ICT utilization.

(3) Mobile utilization situation

Cellular phone, a typical mobile communications device, is becoming popular at a rapid pace in developing countries and has become the mainstream, even though the diffusion varies from region to region. However, there are not many cellular phone utilization cases in JICA. This may be because the cellular phone is not used so often to solve problems JICA focuses on. It seems that importance is attached to the system, mechanism, job flow, code of conduct, guidelines, organization, etc. of the government of the recipient country particularly in a technological cooperation project from the perspective of its scheme and there are not many projects which will bring a direct benefit to individuals including citizens and farmers. Two JICA examples were confirmed where mobile devices are utilized. One example is a SATREPS program "Development of Rapid Diagnostics and the Establishment of an Alert System for Outbreaks of Yellow Fever and Rift Valley Fever in Kenya." Under this program, a two-way early-warning/quick response mechanism model between the Ministry of Public Health and relevant healthcare facilities was constructed. This is an example where SMS was utilized as an infectious disease outbreak alert response system. Like this example, there are many cases where JICA extends cooperation to the healthcare system of the central government and local governments, but no examples are found where mobile devices are widely used for citizens in general. The other example is a transportation/traffic project "Capacity Building Project Phase 2 for the Improvement of Dar Es Salaam Transport in Tanzania." This is an example where a parking lot management system (cashless fee collection and parking lot management with a contact tag utilized) was introduced and the cellular phone account was used to collect the fee for the parking lot. In this example, advanced ICT is utilized. Although the cellular phone itself is not used, the system is intended for users having a cellular phone account and the diffusion of the cellular phone is a prerequisite for this system.

In other agencies such as ITU-D and USAID, there are projects in which the cellular phone is utilized. At this point, the outline of the cellular phone utilization situation will be discussed in an example of ITU-D. Although there are some cases where the cellular phone is utilized for emergency communications in the event of a disaster, it is often used in the healthcare field. Among others, provision of medical information and telemedicine/remote consultation are a typical form of use. For example, under the project for Health Education Bureau, Ministry of Health, Sri Lanka, information on prevention of disease, medical advice about disease, and healthcare information are provided via email or SMS. Under the "Project Be Healthy Be Mobile – m-Diabetes – Phase 1 (Senegal)," the risk factors for diabetes and complications are controlled and

the cellular phone is utilized to provide information on treatment. In this project, medical information is provided to each individual. Also, in the example of remote diagnosis/remote consultation, a diagnosis is made by remote control to manufacture a prosthetic leg (Amputee Screening via Cellphone Networking (the Philippines). In this example, a medical worker inputs the patient's information into the worker's cellphone and sends data to the Web-based database together with a picture of the affected part of the body taken with the cellphone camera. The doctor at a remote place sees the image via Smartphone to make an evaluation and provide advice about the use of the prosthetic leg in real time. The patient can receive the prosthetic leg one month later. There is another example where Smartphone is used to make a remote diagnosis of the eye disease and perform a remote screening of an oral cancer. These examples provide a platform that connects villagers with medical specialists. Both examples are a solution to the problem peculiar to the local area by using the cellphone. In the present situation where the mobile device is a big current, it can be said that these examples help JICA to face future challenges.

(4) Utilization situation of Cloud Computing, IoT, Big Data, Open Data, and 3D printing

There are no examples of explicitly applying these technologies to JICA's projects.

The use of cloud computing in developing countries is still a big hurdle from the perspective of broadband network development and computer systems security. However, a major IT company received an order of a project "Validity Study of a Participatory Disaster Prevention System for Vietnam's Thura Thien Hue Province." In this project, the quantity of river water and rainfall at major points in the province, images of the surrounding areas, and GPS information are integrated in the cloud in Japan, together with the reporting time, via a Smartphone application to utilize them for disaster prevention/reduction activities. The cloud environment in Japan is used in this example and this is the only example of the utilization of cloud computing.

Although there are no IoT projects, several JICA projects containing remote sensing, one of the IoT technologies, are found in the water resources/disaster management, natural environment conservation, and natural resources/energy fields. In a SATREPS project, in particular, there was an example of enabling prediction and prognosis by computer simulation based on collected data.

There are no JICA's projects concerning Big Data. The World Bank and USAID have just begun to work on Big Data.

There are no JICA's projects about Open Data. Utilization of Open Data is a specific activity theme as one of the four sectors which the World Bank Group ICT Sector Strategy (2012) must focus on.

As for 3D printing described in "BOX8 (p.49) in detail, regional development assistance has been recently implemented through the foundation of Fabrication Laboratory

(FabLab) in the activities of Japan Overseas Cooperation Volunteers (JOCV) in the Philippines. Taking advantage of the success in regional development assistance, JICA Research Institute (JICA-RI) plans to hold a workshop titled "Open innovation and development (tentative title)." JICA-RI has begun to theorize about the impact the trend of open innovation, typified by FabLab, has on regional development and study the feasibility of producing goods on a commercial basis.

(5) Utilization of Open Source Software

Utilization of Open Source Software [33] (OSS) is in widespread use on a global basis. Linux is widely used as an operating system, basic software for the network server that controls the network and the Web server. However, Open Source Software is hardly used in JICA's projects. Note that in some cases Linux may be actually used instead of Windows. It has been confirmed that Open Source Software (such as QGIS) is used in Geographic Information System (GIS) as software for generic applications. There are not many overseas donners' projects which explicitly involve the use of Open Source Software. ADB's project (Applying Space-Based Technology and Information and Communication Technology to Strengthen Disaster Resilience, 2015) specifies the use of Open Source Software called Open Street Map (OSM) as a tool to establish the disaster risk management (DRM) system.

Bridging digital divide, improving the Copyright Act to control unauthorized use of pirated software, cultivating ICT personnel, and developing the software industry are a national challenge to developing countries. To meet the challenge, the diffusion and expansion of Open Source Software is expected to play a certain role.

[33]. Source code of software which is freely available on the basis of the concept of Open Source. Secondary use of Open Source Software is possible - that is, anybody can edit, improve, or redistribute it. The advantages in software development are cost- and time-saving.

BOX 7. Utilization of Open Source Software

Encourages innovation of open tool to identify the risk

The development of Open Source disaster and risk modeling software has made great advances in the past ten years. More than 80 software packages available free of charge, most of which are Open Source Software, are for flood, tsunami, cyclone (wind and tidal wave), and earthquake. Among them, at least 30 software packages are in widespread use. Also, the geospatial information tools such as Open Source QGIS and Geo Node have been drastically improved and the tools have lowered a financial barrier to understanding of risk at the national and local levels.

(Source: Excerpt from Policy Note 2014. Toward understanding of ever-changing global disaster risk Global Facility for Disaster Reduction and Recovery (GFDRR))

(6) Analysis of Good Practice

To examine the ICT utilization situation, it is important not only to identify problems with ICT utilization but to share information about good practice in which ICT

utilization has improved project productivity and quality and continues to sustain and further enhance productivity and quality after the completion of the project. There are several factors to ensure project success. These factors are interrelated. The major factor can be known and be described to the extent possible. In this survey, examples of good practice and lessons will be analyzed from the content of ex-post factor evaluation and discussed the following three points as a success factor.

-Visualization of the results

-Ripple effect ICT utilization results have on peripheral business

-Reliable technology transfer and ongoing commitment to human resources

The first success factor is to enable the people concerned to visualize the project results by utilizing ICT so that they can clearly see the results. Two cases will be cited where visualization proved effective.

The first case is "Flood Control Administrative Capacity Building Project in the Philippines" In this case, the use of ICT tools such as a database accelerated information collection and transfer and facilitated information coordination between related organizations. Thus, the foundation of the flood control project was improved. Also, information management took root and facilities management, budget request, and other procedures based on the results were performed. In this case, strengthening of the database function, which had a pivotal role, may have enabled the people concerned to visualize the results and deepened the related organizations' understanding of the project results.

Also, in the "Project for Enhancement of the Volcano Monitoring Capacity in Ecuador," a communications protocol for monitoring was strengthened to collect volcano activity data, issue a warning, and provide the people with evacuation guidance so that the ICT utilization results proved effective in a visible manner. The results served as a driving force behind a nationwide expansion of ICT utilization. In this case, strengthening of the communications protocol was a challenging improvement, but the project proceeded as scheduled owing to visualization of the results.

The "Project for the Enhancement of Tax Administration of Mongolia" is quoted as the second success factor. This project is an example of the "ripple effect ICT utilization results have on peripheral business." Under the encouragement of the more user-friendly website for inputting an invoice for value added tax and the diffusion of the Internet, the number of accesses has drastically increased. In addition, new attempts such as the introduction plan of declaration procedures by electronic signature and online training were carried out. Constructive and continual improvements were made even after the completion of the project. This is a case where one result of website improvement had a favorable effect on other tasks.

As the third factor, there is a case where "reliable technology transfer and ongoing commitment to human resources" lead to a success. In the "Project of Human Resources Development for Weather Forecasting and Data Analysis of Mongolia," transfer of

technology including ICT was appropriately implemented and almost all of the counterparts continuously played a leadership role so that the project continued to produce good results and advanced steadily. Subsequently, they said purchase of new equipment at the counterparts' own expense, training of human resources were planned and implemented continuously, and a budget for equipment maintenance was secured to ensure the maintenance.

There are various keys to project success such as counterparts' capacity, budget of related departments, and trends of ICT environment. The above-mentioned "visualization of the results," "ripple effect ICT utilization results have on peripheral business," and "reliable technology transfer and ongoing commitment to human resources" are important factors.

These factors are expected to serve as a reference or a reminder to consider ICT utilization.

A young man dispatched as Japan Overseas Cooperation Volunteers devoted himself to the foundation of Fabrication Laboratory (FabLab) and produced good results. Although this case was not included in the present survey, it will be described in the following BOX.

BOX 8. FabLab

The "FabLab" has great potential for changing the development model of developing countries.

A "FabLab" is a citizen workshop equipped with digital machine tools. Ordinary people who do not have expertise can make a decent industrial product and its network has spread all over the world. JICA has paid attention to the "FabLab," which has great potential for changing the development model of a developing country, and is promoting cooperation with related agencies.

A Fabrication Laboratory (FabLab) is a citizen workshop equipped with machine tools such as a 3D printer and a laser cutter, and is aimed to make almost anything. The FabLabs have spread to 50 countries of the world and more than 200 places as of May, 2012 and exists not only in industrialized countries but in developing countries including India, Kenya, and Ghana. In developing countries, hopes of contribution to problem solving are running high. For example, the FabLabs all around the world cooperate through TV conference system to manufacture water purifiers and portable toilets (hygiene and sanitation fields), low-head hydroelectric power generators (electric power field), recycled plastic products (environment field), environment measuring instruments (agriculture field), and prosthetic legs and hands (medical field), as well as to prepare various types of teaching materials (education field).

Yasushi Tokushima from Kyoto Prefecture was dispatched as Japan Overseas

Cooperation Volunteers under the job title of “industrial design” to the Department of Trade and Industry (DTI) of the Republic of the Philippines from August 2012 through December 2014. He held discussions with the related agencies jointly with the Bohol Province office of the DTI under the concept of “promoting the development of industry by providing innovator education to a small number of highly-educated people and creating innovations.” Mr. Tokushima said that he took up a new position, intending to help manufacture high-quality goods that can be sold in the international market on the basis of Philippine culture and traditional craftsmanship, but he saw plastic waste littering all over the place in the Philippines and people picking it up to make a living. He thought they would earn much more money if they could transform plastic waste into new plastic material to make products, instead of selling plastic waste as it was. He planned to establish a FabLab as a structure to manufacture products from plastic waste.

Mr. Tokushima immediately started to explain the concept of the FabLab to the colleagues in the office. When the people around him began to understand his proposal, he gave an ambitious presentation in the Department of Trade and Industry. Subsequently, the Department of Science and Technology (DOST) and Bohol State University gave a similar presentation and succeeded in receiving financial assistance. At the end of 2013, the installation of equipment completed and the FabLab was opened in January 2014. Counterparts were sent to the FabLab in the neighboring country, Indonesia, to receive training in equipment operation. Preparations for the operation of the FabLab completed in a short time. In May 2014, the “FabLab Asian Network 1st Conference,” an intra-region international conference by FabLab operators and users, was invited to Bohol. More than 200 people from eight countries participated in the conference and President Ninoy Aquino visited the conference as a guest. The president highly recognized the attempt of the Bohol FabLab carried out under the concept of “earning money from waste” and announced a plan of establishing more FabLabs in the country. Also, the Minister of the Department of Trade and Industry held an industry-government-academia FabLab workshop in December 2014 and an event to promote the understanding of the citizens was held in February 2015.

b Bohol is opened to the citizens as a place where prototypes are manufactured. As for future developments, Mr. Tokushima cherished an idea that he would develop a machine which makes strings out of molten plastic waste and then make high-quality daily goods by twisting the strings together for marketing. Even after returning home, he continued to support his counterpart, leaving the idea to him

Machine tool installed in the FabLab

Rendering of FabLab Bohol

(Source: JICA website and Mr. Tokushima’s report)

(7) Examples of typical lessons learned

Learning from the past examples is necessary as an important point to keep in mind in utilizing ICT. There are two typical lessons obtained from the ex-post facto evaluation as shown below.

-Assessment of the counterpart's financial condition and capacity and measures to be taken

-Prospects for a change in the ICT execution environment and measures to be taken

A case where there was a problem with the counterpart's financial condition and capacity is described below. The objective of the "Solid Waste Management Strengthening Project for the Municipality of Panama" is to improve solid waste management service. In this project, the relay transportation system was monitored, the maintenance database was constructed, and the solid waste management information network system was established. However, the service was not improved because the acquisition of the necessary site for facilities was difficult. As for sustainability, the management of the disposal site and the maintenance of garbage trucks were inappropriate. In particular, there was a problem with the system and skills such as an inappropriate allocation of engineers and no technical training to be provided for the staff. JICA had no other choice but to proceed with the plan without laying the groundwork for the project owing to the problem on the counterpart's side. Also, the situation was not remedied in the operation and maintenance phase.

JICA was faced with a similar problem in the following case. In the "Capacity Building Project for ODA Management in Vietnam," a lack of funding for the maintenance of software componentry such as software, database, and IT network interfered with sustainability. Particularly, when ICT-related software is included in the project, the software needs to be thoroughly studied from the perspective of sustainability at the time of project formation, that is, when commercial software is used, the software maintenance costs including the annual license fee and the periodical equipment maintenance costs must to be incorporated into the budget. It can be said that this lesson is not limited to the above case but common to all of the ICT utilization projects.

The following case suggests the ability to respond to a change in the execution environment. In the "Capacity Development Project of Water Environment Conservation in the Metropolitan Area of Guatemala," the constructed water environment database was not maintained because its capacity was exceeded. A file of another system is used. Although improvements had been recommended to the executive agency for the execution environment such as an increase in the server capacity, satisfactory results were not achieved and the database could not be used. It is important for the counterpart to understand that an increase in the capacity of data will entail some additional costs. Also, it is necessary to monitor the execution environment and reduce unnecessary data and files.

In addition, with the change of the times, the cellphone has spread rapidly and the

project operational environment has drastically changed. In some cases, the operation of a project with the use of original equipment became difficult before the expected capabilities are demonstrated. Of course, attention may have been paid to local technological trends at the stage of project formation. It means that things change so fast that the trends cannot be predicted. Generally, a technical cooperation project is of about three years' duration and ICT will advance and change rapidly during this period. In developing countries, in particular, the mobile environment is drastically changing, making us hesitate about ICT utilization. It will be necessary to collect information on the local situation and identify the future trends of not only the mobile environment but ICT-related equipment.

(8) Efforts for demonstration experiment in SATREPS project

This is a research program jointly conducted by the researchers from Japan and developing countries. In the research areas of "environment/energy," "bioresources," "disaster prevention," and "infectious disease," ICT utilization examples can be seen in such thematic issues as water resources/disaster prevention (8 cases), natural environment conservation (3 cases), environmental management (3 cases), resources/energy (2 cases), and healthcare (2 cases). Recently, in the bioresources area, there have been some cases where a university applies for an ICT utilization project jointly with a manufacturer, aiming to innovate cultivation techniques. SATREPS aims to contribute to solving the development problems of the developing countries not only by conducting advanced technology demonstration experiment but by plowing research findings back into society. For this reason, as Japanese researchers can work on a project on a relatively long-term basis, they can make ICT utilization firmly take root among the researchers and persons in charge of the recipient country. Since the SATREPS projects have a research aspect, a monitor/management system in a specific area is introduced and simulation is done in many of the projects. Simulation can be hardly seen in a technical cooperation project. This fact is an interesting characteristic to be recognized and shared more widely in JICA.

(9) Use of system with a track record in Japan in grass-roots project

There are many cases where a grass-roots technical cooperation, "JICA Partnership Program" (local proposal-based) scheme is used but there are not many ICT utilization examples. However, there are three projects under which local needs were incorporated into a system with a track record in Japan.

Two out of the three projects are examples of telemedicine: "ICT Telemedicine Support Project for Health Management of Pregnant Women and Nursing Mothers and Diabetes in Thailand" and "Kagawa Telemedicine Network System in Thailand" where mobile CTG (Sending system of fetus' heart rate) / Regional coordination pass system for diabetes were introduced. Both of them were proposed by Kagawa University and the telemedicine support project team in Kagawa Prefecture and the counterpart was Chiang Mai University.

The other is an example of reduction of poverty "Income Generation Project for

Farmers at the BOP by using ICT." This project aims to use a telecenter in a farming village as an information center and diffuse information on agriculture useful for production/sales activities with the use of ICT to increase the farmers' income/reduce poverty. This project was implemented by Kyushu University jointly with local implementing agencies (Grameen Communications, Bangabandhu Agricultural University, and farmer supporting group).

A grass-roots technical cooperation "JICA Partnership Program" must be directly beneficial to the local residents in the areas which directly contribute to improving the living conditions of the people in the developing country. Therefore, it is necessary to clearly identify local residents' needs and make a system with a track record in Japan meet the local needs. For this reason, it is important to cooperate with organizations and universities familiar with the local situation in implementing the project and a success in the project will depend on the establishment of a relationship with the local organizations. In the above example, the proposing organization had previously established a relationship with local organizations and universities, which was a factor for success.

(10) Solution-type project in small and medium-sized enterprises overseas operation project "JICA's partnership with the Japanese private sector".

A small and medium-sized enterprises overseas operation project is a proposal-type project conducted by using technology which a small and medium-sized enterprise already has. Therefore, there are many visible solution-type projects that cannot be seen in technical cooperation projects. The small and medium-sized enterprises overseas operation support projects "JICA's partnership with the Japanese private sector" began in 2012 and the number of the projects is 217 until 2014. Nine out of 217 projects are ICT utilization projects: four in healthcare, one each in education, water resources/disaster management, transportation, economic policy, and agricultural/rural development. For the outline of each project, see attachment 1.

(11) ICT utilization examples in private-sector technology diffusion promotion project/cooperation preparation survey (BOP business cooperation promotion)

The private-sector technology diffusion promotion project aims to study the applicability of products, technologies, systems, etc. Japanese companies have to development. The project started in 2013 and 56 cases have been selected until now. Seven out of 56 cases were ICT utilization projects: three cases in transportation/traffic (traffic control system, traffic flow simulation, and bus IC card), two cases in agricultural/rural development (remote sensing, and smart agriculture ICT system), and one each in disaster prevention and in urban/regional development.

Also, the cooperation preparation survey (BOP business cooperation promotion) is a project based on the proposal of the companies which are planning to conduct BOP business in developing countries. The survey began in 2010 and 100 cases have already been selected. Seven out of these cases were ICT utilization projects: five cases in distance learning and one each in natural resources/energy and in agricultural/rural

development.

For the outline of each project, see attachment 1.

3.1.2 Analysis of ICT utilization trends of international institutions and bilateral assistance institutions

For details, see Chapter 2. Also, the relationship with JICA projects was described above. In this section, the features and characteristic trends of each agency will be taken up and references will be described. The ICT utilization condition of the agencies is summarized in the table.

Also, these agencies' efforts, which have not been made by JICA, are described below. Their efforts, for example, collection of ideas from the public, cooperation with the private sector, ICT tool useful for assistance, distance learning, and governance are described below.

(1) Collection of ideas from the public

DFID decides project formation without formulating specific policies owing to rapid advances in ICT and a prolonged project period and collects ideas concerning concrete measures in the form of competition. Also, USAID collects new ideas, technologies, and business models from the public in developing countries. Although developing countries are less mature in terms of ICT environment and ICT-related business, they have greater innovation potential than advanced countries.

(2) Introduction of advanced technology in cooperation with the private sector

The World Bank concludes a contract with the private sector such as management consultants and IT companies within the comprehensive framework without defining job roles and responsibilities. The bank has established a system under which the bank can consider the introduction of a new ICT technology, flexibly introduce the technology, and verify the introduction. Also, USAID carries out a business cooperation program (GDA) in which the government and the private sector jointly provide assistance and promotes cooperation with IT-related companies. (The efforts in this section will be described again in 5.1.3 Cooperation with the private sector.)

(3) Development of ICT tool

The World Bank has developed ICT tools to process huge amounts of data. These tools are freely available to the public.

(4) Interdisciplinary utilization of distance learning as a common tool

The Inter-American Development Bank provides remote technical training to engineers in many different areas including mineral resources, energy, and communications. Distance learning technology, which can be used on a cross-sectoral basis, and measures to which approaches can widely be applied are effective in improving project implementation efficiency.

(5) Two-way ICT utilization in the governance area

UNDP has introduced ICT in the form of two-way utilization, aiming at the diffusion of the administrative service. In addition to the provision of online access (e-Service) to the administrative service, UNDP works on the improvement of the environment (e-Participation) so that UNDP can provide information to the administrative agencies. There is possibility that the integration of the approach toward ICT promotion in the administrative agencies with the introduction of ICT service for the citizens may lead to more smooth diffusion and promotion of effective ICT utilization.

Table 3.1.2: The condition of ICT utilization at international institutions and bilateral assistance institutions (1)

Institution	ICT utilization policy	Major area of utilization	Specific examples	Technologies utilized	Notes	Existence of similar cases by JICA
World Bank	Develop activities based on the following three pillars as a center of strategies: *Pillar for change: improving provision and accountability of services between public-private sectors and government agencies, and policies. *Pillar for innovation: provision of fund and know-how for ICT development. *Pillar for coordination: preparation of fund and guarantee for broadband improvement. Characteristics: (1) Comprehensive framework which does not designate private companies and job contents. Invite ideas for utilization. (2) Development of tools (3) Initiatives in big data	Establishment of framework	Introduction and examination of new ICT technologies by coordination (contract) with 14 private companies (management consultant, IT companies). Also implemented consulting, training, and evaluation against the World Bank's PJT.	None	It is not a coordination based on detailed decision on the job contents but a comprehensive framework which aims to respond flexibly as necessary.	None
		Development of tools	Creation and provision of tools to analyze and visualize data which is collected by data collection tool and the World Bank.	Internet Mobile phones Tablet PC SNS	Many tools are provided without a fee.	None
		Governance	e-Rwanda project e-Ghana project Bangladesh State ID system	Internet Tele-center Database IC chips	All of the projects are multilateral assistance from the both aspects of hardware and software, starting from the reform of policies/systems and followed by specific system construction, operational management, and provision of training.	Results exist at single component level
Asian Development Bank	Following three points are proposed as objectives: * Creating environment which enables executions by improving systems * Provision of infrastructure * Human development for ICT literacy and occupational skills Characteristics: (1) Measures which take approaches from the both aspects of software and hardware	Education: distance learning and improvement of education in poorer region	Basic education ICT project (Uzbekistan)	Unknown	All of the projects are multilateral assistance from the both aspects of hardware and software, including provision of ICT equipment to schools, enhancement of the staff's capacity to utilize equipment, and development of education materials.	Results exist at single component level
		Governance: improving efficiency of government services and capacity development related to its introduction	ICT development project (Maldives)	Internet Network infrastructure (optical fiber, ADSL) Data center	Promotion of e-government through the assistance on the side of hardware including improvement of government organization's network environment and establishment of datacenter, and on the side of software including computerization of government operations and sector reforms.	Results exist at single component level
Inter-American Development Bank,	Assistance in infrastructure development and promotion of wide-ranged adoption and utilization of technologies and services. Design and adoption of sufficient regulatory policies	Education (especially distance learning)	* Provision of individually specialized learning environment * Distant technical training for the engineers in the area of mining, oil, energy, and communication * Implementation of a	Unknown		Results of training which utilized ICT exist

	related to competition and adoption for above mentioned measures. Characteristics: (1) Focused on ICT utilization in the areas of education including distance learning and training		pilot project with One Laptop Per Child (OLPC) Foundation			
UNDP	The assistance is mainly related to the states' comprehensive ICT strategies and policies. On the other hand, it implements individual projects based on ICT and assistance for introduction of ICT components at the state level. Especially, it focuses on "poverty reduction by sustainable development", "democratic governance", and "climate change and disaster resilience". Characteristics: (1) Promote ICT utilization in the area of governance (2) Approaches taken simultaneously at the level of government and at the level of general public	Poverty reduction	Enhancement of smallholder farmers' and women's access to the market by market information system and income improvement (Ethiopia)	Toll-free mobile phone calls Regular transmission of SMS Electronic bulletin board system (83 boards were established in rural district in the region) Websites	Joint assistance with Ethiopian government, United States Agency for International Development (USAID), and Swedish International Development Cooperation Agency (Sida), and European Union (EU).	None
		Governance	Policy proposal to the government, capacity building, establishment of access center and provision of contents for the public (Syria)	Unknown		Results exist at single component level
			Provision of online public services (access to administrative services, proposals for the services and filing of claims, and reporting on illegal act and corruption, etc.) (Kenya, Kosovo, India)	Internet Mobile phones		None
			Provision of tools and methods to prevent illegal act and monitoring for civil society organizations (Bolivia, India, Uganda, Zambia)	Unknown		None
		Disaster prevention and environment	Real-time transmission of disaster information (digital images) (Kirgizstan)	Satellite communications system Others unknown	Implement not only provision of ICT-related equipment but also assistance on the aspect of policies including planning for management strategies and introduction of regulations and standards.	Results exist in disaster monitoring systems and resources monitoring systems, etc.
			Monitoring system for the situation of energy consumption and emission of greenhouse gas (Kirgizstan) Monitoring system of climate change and water resources (Uzbekistan)			
DFID	It proposes to utilize ICT towards the following three initiatives: * Establishment and implementation of innovative approach towards poverty	Governance	Establishment of ICT-friendly policies and reform Promotion of ICT-led business (Uzbekistan)	Unknown	Implement capacity building and provision of equipment together with initiatives in the area of policies for low and middle income countries.	Results exist at single component level

	reduction * Policy improvement and coordination with civil society and private sector * Partnership with other donors Characteristics: (1) Creating proposals without the decision on specific measures (2) Invite ideas for utilization from the public (3) Specific approaches * Establishment of universal access * Service provision based according to the region based on existing system * Feasible and realistic ICT utilization * Capacity building	Benefit for BOP	Improvement of electric power and water resources supply services in rural villages in Asia and Africa Effective use of ICT to solve issues of poverty in Asia and Africa	Mobile phones	While both set the amount of contribution and objectives, proposals are created without the decision on specific activities. The former claims that it would invite ideas in the form of competition and aim for the implementation of trials by providing fund for convincing ideas.	None
		Support for assistance-related persons	Assistance for decision making by provision of latest information related to development for assistance-related persons Establishment of democracy and promotion of achievement of MDGs by encouraging utilization of media and communication for assistance-related persons	Unknown		None
USAID	Aims for strategic ICT utilization and propose the following five pillars: 1. Establishment and improvement of policies and regulations in the area of telecommunications 2. Provision of access for the "last mile" group which have insufficient services due to economic and geographic factors 3. Capacity building for organization and individual ICT 4. ICT utilization in USAID's assistance in each area 5. Partnership with other organizations to complement financial and technical resources Characteristics: (1) Focuses especially on promotion of ICT utilization (2) Also works ambitiously on introduction of latest technologies into the area of development; initiatives in big data	Infrastructure Governance	Global Broadband and Innovations Program (GBI)	Unknown	On the side of infrastructure, it aims to solve digital divide by establishing universal broadband infrastructure. At the same time, this assistance program ranges widely from assistance in laws and regulations, to provision of ICT training, promotion of information provision by the government, environmental consideration by utilizing sustainable energy, and promotion of ICT utilization by coordination with other projects.	Results exist at single component level
		Agricultural village development	Income improvement through provision of agricultural products information and fair market value for small-scale farmers. (India)	Mobile phones (SNS)	All the projects aim to benefit directly to rural districts in the region and BOP by utilizing mobile phones.	None
		Finance	Provision of financial data management services for small-scale enterprise managers. Provision of credit evaluation and loan management services for financers. (India)	Mobile phones (SNS)		None
		Healthcare	Provision of health education for mothers Collection of healthcare data (India)	Mobile phones		None
			Centralization of supply chains of	Data analysis	Introduction of an approach which	None

	(3) Invites ideas for utilization from the public in developing countries		projects related to the supply, purchase, and distribution by USAID health sector by data utilization. Detection of threat and prompt and efficient solution of the threat by data utilization.		utilize data (big data, etc.) which attracts attention recently into development.	
		Industrial development	Provision of network which connects employers and job-seekers and entrepreneurs by constructing communication platform (Egypt)	Unknown	Tries to enable sharing and exchange of information by construction and provision of network, and to effectively utilize resources including information and human resources.	None
		Public-private partnerships	Global Development Alliances (GDA)	Unknown	Cooperate with private companies from the phase of project identification and collaborate with them in a form that they share necessary resources, results, and damages in implementation of projects. Participants in this project include many large US IT companies such as Intel, Microsoft, and Cisco Systems.	Public-private partnerships program was implemented
		Invitation and utilization of innovative ideas	Examples in the areas including education, healthcare, agriculture, business, and environment	Internet	An effort to invite solutions utilizing ICT on the Internet. It provides money reward for innovative ideas and assistance towards their realization.	None
ITU-D	Aims for the development of telecommunications technologies in developing countries and implement the following activities: * Improvement of telecommunication networks * Technical assistance * Development and operation of services <u>Characteristics:</u> (1) Categorizes areas of activities according to the area of ICT (2) Area of activities * Technologies and network development Capacity building * Rules ad market environment * Server security * ICT application * Emergency communications * Least developed countries and small island developing countries * Spectrum management and digital	Healthcare (Categories are major areas in ICT applications)	Telemedicine	Internet Satellite communications	In addition to remote diagnosis utilizing images on PC, digital cameras and digital electrocardiogram, it implements remote consultation and video distribution of lectures for healthcare providers.	None
			mHealth	Mobile phones Mobile applications	It implements provision and reminding on mother and child-related information via SMS and development and provision of mobile applications. Among them, there are cases which utilize attached cameras for remote diagnosis.	None
			Global health project repository		An effort to expand activities further by registering and publishing examples of grassroots activities and corporate activities in the past.	None
		Emergency communication	Early warning system of natural disasters (flooding and landslide disasters) (Uganda)	Water level sensor Automatic siren	A system to measure water level automatically using sensors which would sound warning sirens	Result exist in the introduction of disaster monitoring

				Computers	in case the water rises beyond a certain level and let the residents evacuate. The sensor and the sirens are always monitored at the control center.	systems
			Demonstration experiment on the disaster emergency recovery system of communication (Philippines)	Mobile ICT unit	Cooperation project with Ministry of Internal Affairs and Communications and ITU-D. Realize communication by mobile unit which are on-board type or attaché case type.	None

Source: prepared by a research group using materials of various organizations.

3.2. Priority issues

3.2.1 Issues for each job process

(1) Clarification of the positioning of JICA's planning document

(a) JICA's mid-term plan

JICA sets a mid-term plan for the period of five years as independent administrative agency and the latest plan is the Third Mid-Term Objectives (from April 2012 to March 2017). Along with these mid-term objectives, they have a mid-term plan which has evolved into the current Third Mid-Term Plan (March 2015 version).

Although the term "ICT" itself is not used in JICA's mid-term objectives and the mid-term plan, they recognize the transformation of the world by ICT as represented by the idea of "today's international society in which globalization has advanced and in which barriers of national borders are low".

As an initiative towards implementation of strategic projects, the mid-term plan states that "it tries to improve approaches, methods, and processes to implement projects flexibly, without limiting to existing methods of assistance". The plan states that it will form and implement high quality projects based on the viewpoint of human security by carrying out such measures, with the following points as focus areas:

- Poverty reduction (contribution to the achievement of the MDGs)
- Sustainable economic development
- Response to global issues
- Peacebuilding
- Enhancement of strategic characteristic of projects and improvement in project management

As described above, they recognize the transformation of international society; however, they do not mention specific utilization and proactive incorporation of ICT. This plan is an important document which is referred in the effort taken in each development issue and it is necessary to clarify the positioning of utilization and proactive incorporation of ICT in the development of the next (forth) mid-term plan.

(b) JICA's country analysis papers (JICA Country Analytical Work)

JICA's country analysis papers (JICA Country Analysis Paper, JCAP) are the reports which analyze each country from the standpoint of development and they are prepared

with an intention to utilize in examination and implementation of effective cooperation for each country as a development assistance organization. While the Japanese government examines comprehensively including the perspectives of foreign policies and develops assistance policies such as “Country Assistance Policies”, these papers provide information from the aspect of development for the assistance measures by the Japanese government. Therefore, as information in JCAP affects the development of “cooperation program” for each country, it is desirable to specify the positioning about utilization of ICT.

(c) Thematic Guideline on “Information and Communication Technology”

Thematic Guideline on “Information and Communication Technology” is a guideline on the area which should be focused in the area of ICT and the March 2012 version is the latest one. As new trends must be incorporated to meet the needs of the times, an idea to reorganize this guideline with a focus on sub-targets is proposed in the Chapter 4 below.

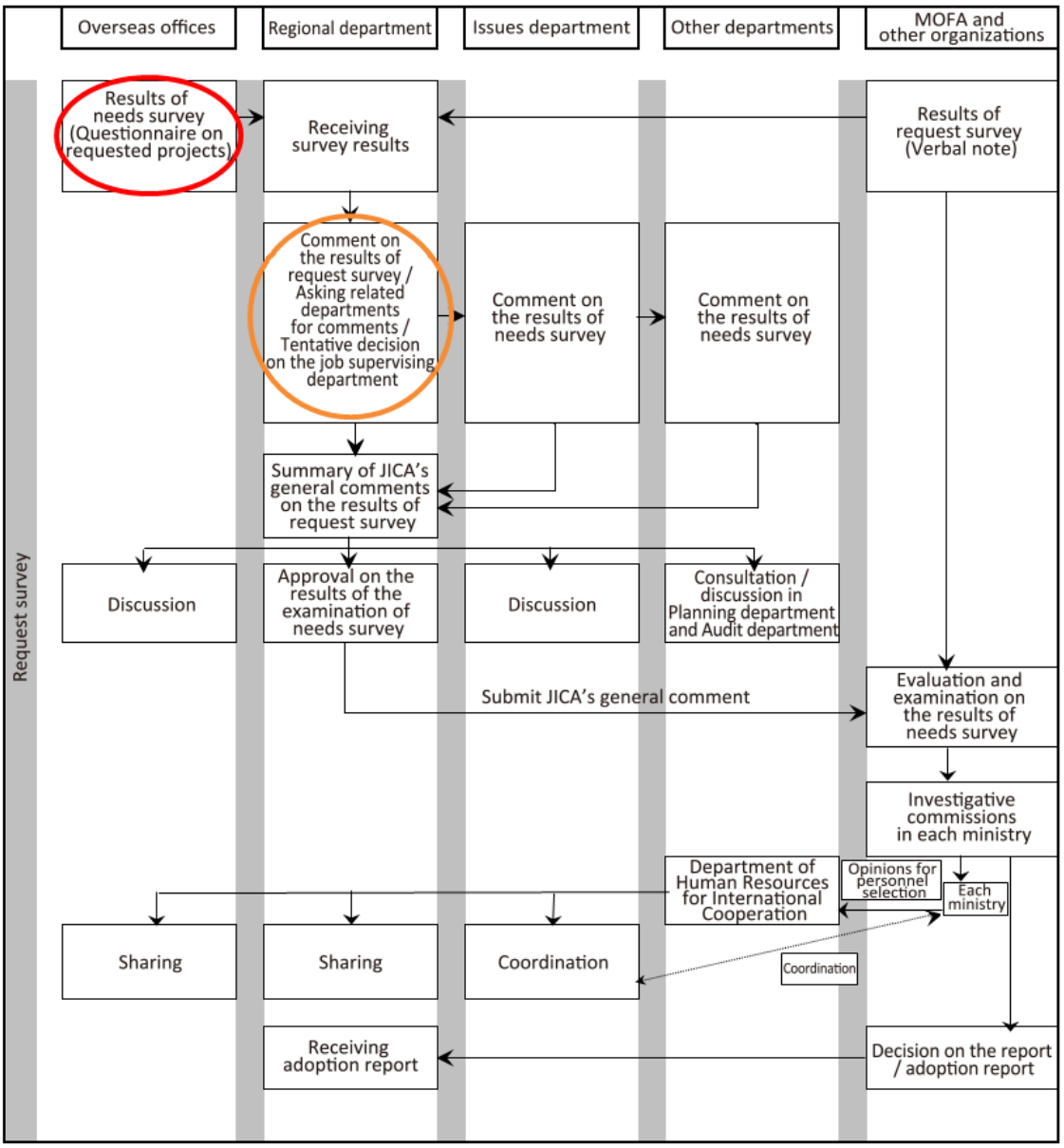
(2) Incorporation and setting flags of ICT utilization from the time of project formation

Regarding the process from requesting to selection of projects, priority areas are decided by Country Assistance Policies (Ministry of Foreign Affairs) and cooperation program for each country (JICA) and the area of ICT does not come to the fore in most cases except for a few countries such as Rwanda, Bangladesh, and Fiji.

However, as shown in 3.1.1(2), the categorization of “ICT projects” and “non-ICT projects” has already become meaningless practically, and it has become important that that to what extent ICT can be utilized and what kind of output and further improvement in outcome can be expected by that utilization. Therefore, in order to utilize ICT, it is necessary to proactively examine the incorporation of ICT utilization tools from the time of project formation and to understand the cases and referent within JICA for overseas office staff members and the people related to ODA task forces to refer to regarding the utilization method, etc.

On the other hand, as mentioned in 3.1.1(2), in order to promote ICT utilization, it is necessary to understand the condition of ICT utilization more clearly. Therefore, it needs to make it a rule to always “set a flag for Information and Communication Technology” for any “ICT project” which utilize ICT. In that case, it is optimal to set a flag in the phase of “results or the Request Survey”, for example, in case of a technical cooperation which is requested by Request Survey, however, the phase in which each regional division conducts screening of “results or the Request Survey” is more important.

Figure 3.2.1 shows the flow of jobs before selection related to a technical cooperation project in case it is requested by Request Survey. The parts indicated with circles are the check points described above.



*Requests are submitted any time.
*Adoption is conducted according to the above described flow even if the adoption takes place in the middle of the year.

Figure 3.2.1: Flow of jobs before selection of a technical cooperation project (in case it is requested by Needs Survey)

(3) Clarification of the merit of /incentives from ICT utilization

As the method and the merit of ICT utilization is not understood by the government of the recipient country at the time of formation of a technical cooperation project, it is often not incorporated in PDM and not listed in the "inputs". As a result, development of ICT utilization (for example, development of new solutions and re-consignment in the recipient country leaves uncertainty for the delivery date, cost, and the quality of the product and would be a risk) which is uncertain tends to be avoided also in the implementation phase. Furthermore, it is uncertain if ICT utilization can reduce the cost

or not.

Therefore, the merit of ICT utilization (cost reduction, saving time, expansion of spillover effect, improvement in efficiency, and increase of beneficiaries, etc.) shall be specified by the side of JICA for the government of a developing country. It is necessary to clarify and share the merit of the tool which can certainly produce results in the Repository (as described below), and utilize it proactively.

In addition, at the time of utilization of ICT which is considered uncertain, it needs environment and scheme to utilize it as a trial.

(4) Concatenation of utilization levels

Currently, ICT is actively utilized up to the level of social media, the Internet, and commercial software (including non-conventional ones). Even in the projects which utilize GIS and database, they are only used for creation, storage and reuse of data and utilization is limited within the application. On the other hand, there are a few projects which provide unique job solutions. Today, there are not many projects between these two levels (Figure 3.2.2). Such projects include construction of various unique database, introduction of hypocenter-determination software, audit system for central banks (BOX4: Project to improve the capacity of the banks in Mongolia p.20), and localization of existing software. For example, specific custom-made solutions including information collection and management, account processing, asset management, paperwork have been introduced for small and medium-sized projects; however, the share of such projects is small compared to the total number of projects. On the contrary, there are many cases in which ICT is not utilized even in the projects of similar size.

If ICT utilization is utilized in such projects, the range of ICT utilization should be expanded and the “discontinued” part should be filled. In order to achieve this, using the cases described in 3.1.1(4) and (5), which were successful and which provide lessons to be learned, should be considered as reference. In addition, it is important not only to regard ICT as an assistance tool to improve job efficiency but also to proactively utilize the strength of ICT in “visualization and quantification” such as improvement in the level of understanding on job process, standardization of job processing, and visualization of progress in development. As standardization of new sales process by introduction of POS and clarification of accounting process by introduction of ERP have been experienced also in Japan, for example, it is expected that the number of new cases of ICT utilization would increase by capturing ICT in such perspective.

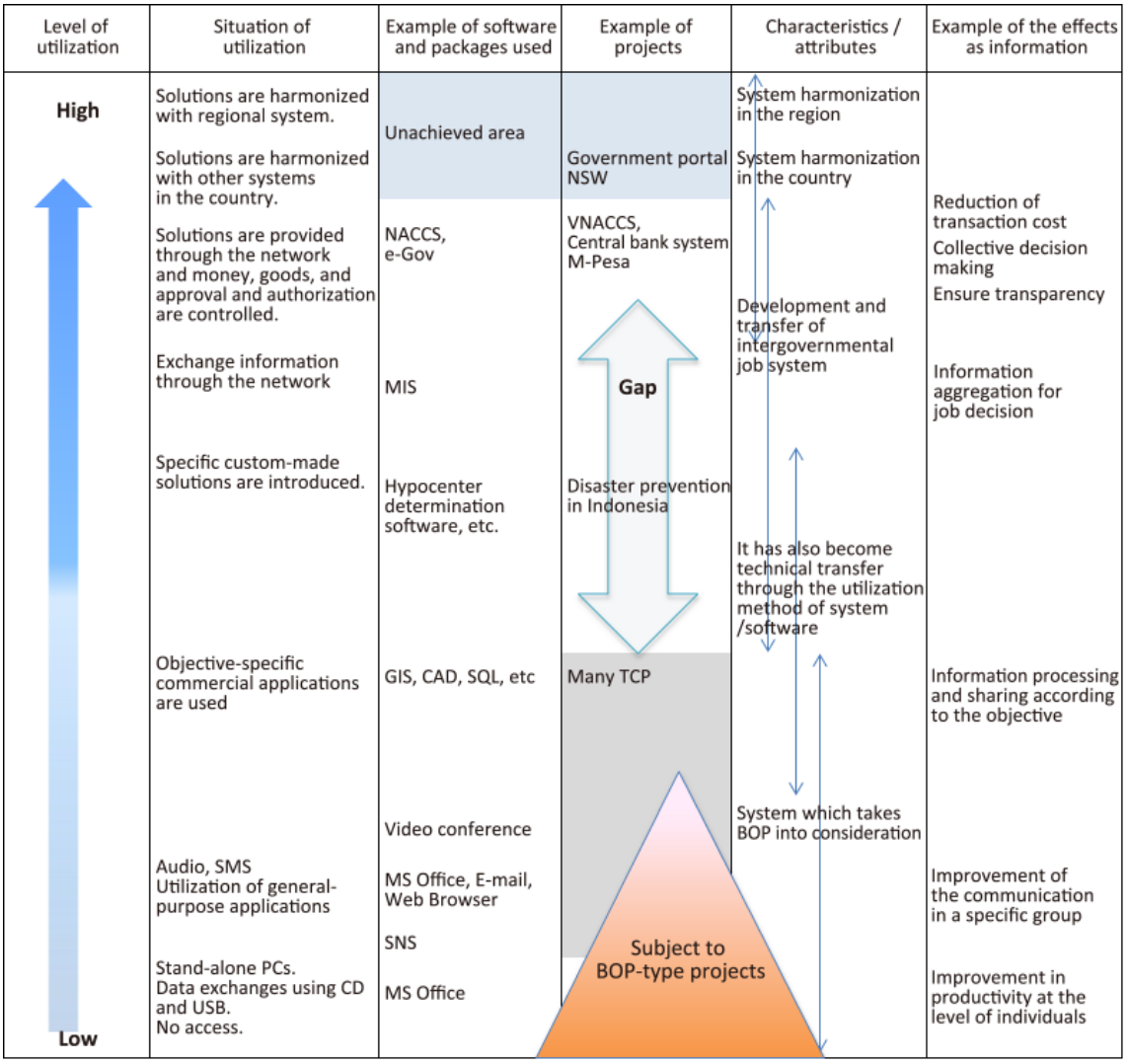


Figure 3.2.2: Classification of the levels of ICT utilization

(5) Examination of procurement method of subject ICT technologies

Software and hardware are closely connected in many ICT solutions. Rather, software account for the most part of current ICT solutions, and equipment procurement which only assumes procurement of hardware and existing software is not relevant in some aspects. For example, the method to add up the workload (man-month and lead time, etc.) which accompanies new development has not really been formulated.

In JICA's technical cooperation, procurement is centered on human resources and it is done by re-consignment (Figure 3.2.3, No. 3) or by separate equipment procurement (Figure 3.2.3, No. 4) of the equipment (hardware) which would be necessary.

On the other hand, there are projects which collaborate with technical cooperation, grant aid, and loan assistance by managing schemes flexibly in response to development issues which provide ICT solutions (Figure 3.2.3).

Number	Loan assistance		Grant Aid Capital Assistance		Technical cooperation	Note
1	Loan assistance	&			Associated technical cooperation project, etc.	Suitable for large-scale projects. Independence for loan assistance (LA) and technical cooperation projects (TCP). As LA is an untied aid, coordination with TCP is difficult. Specifications and procurement of LA are designated by partner country's government.
2			Grant Aid Capital Assistance	&	Technical cooperation projects	Able to conduct technical cooperation in cooperation with grant aid (GA). Coordination with GA and TCP is possible and they have complementarity. Specifications of GA are designated by JICA.
3					Technical cooperation projects (Including Re-consignment)	Many of the projects are general and small-scale ones. Especially, development survey projects. Specifications and procurement of TCP are designated by JICA. Among them, utilization method of ICT technologies is mainly designated by the contractor of TCP
4					Technical cooperation projects & Equipment procurement (with/without specified brand)	Both TCP and equipment procurement are designated by JICA. Therefore, many of specifications for ICT equipment procurement will be the ones with established industry standards. Equipment must be the ones which can be comfortably used by TCP contractors.

Figure 3.2.3: Example of combination of assistance schemes

Therefore, in the ICT utilization in the future, flexible selection and input of schemes shall be examined towards solution of development issues. Especially, it is necessary to organize cases, conditions and ranges of the combination of technical cooperation and financial cooperation (loan assistance and grant aid).

While it is related to the level of utilization, when JICA specifies utilization technology, it is often used as a de facto standard. When it is not specified, it is often selected by the contractor (consultants, etc.) (Figure 3.2.3). When contractors select the technologies, they often introduce general-purpose technologies which has been already established in Japan and it tends to be difficult to incorporate new technologies.

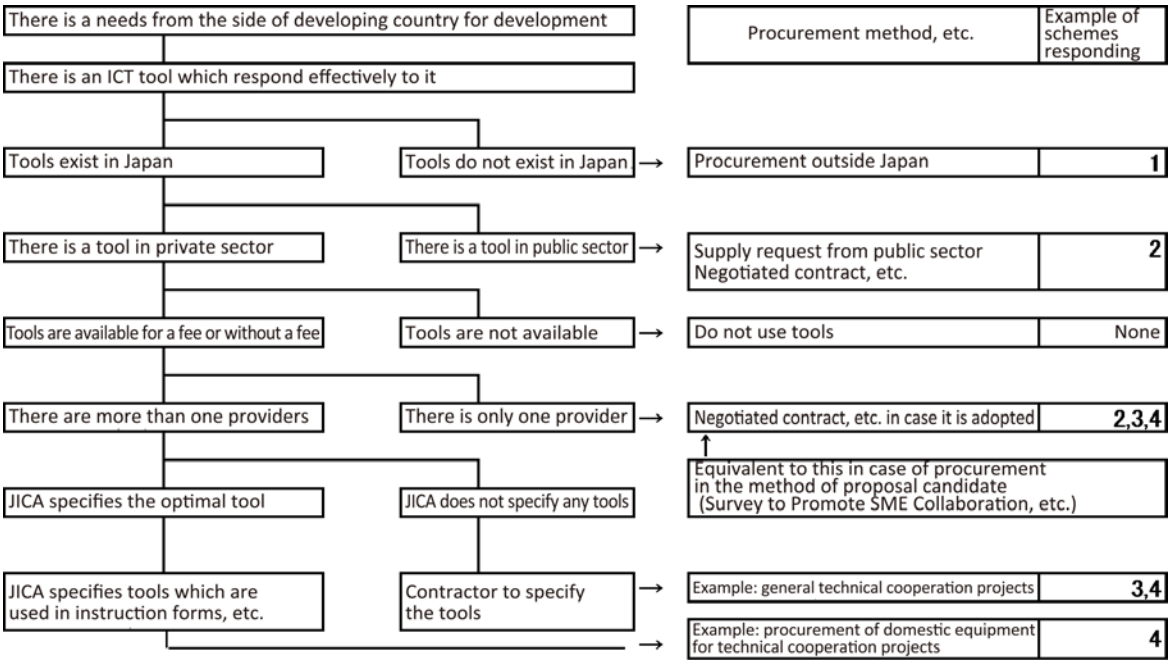


Figure 3.2.4: Flow from request to procurement method

However, in order for JICA to utilize technologies of higher levels than that of general-purpose technologies, we believe that JICA is allowed to specify or designate utilization technology proactively. Many of such utilization technologies may be new and they are often excluded in the selection in case their track records are poor.

For example, they indicate things which are treated as de facto standard in each area in some cases, in the form of reference brand or specified brand such as meteorological observatory equipment and flight simulator. In addition, when ICT technology of Japanese private sector can be applied to development issues well enough and when there are no other similar technologies available, proactive use of procurement by negotiated contract can be considered.

On the other hand, there are cases that utilization in developing countries rather than in Japan will be more realistic, including the case which is proved by privately coordinated projects. By proactively adopting these technologies, various merits including further production of development results and establishment of approaches which are unique to Japan can be expected.

(6) Cross cutting-sectoral ICT utilization

There are cases of development assistance which connect different sectors by ICT utilization. For example, in a case of a project to support overseas operations of SMEs, “the system that expect improvement of added value of agricultural product by recording cultivation history of agricultural products by producers in a form of electronic data, and by providing information to distributors, retail-related persons, and consumers, using the Internet” connects agriculture and distribution. As ICT may be able to form projects which can generate added value by playing the role of connector of different sectors in developing countries, though small in size, without waiting for

each sector to become mature and connect each other, it is necessary to consider proactive utilization of such cases when they have possibilities to pursue production of results which are not bound by certain sectors.

(7) Utilization of the results of SATREPS, F/S to support SMEs, F/S for cooperation (promotion of coordination of BOP businesses), and projects to promote diffusion of commercial technologies

In SATREPS and the F/S to support SMEs, F/S for cooperation (promotion of coordination of BOP businesses), project to promote diffusion of commercial technologies which are cooperation project with private companies, there have been very interesting cases of ICT utilization. As SATREPS is an application and development of technologies which are already held by SMEs in developing countries, it can be described as "supply-driven" in which ICT technologies utilized is clearly specified. Also, as F/S for cooperation (promotion of coordination of BOP businesses) suggests specific proposal of project for commercialization of BOP businesses which contribute to solve social and economic problems held by the base of the pyramid (BOP) and projects to promote diffusion of commercial technologies aim to utilize private companies' specific products, technologies know-how, and systems for social and economic development in developing countries, ICT solutions which private companies have and in which they have strength are clearly proposed. On the other hand, general technical cooperation is started by the request from developing countries' governments and it can be described as "demand-driven".

The technologies used in SATREPS, F/S to support SMEs, F/S for cooperation (promotion of coordination of BOP businesses), and projects to promote diffusion of commercial technologies have high technological strength from the beginning and they are often owned by specific companies. While use of such technologies is desirable when it is reasonable to utilize them according to the purpose of the technical cooperation; however, in general technical cooperation, such technologies which are highly exclusive from the beginning are not adopted very often.

Therefore, it is considered desirable to think about technical cooperation based on those first accepting organization and promote requests, if the technologies used in SATREPS, F/S to support SMEs, F/S for cooperation (promotion of coordination of BOP businesses), and projects to promote diffusion of commercial technologies will be required in the same country even after that.

Many of implementing organizations are government agencies and public corporations and they know its effectiveness better than any other organizations. The types of technical cooperation subject to requests are not limited to technical cooperation projects for domestic dissemination in the requesting country and training under South-South cooperation can be included.

In case of F/S to support SMEs, F/S for cooperation (promotion of coordination of BOP businesses), and projects to promote diffusion of commercial technologies, it is necessary to find sponsors for dissemination including private sector, as it is assumed that confirmation of the feasibility does not bring continuous business for the subject

companies in some cases.

As JICA's effort in this area in the future, adoption of projects that include underlying technology which can be developed in technical cooperation projects after completion of F/S by inviting proposals from private sector which go along with development issues can be considered. Currently, encouragement of preparation of request form from C/P is assumed in order to develop it in case the feasibility is confirmed, as a study on making it into an ODA project itself is included in the survey.

(8) Project formation as Forerunner of Emerging Issues

To make Japan's strength effective, we should set challenges to advance formation of projects which utilize knowledge as Forerunner of Emerging Issues.

Forerunner of Emerging Issues can be described as a country which cannot refer to other countries' models on the problems it faces today, and a country which would be referred to as a model later when other countries face similar problems, in regard with the way it coped with their challenges. Japan has accumulated a plenty and wide variety of experience and knowledge which would contribute to development assistance for developing countries.

The term "Forerunner of Emerging Issues" has emerged recently and it can be said that Japan has been the Forerunner of Emerging Issues for the past few decades, while the issues have changed, as Japan has a historical background that it has become a developed country in a short period of time. Issues include aging society with a falling birth rate, global warming, and disaster prevention and reduction typically, and other issues include urban concentration, traffic congestion, safety and health, protection and assistance for vulnerable people, infrastructure obsolescence, regional depopulation, and energy conservation. Japan is also a forerunner in solving emerging issues as it has a variety of solutions on those issues. ICT utilization is necessary to solve those issues.

Those accumulated knowledge has been utilized naturally in JICA's assistance projects in the past, we propose initiatives to proactively utilize knowledge as Forerunner of Emerging Issues further in project formation:

(a) Modeling and packaging using cases as reference

The basic principles of Development Cooperation Charter[34] describe that "It will also go beyond waiting for requests from partner countries by… proactively presenting proposals". While project formation assumes requests from partner countries, it promotes indication of knowledge it has as Forerunner of Emerging Issues in a way which is easy to understand and submission of proposals more specifically including the merits of the projects in the conversation and cooperation with various bodies such as governments of developing countries and regional organizations. To this end, it takes the initiatives to solve problems into a model using the past cases as reference, use them in the conversation with partner countries and conduct relevant project formation, coordinating understanding on the both sides. It is important to respond flexibly by preparing several solutions for the issues, taking the partner country's situation into consideration. Also, by combining initiatives in capacity development such as operation

management and information security in addition to modeling of projects, more consistent and packaged projects can be formed. By modeling and packaging in each area of issues based on those cases, we believe we would be able to form and indicate Japan's strength in each area of issues.

Also, transferring information on Japan's preceding issues and solutions by this effort, it can promote voluntary initiatives to solve the partner country's problems.

(b) Reference examples for modeling

In project formation, it is not realistic to form a large-scale project suddenly but to start from forming individual and relatively small-scale projects. In this viewpoint, which can be used as reference in developing countries for above-mentioned modeling are comparatively low-end models. Japan has many examples of problem-solving including disaster prevention, energy conservation, healthcare, transportation, agriculture, education, and infrastructure-maintenance, which would be effective in development in developing countries. Also, project to promote regional computerization advanced by Ministry of Internal Affairs and Communications currently aims for promotion of dissemination of ICT utilization and this case would be used as a reference in modeling. Furthermore, as it will be mentioned in "5.1.2 Coordination with domestic research institutes" and "5.1.3 Coordination with private companies", knowledge and advanced effort of research institutes and private sector should be used as reference.

Among JICA's examples, the case of "Seismic Risk Assessment and Risk Management Planning Project (Armenia)" which is based on the lessons learned from the Great East Japan Earthquake can be used as reference. This project is a case which is based on the lessons on the "importance of education on disaster-prevention awareness in everyday life". This project can be described as a result of modeling including the lessons learned in the Great East Japan Earthquake and project formation along with the actual situation in developing countries.

Also, as an example of promotion project for regional computerization, there is a "project on high-level use of integrated GIS" in Urayasu City, Chiba. This project constructs "spatial information system" in which one can enter information such as opinions and requests from citizens to the administration easily on GIS from mobile phones and PCs and also superimpose geographic information related to collected opinions and requests from the citizens with existing information and analyzes them. It is difficult to adapt this case in a developing country as it is; however, it indicates "interactive administrative services with citizens using ICT" in the area of governance and modeling such as "creation of hazard maps by citizen's participation" in the area of disaster prevention, and further indicates modeling of cross-sectional ICT utilization in the sectors of governance and disaster prevention

As such, we believe that organization of lessens and suggestions learned from the cases, in addition to specific method of ICT utilization, would be the key in modeling.

BOX 9 below is an example of Japan playing the proactive role as Forerunner of Emerging Issues.

34 Ministry of Foreign Affairs of Japan. Website of Ministry of Foreign Affairs. “Development Cooperation Charter. -For peace, prosperity and a better future for everyone-”. http://www.mofa.go.jp/mofaj/gaiko/oda/files/000072774.pdf.

35 It includes programs that take advantage of regional characteristics and participation of regional people in making programs. FM radio station which utilizes radio waves of Very High Frequency Omnidirectional Radio Range (VHF).

BOX 9 Lesson left by the Great Eastern Japan Earthquake - What other countries can learn from this?

Responding to the Great Eastern Japan Earthquake, the Japanese government and the World Bank launched a project called "Learning from Mega Disasters" to extract knowledges of the disaster prevention sector in Japan and share them with the world. This project collects and analyses information, data, estimations concerning the Great East Japan Earthquake accumulated by academic and research institutions, nongovernmental organizations (NGO), governmental organizations, and private sectors to help the other countries suffering from disasters by sharing the lessens which Japan has learned from this earthquake disaster. It is expected that, through this project, each countries preferentially address disaster prevention in their development policies and development plans to mainstream disaster prevention.

Sharing experiences with developing countries in the world can be prepared for large-scale disasters by introducing the countermeasures against disaster took in Japan while modifying them as needed, and by understanding the issues clarified from this disaster in Japan.

"Learning from Mega Disasters"

This project intend to provide information through data, analysis, considerations, printed matters, symposiums, online (e-learning, etc.), seminars on the Global Development Learning Network, and dedicated Community of Practice (online knowledge-sharing site) and to support the capacity building of decision-makers of developing countries government and those who participate in development. Necessary materials for those involved and for experts to acquire and practice knowledge of disaster prevention are published online in a searchable form by specialties and difficulty level. In addition, further enhancement is expected by incorporating experiences and ideas of practitioners around the world.

In the first stage of the project, 32 Knowledge Notes (KN) compiled in 6 groups by subject were prepared:

1. Measures for structural objects

2. Measures for non-structural objects
3. Emergency response
4. Reconstruction plan
5. Hazard map, risk information, and decision making
6. Economy and economy policy for disaster and its prevention

The Knowledge Notes of disaster and disaster prevention economy, and of finance analyze and summarize what were the problems and why, and suggest the actions to take to vulnerable developing countries with high disaster risk. The Knowledge Notes also provides the basis for sharing and exchanging knowledges with experts and practitioners. 32 Knowledge Notes are published on: http://wbi.worldbank.org/wbi/megadisasters

(Source：extract from *Lessons from the Great East Japan Earthquake*, Japanese government and the World Bank joint research 2012)

3.2.2. Issues on project implementation

(1) Ensuring of Cyber Security

(a) Improvement of Cyber Security through projects

Circumstances surrounding the cyber security[36] are changing rapidly. Risks are becoming enormous, diffuse, and global level. It is necessary to deal with cyber security not only in developed countries, but also in Developing countries. Especially in developing countries, there is vulnerability in security, as management of CCTLD (country code Top Level Domain[37]) or CSIRT (Computer Security Incident Response Team) is weak or non-existent, and it is difficult for developing countries to protect by themselves. Even in governmental organizations, there are many cases where website was easily taken over or system was down.

Further, this is an era when vulnerability in security of developing countries is becoming threat for developed countries. The "Cyber attacks" against nations and important infrastructures become real, thus it is today a major task for national governments to ensure the "cyber security". In particular, this is a era when everything faces cyber security risk according to the development of IoT.

In the projects of JICA, there are two cases related directly to the cyber security as follows. One is the "information security capacity building project" (From July 2014 to January 2017). This is to construct ISMS introduction support system for governmental institutions to improve implementation capacity of information security measures by Ministry of Information and Communication of Indonesia The other is the "capacity building project in land information system security management for the "promotion of land restitution (Columbia)" (From July 2014 to January 2017). Foreign institutions, for example, ITU-D has set "cyber security" as one of activities area and is proceeding it. The both are structural projects of national CIRT and Governmental CIRT, and they have already many achievements (17 projects). It is

considered that with JICA, the cases of project formation will increase in the sectoral issues such as governance, transportation, urban development, and private sectors.

36 The traditional term "information security" shall be unified to "cyber security". However, the word "information security" may be left in the case of a proper noun or a document in a quotation. It means a protective act against cyberattacks, and means ensuring the security of a computer or a network.

37 ccTLD is a top level domain assigned to a nation or a region. This includes ".jp" of Japan or ".tz" of Tanzania.

(b) Cyber security in individual projects

In the projects, ensuring cyber security is a urgent issue, because if security is not ensured, not only utilization of tools or success and failure of the project, but the national administration system may be compromised.

Security guidelines should be established in individual projects, and their compliance shall be essential. Further, a security officer will be placed in the project to clarify who is responsible. On the other hand, the convenience may be reduced if the security is set too high, thus, in each project, it is preferable to keep the standard of recipient government/implementing agency, and in the case where standard doesn't exist or fall short, the standard of JICA shall be applied and then checked by JICA.

(2) Clarification of database utilization standard

Database is a ICT technology used in many projects. The dimension of database varies, and some forms national network and other is used on a single PC.

Which type of database system shall be used depend on the decision by each project. Also, many database is providing client including mobile through network as a server. Although applications are customized at the project level in some cases, basically, storing and reusing of data are main. Moreover, as a database includes large amounts of information (personal information and national information), the impact is significant in the case of information leak. Therefore, it is important to choose an optimal system configuration (particularly database management system) while strictly dealing with security. Also, maintenance, especially update, may be difficult after the completion of project if a major customize is done. Therefore, the choice of system needs to be made after considering maintainability.

It is not necessary to unify Data formats to those of JICA, but the priority shall be given to circumstance and specification of recipient government.

Though various "databases" are built in diverse projects, each of them is on a different application, and it is not always clear if they meet certain standard (security, usability, speed, scalability, etc.). It would be better to sort out in JICA, the points of attention regarding database construction and applications to use than entrusting only to the project decision. The points of attention in particular are as follows:

- Security
- Maintenance
- Dimension and capacity required
- Choice of Database management system

38 Japanese satellite positioning system composed mainly by a satellite of quasi-zenith orbit. English name: "QZSS(Quasi-Zenith Satellite System". The system and the satellite are nicknamed "Michibiki". It can provide a high-precision satellite positioning service.

39 an indoor positioning system with lo-power and low cost communication protocols and technologies. It is not an intercommunication but an one way communication. It uses as receiver, terminals compatible with Bluetooth Low Energy, and can realize an input detection in a specific area or measure distance from a specific point.

40 indoor positioning system that can acquire positional information by receiving non-audible sound (inaudible sound to human ears) with a built-in microphone of smartphone.

(3) Active promotion of GIS

As mentioned in Chapter 2, GIS is a widespread ICT element technology serving as a platform of geographical information in each country, and which should be actively promoted. In addition, besides the Arc GIS which once was de facto standard, open source softwares are increasingly being distributed today. As for future GIS, the mainstream is expected to be those which offer data from server, looked or edited on client-side.

At the present time, GIS system requires high processing capacity of the hardware side (basically on PC level), and expected to be used more widely according to capacity improvement of hardware and speed improvement of network.

However, analytical tools or other tools may be added to GIS applications with add on, the application by itself shall not be applied after writing over at the project level. Similar to database, concerning utilization of GIS through network, it is important to correspond strictly for security, considering information security.

As well as database, data format need to be in conformity with international standard format. In addition, it is necessary that created data can be shared and distributed in JICA

Moreover, related to GIS, positioning technology has been developed in various ways in Japan. Besides the data from traditional GPS satellite, those by quasi-zenith satellite system[38], iBeacon[39], non-audible sound[40], and Wi-Fi have been realized. Therefore, positioning data can be captured today, from outdoor static information to interior of dynamic data. Though certain errors may occur with GPS, it is recommended to introduce and utilize those positioning technologies under conditions demanding more accurate date.

(4) System construction premised on mobiles

As it stands now, mobile is spreading rapidly in developing countries, and widely

used in business. In Japan, it is considered that PC is for business and mobile is for private area, however, in developing countries, mobile is also largely used for business. Thus, systems need to be built assuming mobile is used as terminal.

It is necessary to recognize mobile as a important terminal tool of ICT, and promote the utilization. In addition, actively using web-based solutions without depending on OS of terminal and applications lead to construction of system with high convenience.

Moreover, it is also possible to utilize sensors, positional information, or images (still images and videos) by linking mobile built-in function. In addition, it is possible to provide informations by push.

(5) Open Data

The situation of JICA and foreign institutions are as mentioned in 3.1.1(4)(p.47). In Japan, by promoting the utilization of open data as public data, improvement of transparency and reliability of administration, promotion of public participation and public-private cooperation, and evolution of economic revitalization and efficient administration are expected. Actually, national and local governments in Japan have already started to offer and use open data. From now on, it is expected that utilization of open date will gradually penetrate in developing countries. However, there are diverse issues such as motivation of data providers, development of rules concerning disclosure and utilization of data, operational responsibility, and costs. The approaches should be considered while taking account of these issues and needs of developing countries, as well as development trends of open data utilization. This survey is trying to organize from the point of view of project implementation, and the entire approaches of JICA concerning open data is not considered in this survey.

BOX 10 Rise of Open Data

The Global Facility for Disaster Reduction and Recovery (GFDRR) and the World Bank established Open Data for Resilience Initiative (Open DRI) in 2011 to foster and accelerate movements of Open Data for climate and disaster resilience. Under this initiative, more thas 20 countries have published more than 1,300 data set of Geospatial Information by using web-based Geospatial Information platform on (Geo Node), and promoting the community mapping of buildings and infrastructures.

The promotion of Open Street Map in Sri Lanka is a typical example of government-led and spontaneous Geospatial Information initiative. More than 30,000 buildings have been mapped in two month thorough a larger range of risk identification program.

(Source：Policy Note 2014, "Understanding Risk in an Evolving World" Global Facility for Disaster Reduction and Recovery (GFDRR))

(6) Response to the trend of Open Source Software

While Open Source Softwares(OSS) were not been used much in JICA projects as mentioned in 3.1.1(5)(p.47), considering the worldwide trend, it is expected that OSSs will be used in many project from now on. Especially, regarding advanced technologies such as cloud, IoT, and big data, development through OSS has become the mainstream. New technologies are openly developed (open innovation) by various engineers, and they are said to be developed earlier than commercial softwares. It is important too see the trend where leading global IT companies which were developing commercial softwares until now, or emerging IT companies, are investing significantry in development of open source software. In view of these trend, developing countries would take a great interest not only in anti-piracy or cost measure, but also in open source softwares. In this context, it is considered that paying attention to trends, JICA also needs to keep an eye on the utilization of open source software in the future ICT utilization.

(7) Overview about maintenance costs

As mentioned in 3.1.1(7), there are quite a few cases which couldn't be sustainable due to a budget shortfall in maintenance of systems such as software, database, or IT network. The sustainability may be reduced if mid-size or larger system is introduced and that the implementing agency cannot bear the maintenance cost. For this reason, sometimes, it is difficult to judge if they should introduce Japanese ICT technology. For example, it has been analyzed that the maintenance cost needed after software development in Japan was, from the first year to 6 years later, 11% - 16% of initial cost every year[41].As for hardwares, while maintenance fee tends to decrease overtime, it is unlikely to become extremely low when the maintenance of software is performed by SE, considering labor cost.

For this reason, when introducing a ICT solution, it is necessary to confirm the understanding of recipient government and the method of sharing burden concerning maintenance costs. Besides, it is necessary to guarantee the sustainability to reduce the burden by increasing the proportion of local maintenance as much as possible, introducing BOT method, or prolonging maintenance warranty period than standard, etc.

41 Japan Users Association of Information Systems. Investigation report about software development management standards (Software Metrics investigation) (PDF). p.163.

3.3. Outlook

World Development Report 2016 (BOX5 p.28) schedules "Digital Dividends", and it assumes that the share of developing countries in the Internet economy will increase from 30% in 2010 to 50% in 2025. In the world of ICT, 10 years represent a long period, and a totally new trend may be arise, however, the future assumable at present time shall be considered in this report.

This paragraph, first, have a view of technology development of ICT, and each developing countries of 10 years out, and next, of utilization methods with the above-mentioned issues will be indicated, by 4 individual trends mentioned in 2.1.2 (mobile, cloud, IoT, big data, 3D printing).

3.3.1. World of 2025

(1) Technological development of ICT

ICT Growth Strategy Conference of the Ministry of Internal Affairs and Communications announced "ICT Growth Strategy" in June 2013, and fixed "Become the most active country in the world -economic growth and contribution to the international society by ICT" as its mission to implement "nationalization and comprehensive promotion of projects" under following 3 visions: ①creation of new added value industries, ②solution of social issues, ③ sophistication and enhancement of ICT infrastructure.

By those measures, it is expected to realize by around 2020, i) for super-aging society problems, promotion of national wide development of medical information cooperating infrastructure, establishment of ICT health model (prevention), spread of new work styles, ii) for resource problems, ①effective data analysis technologies, and research and development of informational technology which realize value chain from production, distribution to consumption, ②research and development of sensor technologies and utilization technologies which realize effective maintenance of roads and bridges.

It is important that they will result in creating new industries, generating economic effects, and expanding in foreign countries.

Though it is difficult to forecast when and what will be developed for individual ICT technologies, it may be possible to predict a comprehensive trend to some extent.
"Technology roadmap 2014-2015" has the following perspectives.

Table 3.3.1 Stages of development of ICT, and perspective towards 2025

Chronology	Around 1960 - 1980 Era of experts	Around 1980 - 2000 Era of popularization	2000 - 2014 Era of connection	2015 - 2025 Cooperation with others, development of knowledge society infrastructure by deepening ICT utilization
Main services with ICT utilization	Core functions such as accounting or production control	Expansion to office operation and sales management	Diversification into e-commerce or CRM/SFA	
Purpose of data processing	Automation, laborsaving	Arm with information technology	Differentiation by information technology	
Place of use	Computer room	General office	Outside, Outdoor... anywhere	

Source: Shinichi Ogata, and others. Technology roadmap 2015-2024 [Compiled by ICT fusion new industries]. Nikkei BP, 2014. p.9, and others.

Particularly as for the social infrastructure, it is expected that the following technologies will be realized.

Table 3.3.2 New technologies in the social infrastructure field expected to be developed by 2025

Theme	New technologies at the product level
Smart City	-Energy integration management function in whole region -Choice of optimal number of energy mix in ream time -Integration with car system
Transportation systems	-Response to the compact city -Mobility with minimal environmental load -Self-driving (level 3) -Train control system with independent vehicles -Fully automated air routes -Eco ship
e-government/e-municipality	-Omni-channelized administration -Expansion of My Number service -Cross-border cooperation system -Global, wearable -Utilization technology of personal information

Open data	Non-text data/data catalog -General Catalog of national and local governments -Service creation through utilization of LOD (Linked Open Data) -LOD value creation support service
Countermeasures against deterioration	-Sophistication of collection and acquisition of information and data -Integration with information and data collection/acquisition system -Sophistication of analysis, utilization, sharing and transmission -Integrated communication infrastructure

Source: Shinichi Ogata, and others. Technology roadmap 2015-2024 [Compiled by ICT fusion new industries]. Nikkei BP, 2014. Chapter 4.

The following arguments are pursued assuming these ICT technology will be realized.

(2) Developing countries

As 2015 is the deadline year of the Millennium Development Goals (MDGs), discussion have been held to establish the international development goals beyond 2015 (post-2015 development agenda). In the United Nations Conference on Sustainable Development (Rio+20) held in June 2014, the establishment of Sustainable Development Goals (SDGs) was discussed as a complement of MDGs. SDGs were approved in the United Nations Sustainable Development Summit in September 2015. 17 objectives are set in the SDGs. Though there is no objective concerning directly ICT (Ex: access to information or penetration rate of mobile phone), ICT is mentioned in the following targets (Table 3.3.3).

Chart 3.3.3 Reference to ICT in SDGs

Goal	Target
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	2.c. Adopt measures to ensure the proper functioning of food commodity markets and their derivatives, and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility
4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	4.b. By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries
5. Achieve gender equality and empower all women and girls	5.b. Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of

	women
9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	9.c. Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020
16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	16.10. Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements
17. Strengthen the means of implementation and revitalize the global partnership for sustainable development	17.8. Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology

Source: Provisional translation by the Institute for Global Environmental Strategies (July 2014)

Applying ICT in many different ways will be an important factor to achieve other SDGs as well.

Although GDP is expected to exceed 10,000 dollars in around 10 developing countries which will thereby graduate from ODA by 2025, poverty will still remain in many countries including those graduates. The world population will increase from 7.34 billion to 8.14 billion in the next 10 years, and it is forecasted that the population share of lower-middle-income and low income countries will increase slightly (Chart 3.3.4).

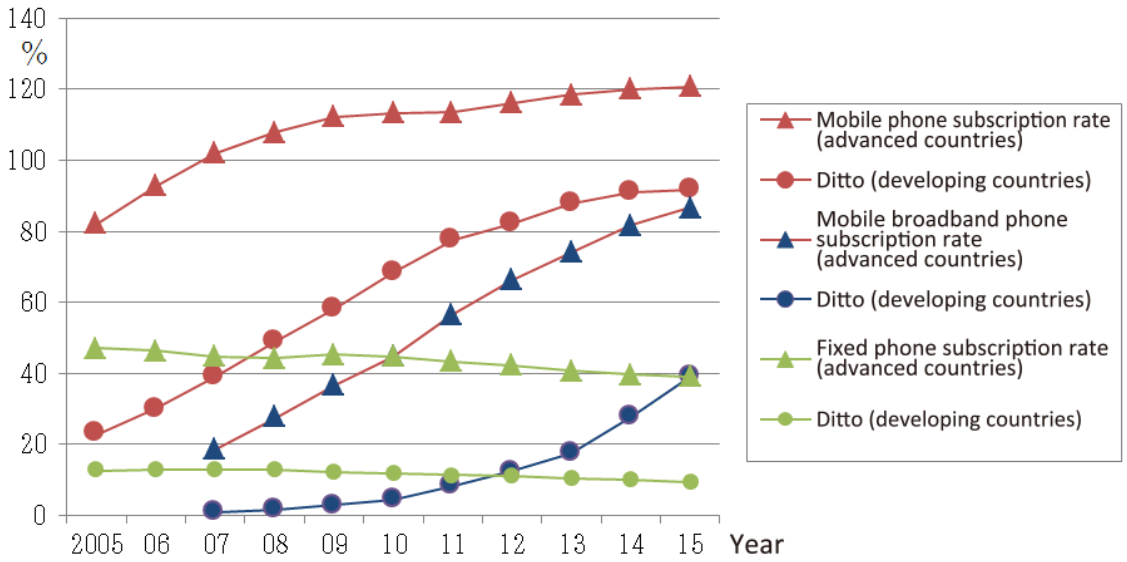
Chart 3.3.4 Transition of World Population

Unit: 1,000

Year	2015		2020		2025	
High income countries	1,401,479	19%	1,431,215	18%	1,455,448	18%
Upper-middle income countries	2,390,125	33%	2,468,631	32%	2,525,476	31%
Lower-middle income countries	2,916,158	40%	3,128,467	40%	3,335,611	41%
Low income countries	638,735	9%	726,696	9%	821,812	10%
Total	7,346,497	100%	7,755,010	100%	8,138,347	100%

Note: Country classification is of 2015.

Source: The 2015 Revision of World Population Prospects by the Population Division, the United Nations



Source: ITU-D. ICT Statistics 2015 (Note: the figures of 2015 are tentative.)

Figure 3.3.1 Comparison of ICT Environments in Advanced and Developing Countries

While trends of population and economic development might vary from the current status, mobile phones are expected to spread on a continuous basis. Especially in developing countries, the diffusion of mobile phones started way before fixed phones became common (roughly 50% of population), and in 2015, the subscription rate reached 91% (Figure 3.3.1). This trend is expected to continue, and it is forecasted that the subscription rate of mobile phones will be around 120% of the population in 2015 and reach saturation as much as in the current status of advanced countries. It is worth mentioning that developing countries have skipped some steps of the ICT technology experienced by Japan and other advanced countries. Certain technologies have spread in a short period of time in developing countries, which are currently experiencing the most advanced technology in those particular areas.

With the diffusion of mobile phones, related services have been started. In Kenya, the subscription rate of mobile phones reached 61.6% in 2010. A mobile banking service called “M-Pesa” using SMS (Short Message Service) has been provided by Safaricom, a mobile phone company, since 2007, which has been used by more than 40% of the adult population in Kenya by 2010 (see Box 5 Maximizing Mobile (Pg 71)).

The rapid spread of the Internet is also important. The number of the Internet users in Africa increased by as much as 317% in five years from 2007 to 2012. It increased by 294% in the Middle East and 143% in Asia, which reflects the fact that the Internet has been established as an important infrastructure also in developing countries in such a short period[42]. The background includes the diffusion of mobile phones, especially smartphones. For using the Internet through smartphones in developing counties, there are no LTE (Long Term Evolution) specifications which are also called 3G or 3.9G in Japan, and prepaid phones are still the mainstream. However, they are being used through Wi-Fi at particular locations in many cases, and maintenance of Wi-Fi is in

progress.
Thus, what has been experienced by Japan and other advance countries concerning ICT and what is currently being experienced by developing countries are totally different. The especially remarkable ICT applications in developing countries are, as stated above, mobile phones and Internet access using them, and services applying them are emerging in the fields of business and assistance. This trend is significant as a precondition for considering assistance, and is important for incorporating more effective ICT applications in assistance.

Even under such situation, poverty will not have been totally eliminated in 2025, and assistance by advanced countries and international organizations will still be necessary to meet development needs of developing countries. As the information gap between advanced countries and developing countries will be much smaller then, it is assumed that developing countries will acquire various technologies and know-how through the Internet, diversify types of financial access and provide administrative services of the government through the Internet. On the other hand, technological and financial gaps between advanced countries and developing countries will also decrease. Although the time lag of general purpose technology will be virtually eliminated, areas where it is impossible for developing countries to catch up with will also expand. For example, as far as new SNSs are concerned, time lag of dissemination or development no longer exists between advanced countries and developing countries. On the other hand, in the areas of OS and solutions which have been swept over by advanced countries, it will be more difficult for developing countries to develop originals except in limited areas such as partial localization.

The conventional scheme for technical cooperation used to takes into consideration a time lag of technical development between advanced countries and developing countries, and the main point was to incorporate technologies of advanced countries in developing countries in accordance with the local situation. When access to information becomes easier, it will be possible for developing countries to select the most needed technology out of many options. Technical cooperation will be promoted respecting mutually complementary relationship instead of unilateral relationship between donor and recipient. For example, a technology which is impossible to apply in an advanced country due to certain regulations might become applicable in a developing country. Under such situation, Japanese technology will have an aspect of trial and uncertainty.

[42] Pg101 of 2014 WHITE PAPER Information and Communications in Japan (PDF version), Ministry of Internal Affairs and Communications
Website of the Ministry: http://www.soumu.go.jp/johotsusintokei/whitepaper/ja/h26/pdf/26honpen.pdf. (July 2015)

3.3.2. Individual trend and application

Based on the above described prospect, the existing ICT technology and the future trends that are certain to come true are forecasted for around 5 years from now as follows:

(1) Mobile

In a project targeted at the poor, it is possible and effective to use SMS in information services and public relations. However, SMS is not necessarily effective

where the literacy rate is low.

In areas where smartphones are used widely, it is necessary to adapt web designs and SMS accordingly. Information services incorporating video and audio are effective approaches where the literacy rate is low.
Concerning solutions centering on e-mail, it is preferable for server/client designing to assume using a browser of a Smartphone or a tablet instead of a PC.

Application styles vary from regular dissemination of information (knowledge, market conditions, system) (e-mail newsletter style) to e-mail list for interactive discussions (list server style). Incorporating the push system will further improve the freshness of information.

Social media is also advancing day by day. Concerning general-purpose tools such as Facebook, Twitter and LINE, it is preferable to clarify the management system and apply widely based on JICA's social media policy.

BOX 11. Maximizing Mobile

The report (2012 Information and Communications for Development Maximizing Mobile) made by the World Bank and infoDev in 2012 clarifies the cases of incorporating mobile devices for strengthening the ICT strategies in 2012. In developing countries which are "more mobile" than advanced countries, many services unprecedented in advanced countries including multi-SIM card phones, low-cost recharges and mobile payment have been started under the trajectory of "mobile first".

In the current communication environment in developing countries, the bond between mobile operators and users is loosening as computer and Internet companies invade the mobile space and cause the emergence of high-speed broadband networks.

In the agricultural sector, it has been already proved effective in improving access to agricultural information, data visibility for value-chain efficiency and market access.

In the health sector, services of mHealth include development of mobile applications (medAfrica, medafrica. Org. in Kenya) and monitoring of food supply chains by SMS (in Ethiopia, by UNICEF).

There are other cases of development in the financial and private sectors. M-pesa (It was started in Kenya and is being operated in six countries. In one month in 2011, 20 million uses remitted 500 million dollars.) is famous as a case of mobile remittance/payment, but there are other operators a well. In 2012, 56 operators out of the world's 124 mobile money operators existed in Sub-Saharan Africa, and were mostly managed by the mobile operators themselves. On the other hand, it is considered that the management leadership of such service model will transit from mobile operator to bank, and further to multi-channel, as

the economy develops.

In any of those cases, there are application cases centering on SMS in addition to smartphones. Although information solely through SMS is limited, incorporating smartphones greatly expands the scope of application.

Source: World Bank. *2012 information and Communications for Development Maximizing Mobile. 2012.*

(2) Cloud Computing

In developing countries, it is often difficult to establish a stable high-level server originally. In general, it is possible to reduce costs of incorporation and maintenance of ICT by cloudization, which should promoted in developing countries on a long-term basis. It will also solve the shortage of ICT technicians. In case of establishing an information system in an organization managed by a user, it is necessary to have technicians to operate and maintain it within the organization. As it is not necessary in case of cloud, it is highly effective to use the cloud in developing countries where the shortage of ICT technicians is becoming more significant.

In application at the project level, as terminals are being mobilized as stated above, it is necessary to construct a system to operate main information processing with a server on the cloud. As many of multi-purpose services[43] by the cloud are free of charge, it can be spread rapidly in developing countries. However, it tends to depend on the bandwidth of the line to the server. Original setup and costs are required in order to diffuse PaaS (Platform as a Service) and IaaS (Infrastructure as a Service) which are more than just SaaS to use services on the cloud, and it is not easy to incorporate.

Depending on the situation of the developing country, it can be an important point whether to construct a cloud environment in the country. It is possible to access to public clouds operated by Google and Facebook, acquire all kinds of information and enjoy multi-purpose services freely and free of charge without constructing an cloud environment in the country as long as an Internet environment and a bandwidth are secured. It is also possible to build a website or a business system for relatively low costs. However, many countries are censoring and regulating international internet access to political and sexual contents among others. Under such situation, as there are many cases in which the government restricts communications with foreign countries, it is concerned that connection might become unstable when cloudization is advanced.

On the other hand, a system for important administrative services is constructed usually using a special server or on the cloud within the country. For example, some countries including Indonesia have set restrictions for constructing a government-related system on the cloud of a foreign country. Depending on the scale of the cloud, high-level infrastructure technologies (virtualization technology, fault tolerance technology, operational management technology, security technology, etc.) are required in order to construct a cloud within a country.

As stated above, the global trend of cloudization affects the progress of ICT

incorporation in assistance projects. Considering such influence, the direction is determined after carefully examining the situation of the recipient countries and users: whether to use a public cloud from outside of the country or a cloud existing in the country, whether to use SaaS, PaaS or IaaS, etc.

[43] Many cases are of Software as a Service (SaaS) such as e-mail server and hosting service.

(3) IoT

IoT (Internet of Things) has a structure in which different devices and their data are connected to the Internet and thereby creating new values. As for the number of connected devices in the world, there were 12.5 billion in 2010, exceeding the entire world population, and will be 25 billion in 2015 and 50 billion in 2020, doubling every five years. IoT is considered to have started when the number of sensors exceeds the population[44]. There are issues of global IP address and operating power for increasing sensors, and incorporation of IPv6 and nano power generation is being considered.

As the costs of sensors go down, the possibility of applying in developing countries expands. It is applicable in development assistance in different sectors, contributing to monitoring and risk assessment such as health checkup, monitoring of agricultural and stock-raising productivities, environmental monitoring, equipment control, traceability in the logistics sector, and should be promoted actively. In case of needing only a few sensors, there are technologies that enable immediate incorporation. It is applicable for health checkup and weather and earthquake analysis for risk assessment using a lot of data, which should be promoted actively.

(4) Big Data

Concerning application of big data which tends to be handled with leadership of the client/user, it is important to identify the purpose on “what is wanted” by the client/user who owns the actual place of application. However, under the current situation of developing countries where it is not even clear what can be done by big data analysis, most of it is often regulated depending on the available data. Therefore, it is possible to start by analyzing on a trial basis. Some cases have been already introduced, but they are still at the stage of verification experiment or pilot application except for some cases.

Big data analysis is featured by application of machine learning using artificial intelligence. Deep learning has enabled to further sophisticate the quality of analysis by advancing learning without human involvement.

Although application of big data in assistant projects is still at the stage of experiment, the programs of UN Global Pulse can be of use as a reference (BOX12, pg76). “Big Data in Action for Development[45]” has been published by the World Bank, in which the concept is stipulated.

Structured data existing in developing countries that are relatively easy to acquire include: (1) call detail records via mobile phones, (2) remote sensing images from satellites, (3) search queries on the Internet, (4) various text sources on the Internet,

(5) social media tweets and (6) credit card transactions[46]. The application scope is expanded as big data analysis enables to target at unstructured data (images, video). The categories in which analysis results can be expected are: (1) early warning, (2) enhancement of awareness of situations and real-time feedback, (3) understanding and interacting with social systems and (4) new challenges[47].

While a high level of security is required for protection of personal information and confidentiality, data should be handled more carefully because legal regulations are not sufficient in developing countries.

Applications up to the IoT stage were mainly for collecting vast data and processing information for human judgment, in which information processing and decision algorithm themselves including incorporation of ICT were targeted by technical cooperation. At the stage of machine learning advanced by application of big data, decision-making will be performed by computer, and the form of technical cooperation scheme will be reconsidered.

For example, concerning weather forecast, collection, interpretation, judgment and announcement of data are performed. In this process, interpretation and judgment have been performed by human, and the approaches have been subject to technical cooperation. In analyzing big data, as vast accumulation of data and constantly flowing streams of information are evaluated by data mining, analytic technology and machine learning, it is not necessary for human to consider decision algorithm itself. Therefore, when using big data, it is necessary to identify the purpose such as a specific administrative decision. The nature and approaches of capacity development on the part of the government of a developing country will be totally renewed, such as assistance for capacity development of technologies related to big data processing for achieving a certain result.

[44] Cisco. 2011. Internet Business Solutions Group.
[45] World Bank Latin America and Caribbean, World Bank Group, and Second Muse. C2014. Big Data in Action for Development. PDF version.
[46] Source: Ditto. Section 3
[47] Ditto. Section 3.

BOX 12 Examples of ICT utilization

Forecast of damages in Flood disasters by behavior analysis

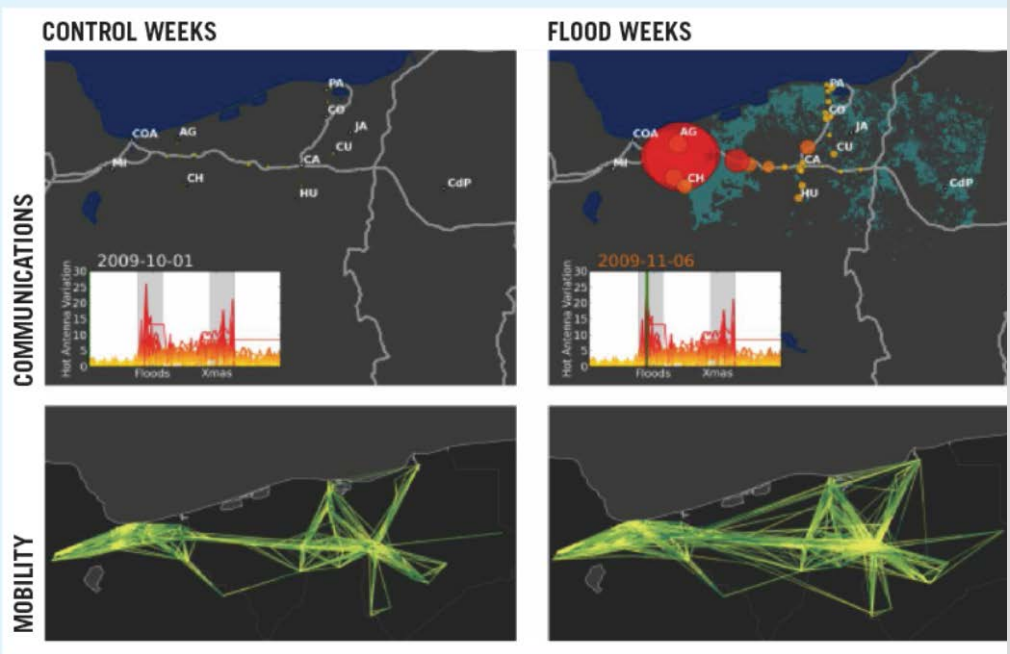
Analysis of Flood disasters using mobile phone data in Mexico

United Nations Global Pulse is an agency of the United Nations established in 2009, which conducts investigation researches on big data. In 2014, Global Pulse conducted 25 big data-related researches, and studied connection with development theme such as food security degree or shifting cultivation, by using data from mobile phone companies. Although it is more regression analysis than big data analysis at present, here is a title survey highly suggestive as an analysis with direct mobile phone data.

By joint researches with World Food Programme (WFP), Mexican government, Telefonica (cellular phone company) and Polytechnic University of Madrid, Global Pulse has analyzed the correlation with impacts of disaster by analyzing behaviors in disaster.

During the great flood of 2009 in the state of Tabasco in Mexico, they have found that behavior of people from Mobile phone data and satellite data could be an indication of whether people knew the seriousness of damage to infrastructure and the situation.

If they could be analyzed in real time, it can lead to early warning of disaster.



Estimation of the disaster impact (At the flood in 2013)

Source: UN Global Pulse, 2014 Report

(5) 3D printing

When thinking about the impact of 3D printing on development, "Investigative commission on the Basic design of fab society" from January 2015 actively organized by Institute for Information and Communications Policy (Ministry of Internal Affairs and Communications) and its debrief report serve as a very useful reference (http://www.soumu.go.jp/menu_news/s-news/01iicp01_02000030.html). Looking toward the arrival of fab society by spread of digital fabrication device like 3D printer, this report considers about information infrastructure, institutional foundation, and human base which support the society, and it is thought that over the next few years, leverage effect on development by using 3D printings will dramatically increase like in Asia and in Africa where many examples are already seen.

Looking ahead to the year 2025, in a time when the entire world is linked by the Internet and the number of cellular phone subscription look set to exceed that of the global working population, with the evolution and spread of 3D printing and the growing encouragement to publish and share designs via the Internet, there is a possibility that there will be a time when the citizens themselves will undertake manufacturing, even resulting in a significant transformation of the structure of trade.

In such a period of revolutionary changes, it can be assumed that there would be an obvious necessity to give considerations to cooperative content that incorporates 3D printing, as there would be a need to revise the concept of transferring technology and know-how in conventional technical cooperation as well as needs in financial cooperation to establish a plan that adequately grasps changes to the structure of industry and trade in recipient nations.

3.4. Adoptable examples of ICT as a new trend utilization tool

The efforts of ICT utilization are expected to increase in the future, however, there are wide range of problem areas, thus for the efforts with IoT or big date, the introduction should be considered relatively early, and operability is already enough at this time. For example, these possibilities can be found in disaster prevention, transportation, of public safety. In those problem areas, prevention and countermeasures by forecast and prediction are main viewpoints, and those may be considered as a technology tool promising increase of benefits for developing countries and reduction of assistance cost by using IoT and big data. For example, The World Bank published a report "East Asia's Changing Urban Landscape: Measuring a Decade of Spatial Growth" in January 2015, in which they emphasized the necessity of a creation of more accurate urban planning by objectively forecasting the movements of people or things in the future by using a lot of big data which contains satellite images from 2000 to 2010, and proposed their methodology against accelerating interurban problems in Asia. Such initiatives can be also used at full value to formulate master plans for urban and regional development operated by JICA.

Also, many of these new trends offer solutions are situated between ready-made and custom-made, and may fill gaps of solutions for ICT utilization described in 3.2.1(4).

As mentioned above, it is a local need which becomes a starting point of big data utilization, and the needs will be looked for with several utilization images as a base of review. Referring to the efforts of domestic vendors, some images of IoT or big data utilization in developing countries are shown as follows.

3.4.1. Sediment disaster prevention

In the case of sediment disaster, prevention and prediction are important because it may happen in a very short time from premonitory phenomena to actual collapse. After having determined the risk of a slope with GIS, you can analyze information (including weather forecast) acquired from dedicated sensor in soil, rain gauge, or other sensors, with IoT and big data analysis, focusing on high-risk points to grasp the state of earth and sand, and calculate degree of risk of the slope. Data accumulation can lead to transmission of alerting information. In addition, overall effects can be increased by applying accumulated information to other areas. There are already some case examples of assistance by JICA, with disaster prevention systems (flood, earthquake, volcano, etc.) using remote sensor, and there is a possibility to further increase benefit effects of developing countries by using the collected data as big data.

3.4.2. Deterioration detection of transport infrastructure

Coping with degradation problems of roads and bridges. Monitoring of road bridges through wireless sensor network using sensors, include detecting deterioration of durability by corrosion and fatigue crack in steel components of bridge, or prominent crack on concrete member by vibration sensor. It is possible to ensure the safety and reduce the maintenance cost by accumulating information of sensor and grasping deterioration situation.

3.4.3. Transportation planning/traffic control solutions

Time-series location information of transit users can be obtained from mobile telephones, surveillance cameras, roadside sensors, emergency telephones, etc.

By analyzing time-series behavior of these users, conventional person trip surveys can be replaced by these data, which can be reflected in highly precise and long-term transit and urban planning.

Furthermore, if such time-series location information can be obtained in real time, not only real-time monitoring of traffic congestion with instant big data processing, but also negative incidents can be avoided. This can be made possible with methods including predicting occurrences of traffic jams and accidents in advance, providing information to navigation software, and contacting and instructing road management centers.

3.4.4. Security system for railways and airports

In the railway stations and airports used by many people, it is necessary to grasp promptly the situation like a threat of terrorism to prevent crime or reduce damage. At the same time, in railway stations and airports, convenience and comfort of the procedure like security check or immigration control are required. Also, it will be possible to enhance security of important facilities including railway stations, airports, concourses, trains, plains, and control centers to manage risk appropriately by using biometric authentication technique and behavior detection technology. It enables also to simplify immigration procedures.

3.4.5. Development of smart city

Among the smart city functions, this section describes aspects focused on electrical

power. It is also called Smart Grid. Many developing countries rely on import for energy sources, but it's costly and the demand of air conditioning has been growing rapidly. Electricity distribution system with low power consumption is realizable by equipping ends of electric grid with various sensors including a smart sensor (power meter), and by analysis and operation with big data to reduce loss. It is also possible to further reduce the environmental load by widely introducing solar power.

In particular, companies in a developed country may implement it using Clean Development Mechanism (CDM) In addition, by different energy conservation measures, there is also a possibility to receive a sub-loan by yen credits (countries with existing yen credits, etc.).

In developing countries, new electrical grid may be rebuilt in specific areas. Accordingly, construction of smart grid by single system is likely to be easier than in developed countries. Regarding introduction of smart city, following points need to be considered:

- ―External power supply (power plant)
- ―Capacity and communication method of power-generating facilities (solar power, etc.) or electric storage devices (large storage battery, etc.
- ―Method of transmitting and receiving from electric grid or consumer's smart meter
- ―Exchange of information from sensor or so on (temperature, etc.)
- ―Composition of information center and judgment method.

3.4.6. ICT utilization for further application of distance education and inclusive education

In the field of education, teleconferencing system is applicable for distance learning or IT human resources, and following ICT utilizations for inclusive education can be considered:

Distance learning is not only for learning field but it can be also considered as a common tool of all areas, applicable to local engineering education in each sectoral issues. Inter-American Development Bank is operating remote technical trainings for engineers in the fields like mining, oil, energy, or communication. JICA also can be expected to increase the development efficiency in projects of each sectoral issue, by applying distance learning technologies to training of local counterparts. JICA-Net should be utilized better and include the elements of remote technical cooperation in each project.

With regard to inclusive education, due to various ICT technologies, it is becoming possible for people with various educational needs to access higher quality education and information.

Examples of ICT technology utilization applicable in the field of education are as follows.

- ―Hearing aid or voice to text converter for children with difficulty in hearing
- ―Electronic blackboard or text reading software for children with visual

difficulties

—Distance learning (teleconferencing system, etc.) for children with difficulty attending school (residents in remote places).

—Individual learning systems, supplementary systems, tablets, keyboards and switches corresponding to various educational needs

—DAISY (Digital Accessible Information System) for children with difficulty accessing to printed information.

—Sharing of study and experiences for teachers by teleconferencing system

3.4.7. Utilizing ICT in healthcare sector

ICT is utilized very actively in the healthcare sector of International institutions and bilateral assistance institutions, and used in various ways, including telemedicine. Although some specific examples are shown in attachment 2-6 and attachment 2-7, few technical cooperation projects of Japanese healthcare sector deal with medical front, thus not all of them can be used directly. In this section, applicable ones are mentioned according to the characteristics of cooperation in healthcare sector.

(1) Maternal and Child Health Handbook and e-Health (Jordan)

Maternal and Child Health Handbook is rolled out in each country with field cooperation from Japan Healthcare, and this has achieved a variety of results. To increase the entry rate of Maternal and Child Health Handbook by Palestinian Healthcare workers, Electronic Maternal and Child Health Handbook as well as Electronic Healthcare Information System as a linked development is supported[48].

(2) Maternal and Child Healthcare and e-Health (Cambodia)

In Cambodia, based on issues of Maternal and Child Healthcare in this country, «Introduction of remote learning for midwives" and "Education to promote the use of healthcare facilities for women in the rural communities" is proposed as an enterprise plan. The former provides educations through a learning management system which enables learning history and certification test to bridge the pre-graduation education courses for midwives, post-graduation education courses for midwives, and associate midwives to formal midwives.

Also, the latter introduces computers and the Internet connectivity (and in some cases, power source facilities) to the health centers, and in addition, Healthcare educational materials and information are not provided only through text (written forms) but also in videos, and education to promote the use of Maternal and Child Healthcare Service (healthcare facilities) is proposed[49].

[48] "Investigation research for utilization of IT in maternal and child health" PADECO, 2014, JICA.

[49] idem

(3) In-hospital system

In the healthcare field, support for large-scale hospitals construction has been

schedules into the future and this support is provided to Viet Nam-Japan Friendship Hospital (Cho Ray Viet Nam-Japan Friendship Hospital) and Yangon New Specialty Hospital in Myanmar, where hospital facilities and equipment provision has been scheduled.

The former if by a loan assistance and the latter is by a grant aid. Specially, in the former case, an agreement on the ICT System Specification has already been reached between the JICA and the government of Viet Nam. In the future, regarding the hospital construction, hospital construction and equipment are scheduled to furnish the ICI system in the same manner and at the same.

On the other hand, regarding the existing ICT System, assistance depends on the scale and needs and cannot be generalized, however, other than aid and assistance, through grass roots cooperative efforts, ICT technology deployment and development can be expected.

As typical systems utilizing ICT, there are PACS (Picture Archiving and Communication System) to archive and share medical images within the hospital system, Ordering System to deliver tests and medication instructions to related parties electronically, and BEMS (Building Energy Management System) to manage building energy usage.

Also, in the field of medical education, there are working examples of ICT utilization where surgery and scan images are shared by multiple healthcare workers within the system.

Furthermore, ICT can be actively utilized to collect insurance premiums payments and payments of medical care costs efficiently and avoid duplication of payments by sharing information among the payers, the medical organizations and audit bodies.

(4) Telemedicine

Telemedicine allows specialists to diagnose through images and teleconferencing system can also be introduced to further effectiveness. This is relatively an easy system to build and implement. Currently, functionality of mobile phones can be utilized.

In Bolivia, the government has introduced such a system and to provide guidance for its operation, through the efforts and findings of the investigation teams, Telemedicine Development Center of Asia of Kyushu University has sent out support teams and has shown proven achievements. Also, In Sudan, general vehicles have been modified to allow test equipment and communication gears to be boarded so that telemedicine can reach villages that normally lack doctors. This enterprise is called Dr. Car and is implemented through JICA and private sector proposed model and is a popular and proven business, which

can be used in a variety of ways and can benefit from cooperation in technology. However, regarding the telemedicine, furnishing the environment for data communication alone cannot achieve results and it is imperative to secure required medical workers who receive such information and provide the necessary skill set.

(5) Communicable Diseases

In a system where the information concerning the occurrence of suspected communicable diseases is immediately relayed to terminals[50], JICA has already achieved some enterprises in Kenya.

Furthermore, communicable diseases are spread through contacts (direct transmission) and airborne droplets (air transmission), and therefore, big data can be used to analyze the communicability risk. By analyzing the behavior of the diseased persons and the latent infectees, through the proper analysis of social media data, risk could be analyzed and the infection risk could be determined.

[50] Following: http://www.jica.go.jp/project/kenya/006/news/20150708.html

(6) Human Resource for Health Information System (HRHIS)

In Tanzania, Human Resource for Health Information System (HRHIS) had been developed to grasp information about human resource for health in medical facilities, and Training Institution Information System (TIIS) which enable to see the prospect of human resources for health in HRH training schools. At the end of 2014, HRHIS has been diffused in all 25 states and all 178 prefectures, and TIIS in all certified schools, and function as core system of human resource for health in Tanzania. It is possible to develop and spread a similar Human Resource for Health Information System in other countries.

There are also examples of utilization in health management information system which collect and analyze human resources information and hospital management information regularly (Ghana, Tanzania, Pakistan, etc.). In addition, utilization of ICT is also conceivable in a system for sharing laboratory data between hospitals.

3.4.8. Monitoring and livelihood improvement for poverty reduction

The projects may also be considered to reduce poverty by monitoring the poor as well as generating various facilities in combination with existing ICT technologies used in developed countries. The conditions of ICT utilization are considered as below:

- ☐ Capable of stable operation even with poor network or electric power environment.
- ☐ Respond to the development needs of the poor, and contribute to the livelihood improvement.
- ☐ Contribute to supply of basic human needs (BHN)(food, clothing and housing, water, sanitation, health, education, etc.)

For example, the projects intended for deprived areas and specific administrative districts have components as follows:

- ☐ Provide local citizens with opportunities to earn cash income by telework
- ☐ Provision of information on agricultural market by SMS
- ☐ Monitoring of early drought, water shortage, and water quality by water sensor (well water, surface stream water)
- ☐ Analysis of public sanitation and health from SNS (like Twitter) with big data
- ☐ Introduction of attendance management system to encourage students to

attend school. Implementation of remote teaching in a branch school in the case of a remote location.

In the absence of permanent connection, visit to collect and supply data on a regular basis (e.g. once a week). Take prompt measures specially if a deterioration trend is seen in water supply or education (providing healthcare services, securing alternative water sources, support for returning to school, etc.). Through them, prevent vicious circle of poverty to improve livelihood and MDG index.

Chapter 4 Amending JICA's ICT thematic guidelines and development strategic targets

4.1 Overview of ICT thematic guidelines

JICA has created "The Effective Approaches to Development Issues—ICT" in September 2003. In it JICA set five development strategic goals as effective approaches to development issues, and incorporated them into ICT Thematic Guidelines (First edition) in December 2003.

Following the revisions in April 2005 and in May 2009, the guidelines were merged with "Trends of Aid Cooperation in Broadcasting, September 2009" which has become its latest version.

Here ICT issues within the whole thematic issues will be discussed. Table 4.1.1 below will show the entire ICT schematic chart for development issues. Those development strategy goals 1 to 5 shown in the table are similar to those of initially set in September 2003, but with added intermediate goals in the table.

Table 4.1.1 ICT schematic chart for development issues

Development strategy goals	Intermediate goals	Sub goals
1. Improvement of ICT policy-making capacity	1-1 Establishment of ICT policy	1-1-1 Formulation of ICT policy
		1-1-2 Introduction of the principle of competition
		1-1-3 Formulation of policy to solve internal digital divide
	1-2 Establishment of ICT industrial development policy	1-2-1 Establishment of industrial development guidelines and policy
	1-3 Establishment of user protection policy	1-3-1 Formulation of information security policy
		1-3-2 Development of user protection laws
		1-3-3 Development of intellectual property protection laws
2. Development of ICT human resources	2-1 Professional development of ICT engineers	2-1-1 Support for content creation
		2-1-2 Development of SE resources
		2-1-3 Technology of Tele-communications
	2-2 Professional development of ICT policy practitioners	2-2-1 Development of administrative (working level) resources
	2-3 Improvement in ICT literacy	2-3-1 Support for improving user literacy
		2-3-2 User education of security, etc
		2-3-3 Introduction of training and learning
3. Development of ICT infrastructure	3-1 Development of ICT infrastructure	3-1-1 Development of backbone network
		3-1-2 Development of broadband access network
		3-1-3 Development of infrastructure of rural areas
	3-2 Development of ICT base	3-2-1 Development of ICT parks
		3-2-2 Development of data centers
		3-2-3 Development of publicly accessible facility
4. Promotion of use and application of ICT	4-1 Application of ICT to individual development issues	4-1-1 Application of ICT to support and promote good governance（e.g. e-Government）
		4-1-2 ICT application for BHN issues （education, health/medicine, rural development）
		4-1-3 ICT application for environmental disaster resiliency

		4-1-4 ICT application for economical and industrial issues
		4-1-5 ICT application for cross-cutting issues
	4-2 Effective use of JICA-Net	4-2-1 Use of remote training skill
	4-3 Improvement in efficiency and effect of cooperation using ICT	4-3-1 Dissemination/transfer of existing knowledge
		4-3-2 Sharing/creating of acquired knowledge
		4-3-3 Application of ICT for business implementation

Source：JICA Thematic Guidelines on ICT

In December 2004, the comprehensive analysis of evaluation of strategic goals of "Development of ICT/IT Human Resources" and "Application of IT in Individual Areas was conducted based on the past projects; in particular, the Development Strategy Goal 2—Development of ICT Human Resources and the Development Strategy Goal 4—Promotion of Use And Application of ICT.

The result indicated the needs for Development of ICT human resources were (1) knowledge management, and (2) continuous action. And for Applications of IT—the needs were derived from an analysis from projects related to education, health/medicine, poverty, and environment— (1) lessons learned from each cases/projects, (2) construction of vertical and horizontal networks, (3) and designing systems in which the position/role of IT plays is clarified.

In making of present edition of 2012, the following appendixes were included: 1. Major cooperation cases, 2. Major donors' approaches in ICT, 3. Basic check items, 4. Present situation and priority issues.

4.2. Intermediate goals and cooperation cases

Table 4.1.2 below shows appendix 1.Major Cooperation Cases. Number of cases divided by years.

Table 4.1.2 ICT schematic chart for development issues and number of cases

Development Strategy goals	Intermediate goals	No. of cases				
		1962-79	1980-89	1990-99	2000-12	2013-15
1. Improvement of ICT policy-making capacity	1-1 Establishment of ICT policy	1		4	21	1
	1-2 Establishment of ICT industrial development policy	1		3	8	
	1-3 Establishment of user protection policy				1	
2. Development of ICT human resources	2-1 Professional development of ICT engineers	1	3	14	49	4
	2-2 Professional development of ICT policy practitioners			1	7	3
	2-3 Improvement in ICT literacy				3	1
3. Development of ICT infrastructure	3-1 Development of ICT infrastructure	56	69	57	15	3
	3-2 Development of ICT base		1	3	4	
4. Promotion of use and application of .ICT	4-1 Application of ICT to individual development issues	1	4	11	49	3
	4-2 Effective use of JICA-Net				1	
	4-3 Improvement in efficiency and effect of cooperation using ICT				2	
	Total (includes overlap)	60	77	93	160	15

Notes: Number of cases has been grouped from the first year. Some cases may have more than 2 intermediate goals, and may have overlap.

Source: Number of cases in 1962-1979 periods is from the JICA Thematic Guidelines. The figure in 2013-15 period was obtained from this research by International Development Center of Japan)

As seen from the table, the shift in the largest number of cases, which fell under the category of "3-1 Development of ICT Infrastructure", lasted until the 1990s. And most of these cases, supported by ODA loans, to do with expanded telecommunications networks works, such as communication channels, subscriber network, and switching equipment. Then in 2000 onward, a sharp increase is seen in the "2-1 Professional Development of ICT Engineers" and "4-1 Application of ICT to Individual Development Issues." This trend suggests that once nationally-owned telecommunications company in developing countries turned private, in addition to disseminated cellular phone network, led to the decrease in the number of projects supported by aids. The core of expansion and improvement of telecommunications network work have shifted to private sectors. Since 2000, the expansion work for telecommunications network in areas continued as developing fiber optics.
"4-1 Use and Application of ICT" is an example of areas showing rapid increase. Chapter 2 reviewed the particulars of the individual ICT usage cases, but most cases that were either non-existent or were handled by mainframe, became available for application for projects after the 1990s due to improved convenience or reduced costs.

4.3. Review of thematic guidelines

4.3.1. Development strategy goal 1. Improvement of ICT policy-making capacity

As to Development strategy goal "1. Improvement of ICT policy-making capacity", the need for improved policy-making capacity is increasing coinciding with the growth of ICT as well as the increased number of cases. In all, it is found to be essential to search proactively and identify requests made by the developing countries because they hold a large capacity for needs. Since Japan's technical resources are limited, it is desirable to cooperate and work with Advisory Services conducted by the World Bank as part of the TA.

Intermediate Goals 1-1 Establishment of ICT policy has been conducted mainly in a form of technical assistance, either by dispatching expert policy advisors or by training courses. If the telecommunication companies are either publicly owned or government corporation, the "National telecommunication network development survey (Ethiopia, Laos) etc. were conducted but the actual cooperation cases are not so numerous. One way to cope with a fast-moving current of ICT, and to draw up necessary policies, it would be to delegating expert policy advisors (e.g. for about one year duration) with the aid by donors—and contribute in policy developing and establishing. To this end, additions to the sub goals category "1-1-1 Formulation of ICT Policy"," 1-1-2 Policies for telecommunications carriers" (such as promotion of ICT investment, competitive principle policies, permit standards for foreign capital investments), and "1-1-3 Spectrum management system" (allocation of frequencies, monitoring illegal spectrum etc.) suggested.

1-2 Establishment of ICT Industrial development policy defines the ICT industry as hardware and software industries; however, now that most of the work is conducted by the private sectors, ICT industry is no longer considered requiring a specialized field of knowledge but is thought as equally important strategically as other economy-fostering industries even among developing countries. It is concluded that this article

should be placed in the separate JICA theme “Development of private sectors.” Thus, “1-2 Establishment of industrial development policy” shall be deleted.

“1-3 Establishment of user protection policy” is considered an area of increasing importance now and the future; however, there is very few cases existed so far but one project—the Vietnam National Intellectual Property Protection Information Application. The fact remains that the need for cybersecurity measures, such as establishing and implementing user protection policy for national and private levels, is rapidly increasing. So far there are very few implemented cooperation cases despite a strong need for them, therefore, more aggressive offers are required by way of reconsidering approaches of cooperation. Or, when necessary, taking an approach through a public-private partnership could be considered. Protection of intellectual property will be deleted for reason of not directly related to ICT because it is more related to patent law and copyright to be considered within an industry development policy. Recently the Japanese government changed and unified the term from the previous “information security” to read “cybersecurity,” so the sub goal of “1-3-1 Strengthening cybersecurity” to include existing “Development of user protection policy.” As explained above the “1-2 Establishment of ICT industrial development policy” has been deleted, the category number would be moved up to read “ 1-2 Establishment of user protection policy” and “1-2-1 Strengthening cybersecurity.”

4.3.2. Development strategy goal 2. Development of human resources in ICT sector

The Development strategy goal " 2. Development of ICT Human Resources” has been actively promoted within the context of technical cooperation, and is expected to retain its strong need for it.

The “2-1 Professional development of ICT engineers” has peeked in the 2000s, and the number of cases has continued to decrease gradually. Professional development of ICT engineers could be conducted through relevant universities and the Japan Centers, at the same time, partnership between private sectors of Japan and developing countries could be promoted through granting certificates/diploma for qualified engineers. To determine what level of ICT engineers to be developed should be discussed thoroughly, but it is advisable for JICA to narrow the focus in order to obtain effectiveness and efficiency.

Professional development of ICT engineers for those areas that ICT is indispensable (e.g. meteorology, topographic mapping, statistics), it is advisable to clarify the position of ICT within the context of each field of technical assistance.

The sub goal “2-1-1 Support for content creation” was too ambiguous of its purpose, in addition to the declining technical difficulty in content creation, it is to be deleted. So, “2-1-2 Development of SE resources” and “2-1-3 Technology of telecommunications” will each be moved up to form sub goals.

The intermediate goal “2-2 Professional development of ICT policy practitioner” is

said “to contain relatively difficult section” even among the guidelines.. This goal should be coordinated with goals 1-1 through 1-3, and not alone due to perceived difficulties. For policy development of privatization of telecommunications carriers, actual ”policy making of telecommunications carriers” courses has been conducted, in addition, developmental research etc. could be worked out. For its sub goal, “2-2-1 Development of administrative recourse (working level)” will remain as is.

“2-3 Improvement in ICT Literacy” has very little actual work record so far to show for, but if we could find an effective approach to be implemented from the standpoint of dissemination of ICT to bring about benefits to the poor, such as measures to solve digital divide and to boost poverty reduction, this goal has a potential to be very effective and to escalate the number of cases. As to the issue of the security, special attention needed to be called for. The sub goal “2-3-1 Improvement in user literacy” to stay unchanged, but “2-3-2 User education of security, etc.” to be absorbed by “1-3-1 Improvement in cybersecurity”, and “2-3-3 Introduction of Training and Learning” to be absorbed into “1-3-1 Improvement in cybersecurity”, and “4-1 Application of ICT to Individual Development Issues.”

4.3.3. Development strategy goal 3. Development of ICT infrastructure

The development strategy goal 3. had many examples of aids due to the fact that the work was considered as part of developing telecommunications network, but as mentioned above, the widespread of ICT is changing the situation drastically.

The “3-1 Development of ICT Infrastructure” conducted many projects which included ODA loans to develop telecommunications infrastructures. Though current situation has it that such work on infrastructure is been carried out by private telecommunications carriers (mostly cell phone carriers) in many countries, but among the developing countries, they still need support in development of infrastructure. It is expected the needs for expanded trunk telecommunications network to emerge to cope with increasing connections of terminals and sensors to the Internet due to widespread mobile terminals and advancement of the IoT. Projects to push for universal services to the rural regions may continue to see needs. To sum up, the Sub Goal “3-1-1 Support for Development of Trunk Telecommunications network” to include both direct and indirect work on the development of the trunk network. Development of broadband access network and development of infrastructure in rural areas to be included as a part of the above development of trunk communications network.

The “3-2 Development of ICT base” included “Development of ICT parks”, “Development of data centers”, and development of publicly accessible facility” as its sub goals, but how suitable ODA loans could better serve in these cases require further reexamination by observing the current ICT situation in the relevant developing countries.

While the need for developing data centers are rising especially in developing countries, prompted by user terminals becoming more mobile (such as cell phones and tablets) and by increasing use of cloud computing , the private enterprise’s

involvement in developing publicly accessible facilities is considered essential. For this reason, the final and only sub goal to be the "3-2-1 Support for Development of Data Centers." There is an option of establishing ICT incubation center, which has a potential to become ICT facility but this is not be chosen as a sub goal.

4.3.4. Development strategy goal 4. Promotion of utilization and application of ICT

Development strategy goal 4. Promotion of use and application of ICT is the main theme of this project.

4-1 Application of ICT to Individual Development Issues

Application of ICT to individual development issues is expected to reach wide range of areas. Further discussions on such subjects as procurement methods and coordination amongst relevant departments to determine how to select the most suitable ICT for the project. No change in the sub goals.

4-2 Effective use of JICA-Net

JICA-Net has signed a cooperation agreement with GDLN (Global Development Learning Network) established with the cooperation of the World Bank, and is working together to share facility and knowledge. JICA has video conferencing system to simultaneously connect many facilities throughout the world. It also has widely-utilized e-Learning system. The teleconferencing system uses protocol ITUH.323 which offers high security, but is a relatively expensive codec system (such as Polycom's HDX series). But now the software that realizes the same protocol has been made available on PC and mobile devices, therefore, it is desirable to widen the range of the applications and use.

In case of live distribution, communicating with regions with a large time difference will be relatively difficult. Since there is a significant time difference between Latin America and Asia, including Japan, it is very difficult to find a convenient time zone for both parties to communicate. Under such situation, if the personal computer could be connected to participate in a teleconferencing from one's home, the problem could be mitigated. On-demand e-Learning system could also be used for self-learning. To conclude, sub goal of 4-2-1 Use and Expansion of Opportunity for Remote Training and Learning Skills will have an additional sub goal of 4-2-2 Expansion of Usage Range.

4-3 Improvement in efficiency and effect of cooperation using ICT

Not only improving efficiency and effect of ICT introduction in the JICA 's internal operations but the use of ICT for conducting projects are also mentioned in the guidelines. Application of ICT for project is been referred in the intermediate goal of 4-1, therefore here in this paragraph, only the internal operations will be discussed. JICA's business operations as a whole could be said that its efficiency and effect from introduction and managing the system, both domestically and in abroad, is improving.

Compared to examples taken from abroad, Japan's library operations and procurement operations utilizing ICT application are working effectively and with good results. Take the library operations for example, majority of public reports are downloadable in PDF format and browsable. Knowledge management offers JICA's business operations in accurate manner. Since the two sub coals, 4-3-1 Dissemination/transfer of existing knowledge and 4-3-2 Sharing/creating of acquired knowledge, are very similar in nature, therefore replace 4-3-2 with "Promotion of Introduction and use of new technologies." The "4-3-3 Application of ICT for business implementation" remains unchanged.

4.4. Review of thematic guidelines (draft)

The following amendments to thematic guidelines are suggested considering the above explanation.

Table 4.3.1 Amendment of thematic guidelines (draft)

Development strategy goals	Intermediate goals	Sub goals	Amendment of sub goals(draft)
1. Improvement of ICT policy-making capacity	1-1 Establishment of ICT policy	1-1-1 Formulation of ICT policy	Provisions in force remain.
		1-1-2 Introduction of the principle of competition	To be included in 1-1-1. Change to →1-1-2 Establishment of Telecommunications carriers policy
		1-1-3 Formulation of policy to solve internal digital divide	To be included in 1-1-1. Change to →1-1-3 Establishment of spectrum management system.
	1-2 Establishment of ICT industrial development policy	1-2-1 Establishment of industrial development guidelines and policy	Delete →1-2 Intermediate goals.
	1-3 Establishment of user protection policy	1-3-1 Formulation of information security policy	Amend to:1-3-1 Strengthening cyber security (national and individual basis). Move up category number to 1-2-1.
		1-3-2 Development of user protection laws	To be included in →1-3-1.
		1-3-3 Development of Intellectual property protection laws	Intellectual protection to be moved from ICT to industry development issues. Delete1-3-3.
2. Development of ICT human resources	2-1 Professional development of ICT engineers	2-1-1 Support for content creation	Delete due to being ambiguous.
		2-1-2 Development of SE resources	Move up category number to →2-1-1 Development of SE resources.
		2-1-3 Technology of Telecommunications	Move up category number to →2-1-2 Professional development of telecommunications engineers.
	2-2 Professional development of ICT policy practitioners	2-2-1 Development of administrative (working level) resources	Provisions in force remain.
	2-3 Improvement in ICT literacy	2-3-1 Support for improving user literacy	2-3-2 Security to be included in 1-3-1. Others to be included in use and application.
		2-3-2 User education of security, etc.	
		2-3-3 Introduction of training and learning	

3. Development of ICT infrastructure	3-1 Development of ICT infrastructure	3-1-1 Development of backbone network	"Development of facilities" to read "support telecommunications carriers." 3-1-1 Support for Trunk Communication Network development.
		3-1-2 Development of broadband access network	
		3-1-3 Development of infrastructure of rural areas	
	3-2 Development of ICT base	3-2-1 Development of ICT parks	To adjust with increased cloud computing, concentrate on developing data centers. 3-2-1 Support Development of Data centers.
		3-2-2 Development of data centers	
		3-2-3 Development of publicly accessible facility	
4. Promotion of use and application of ICT	4-1 Application of ICT to individual development issues	4-1-1 Application of ICT to support and promote good governance（e.g. e-Government）	Provisions in force remain for all 4-1-1 to 4-1-5 sub goals.
		4-1-2 ICT application for BHN issues（education, health/medicine, rural development）	
		4-1-3 ICT application for environmental disaster resiliency	
		4-1-4 ICT application for economical and industrial issues	
		4-1-5 ICT application for interdisciplinary issues	
	4-2 Effective use of JICA-Net	4-2-1 Use of remote training and learning skills	Change to →4-2-1 Use and expansion of opportunity for remote training and learning skills. Add, 4-2-2 Expansion of usage range
	4-3 Improvement in efficiency and effect of cooperation using ICT	4-3-1 Dissemination/transfer of existing knowledge	Provisions in force remain.
		4-3-2 Sharing/creating of acquired knowledge	Change to → 4-3-2 Promotion of Introduction and use of new technologies.
		4-3-3 Application of ICT for business implementation	Provisions in force remain.

The following table shows the resulting strategy development goals-intermediate-goals-sub goals. Those letters in bold are newly added goals.

Table 4.3.2 Amended development goals/intermediate goals/sub goals

Development strategy goals	Intermediate goals	Sub goals (tentative)
1. Improvement of ICT policy-making capacity	1-1 Establishment of ICT policy	1-1-1 Formulation of ICT policy
		1-1-2 Establishment of Telecommunications carriers policy
		1-1-3 Establishment of spectrum management system
	1-2 Establishment of user protection policy	**1-2-1 Strengthening cyber security**
2. Development of ICT human resources	2-1 Professional development of ICT engineers	2-1-1 Development of SE resources
		2-1-2 Professional development of telecommunications engineers
	2-2 Professional development of ICT policy practitioners	2-2-1 Development of administrative (working level) resources
	2-3 Improvement in ICT literacy	2-3-1 Support for improving user literacy
3. Development of ICT infrastructure	3-1 Development of ICT infrastructure	3-1-1 Support for Trunk Communication Network development
	3-2 Development of ICT base	3-2-1 Support for development of data centers
4. Promotion of use and application of .ICT	4-1 Application of ICT to individual development issues	4-1-1 Application of ICT to support and promote good governance（e.g. e-Government）
		4-1-2 ICT application for BHN issues（education, health/medicine, rural development）
		4-1-3 ICT application for environmental disaster resiliency
		4-1-4 ICT application for economical and industrial issues
		4-1-5 ICT application for interdisciplinary issues
	4-2 Effective use of JICA-Net	4-2-1 Use **and expansion of opportunities** for remote training skills
		4-2-2 Expansion of use range
	4-3 Improvement in efficiency and effect of cooperation using ICT	4-3-1 Dissemination/transfer of existing knowledge
		4-3-2 Promotion of introduction and use of new technologies
		4-3-3 Application of ICT for business implementation

Chapter 5 Internal and External Cooperation Enhancement

5.1 Cooperation among domestic organizations

5.1.1. Cooperation within JICA

(1) Related departments in JICA

(a) Infrastructure and Peacebuilding Department, Transportation and ICT Group.

Transportation and ICT Group (hereafter referred to as EITG) in Infrastructure and Peacebuilding Department (hereafter referred to as EI) is mainly in charge of work related to ports (including marine transport), railways, highways and bridges, aviation, and ICT.

Team 1 of the group is mainly in charge of ICT. As of October 2015, the team consists of a director and twelve staff. About four of those staff members are involved in work related to ICT, and most of them also work in the transportation field.

JICA-Net library desk is located within Planning and Coordination Division (hereafter referred to as EIPC) of the department.

(b) Knowledge management network

Based on JICA Knowledge management operational guideline (October, 2011), ICT knowledge management network (hereafter referred to as KMN) has been established in Infrastructure and Peacebuilding Department. It is expected to do the following operations for the purpose of project solution organization/systemization/theorization according to the work cycle, JICA human resource development, and other promotion of knowledge cultivation/accumulation/transmission:

*Guidelines by issue, position paper development and update
*Knowledge site database organization and management by field and issue
*Building and management of the network among ODA personnel
*Execution of research study and presentation of the results
*Dispatch of information to related operation practitioners, and technical assistance or ability enhancement
*JICA HRD training (including OJT)
*Other operations related to the knowledge management network

The structure of the network in year 2015 consists of one network manager (Deputy director general for EI, and group director for transportation and ICT), five office staff (EITG Team 1 staff), core members (Team 1 director), 34 members from other departments (three advisors, eleven members, 20 support members; all JICA staff, mostly from Team 1 above).

In 2014, there were ten activities such as internal study sessions, external (MIC, ADB, ITU) briefing sessions, and discussion meetings.

‘Thematic issue ICT assistance committee’ with external literates is set up for necessary support for knowledge management operations. Its mission is to give specialized and technical advice to the director general of EI About the following:

*Establishment/Change of guidelines by issue
*Concerning knowledge/know-how accumulation/sharing/application
*Concerning overall operation plans and evaluations
*Other matters concerning necessary items for operation execution

In 2014, there were four delegates to discuss the direction of the operation etc.

(c) Issue Departments

JICA takes its approach based on developmental issues. Currently, there are five departments that work on issues that are shown below. Each department and overseas office makes a major role to structure each project.

*Infrastructure and Peacebuilding Department (EI)
*Human Development Department (HM)
*Global Environment Department (GE)
*Rural Development Department (RD)
*Industrial Development and Public Policy Department (IL)

(d) **Domestic Strategy and Partnership Department**

It has two new departments established in 2013 to manage SMEs overseas business development operation through ODA: Project formulation/operation for supporting Japanese SMEs. Their main duty is to run three schemes: basic survey, request survey, and application/verification.

They run numerous projects that utilize SMEs' ICT products or technology (Transportation, agriculture, health, education, disaster prevention etc.), and they share and transmit the project results and lessons.

Also, they call for propose solutions using ICT from private enterprises using collective data from regional and issue departments and overseas offices, which was assembled as part of reinforcing matching issues in developing countries and products/technology from SMEs.

(e) Office of information system

The office runs JICA Information system and information security duties. It consists of Planning division, Information system division 1 and 2. It is not involved in ICT use in projects.

(f) JICA-Net

JICA-Net is a distance technical cooperation project, thus, it is not an organization, yet it should be mentioned here. It aims for efficiency and quality improvement in JICA operation through three ICT tools: TV conference system, multimedia learning materials, and JICA-Net library.

For TV conference system, TV conference devices (mainly, Polycom HDX series) installed in JICA operation sites (18 domestic, 58 overseas, as of August, 2014) are used, and it is connected to World Bank Global Development Learning Network (GDLN). Web Ex system (Cisco) is also installed.

In multimedia learning materials, various contents from JICA are available through streaming by JICA-Net Library. It was accessed 620,000 times (average of 1,700 per day) in the past year. In regular courses, 1,400 JICA volunteers self-study using seven assigned materials before their dispatch each year. The number of the material copies will be shown in Table 5.1.1.

Table 5.1.1 e-Learning material use

	Training related	Technical projects,. Volunteers	College lectures	Others	Total
2012	3,315 copies 39%	3,145 copies 37%	595 copies 7%	1,445 copies 17%	8,500 copies
2013	2,340 copies 52%	990 copies 22%	360 copies 8%	810 copies 18%	4,500 copies
2014	2,640 copies 44%	1,260 copies 21%	900 copies 15%	1,200 copies 20%	6,000 copies

Source: JICA material

(g) Office of media and public relations and social media response

Office of media and public relations (MP) manages JICA's external affairs. Following its social media policy, JICA has official social media accounts. Main accounts are managed by MP staff. Others are: eight Twitter accounts, 64 Facebook accounts (8 for HQ, 23 for domestic organizations, 26 for overseas offices, seven for projects), 29 Youtube accounts (10 for HQ, five for domestic organizations, 13 for overseas offices, one for a project), and two other accounts.

Some of those transmissions to the Internet from projects are done at the actual operation sites, and in numerous cases, MP is not involved in them. The debate on the social media treatment should be continued.

The distribution of videos as media is becoming highly crucial in the development field. Currently, promotion and e-Learning are the main matters in media, yet, various information distribution through Youtube videos may be done in the near future.

It will be also important to raise interactivity in social media.

(2) Policy proposal for cooperation within JICA

JICA consists of departments that work independently. In order to improve ICT efficiency and its use, cooperation and information sharing among departments and EITG Team 1, which is specialized in ICT. The following discussion will be based on that condition. Also, for operation execution, there may be an issue and a competent issue department for a trial. That most likely be set up in another group within EI.

There are two types of ICT use as shown in Chapter 2. One is indirect contribution to achieving its objective; information collection, accumulation, sharing, and efficiency improvement in office work. The other is strongly direct contribution to the objective achievement; observation for disaster prevention, data processing, GIS utilization. In the latter case, ICT knowledge from each department is particularly essential.

Yet, in evaluating a tool that has not been used in the past using IoT or Big-Data, an ICT group might carry out the duty. Especially, a system that ensures effective and smooth acquisition/organization of detailed and valuable domestic ICT-use information possibly stored in Domestic Strategy and Partnership Department (TA): Project formation/Operation for Supporting Japanese SMEs Division possibly carries (company data, product/technology information etc.) must be discussed.

(a) Information accumulation and cooperation in JICA

Each of JICA organization should run a project in a life cycle, such as the one shown below, operated in an organic linkage. To be more precise, it means to create an adequate routine of assistance and opinion-exchange in each stage of operation processes: project development (location of the developing country's need, requests), operation planning (developing and announcing the specifications, proposal evaluation), project implementation, and operation and maintenance (hereafter referred to as O&M).

In order to promote ICT use in projects, it is necessary to store detailed information as shown below in overseas offices and the competent departments; the start points of the technical cooperation or grant aid project development, as 'repository 51' from which the information can be pulled out whenever needed. In order to achieve it, it will be necessary to record and organize ICT use cases by issue and update it accordingly.

These three below shall be references for ICT use documentation.

-Project Research: IT use for MNCH, Maternal, newborn and child health. JICA, 2014.
-Digital identity toolkit-A guide for stakeholders in Africa. World Bank Group, 2014.
-Global health project repository (Appendix 2-7)

It is highly important to identify developing countries' needs. As noted in 3.1.2 (1), USAID or World Bank has a system that advertises for new technology, ideas, or business models in developing countries. It could be beneficial to attempt a system run by cooperation among overseas offices and HQ looking at such examples.

In the repository development above, ICT Group and KMN members will also participate. In the possible system, within the competent issue department, in case of examining ICT use application or proposal evaluation, ICT Group will advise.

On the other hand, in case of ICT use management in a project run mainly by ICT group, it is difficult to update ICT use status by thematic issue completely, thus, it is not efficient. However, by using IoT or Big-Data, ICT Group may do so in the case of evaluating a tool that has never been used in the past.

KMN members should include staff members who have experience of organizing tools such as those noted above in each department and gather vast ICT use know-how. Also, as the network's internal communication method, mailing list, can be set up for smooth information sharing. Moreover, it is recommended to share ICT use result and problems following the current '10% sharing rule 52.'

(b) Collection and organization of related information

As ICT trends and ICT use tendencies continuously change, it is effective to collect and organize the information noted below for the future ICT use promotion. Those activities will be shared and run by each issue department and ICT Group.

1) Subject issue departments

Cases (Success/Lessons) by thematic issue:

*Cases with great achievement, cases that expanded for its sufficient O&M, cases in which the system was applied to other matters, and cases that show points to be improved through its post-evaluation result by ICT use will be collected and organized.

Organization of ICT use patterns and things to be noted in ICT use by thematic issue:

*For instance, GIS, statistical processing, disaster prevention information system, emergency alert system, health information system, Intelligent Transport System (hereafter referred to as ITS), distance learning system, and other monitoring systems.

2) ICT Group

Cases whose theme is ICT use in international organizations, bilateral aid organizations and domestic and international IoT or Big-Data use cases.

Common necessary information in thematic issues:

*Checklist for understanding the local ICT environment
*ICT tool information for the development assistance
-Open tools by international organizations or bilateral aid organizations, e.g. World Bank published tool (refer to 2.3.1 (2) (b)).
*Mobile phone use patterns and related technology
-Website access method from mobile phones and web application development method and things to be noted about the development
-Mobile phone application development methods and things to be noted about the development
*Development in packages and customization methods
*Small-scale work software development methods
Interoperability, data format
*For instance, data format that makes application of the development achievement in other projects possible, e.g. geographical information
O&M content and things to be noted
Financial estimation method and things to be noted
*Estimate of prices, rights-related information (patent, use rights, licenses etc.).

(c) ICT use possibility input at pre-implementation stage

3.2.1. As noted discussing issues by work process, in case of technical cooperation, if

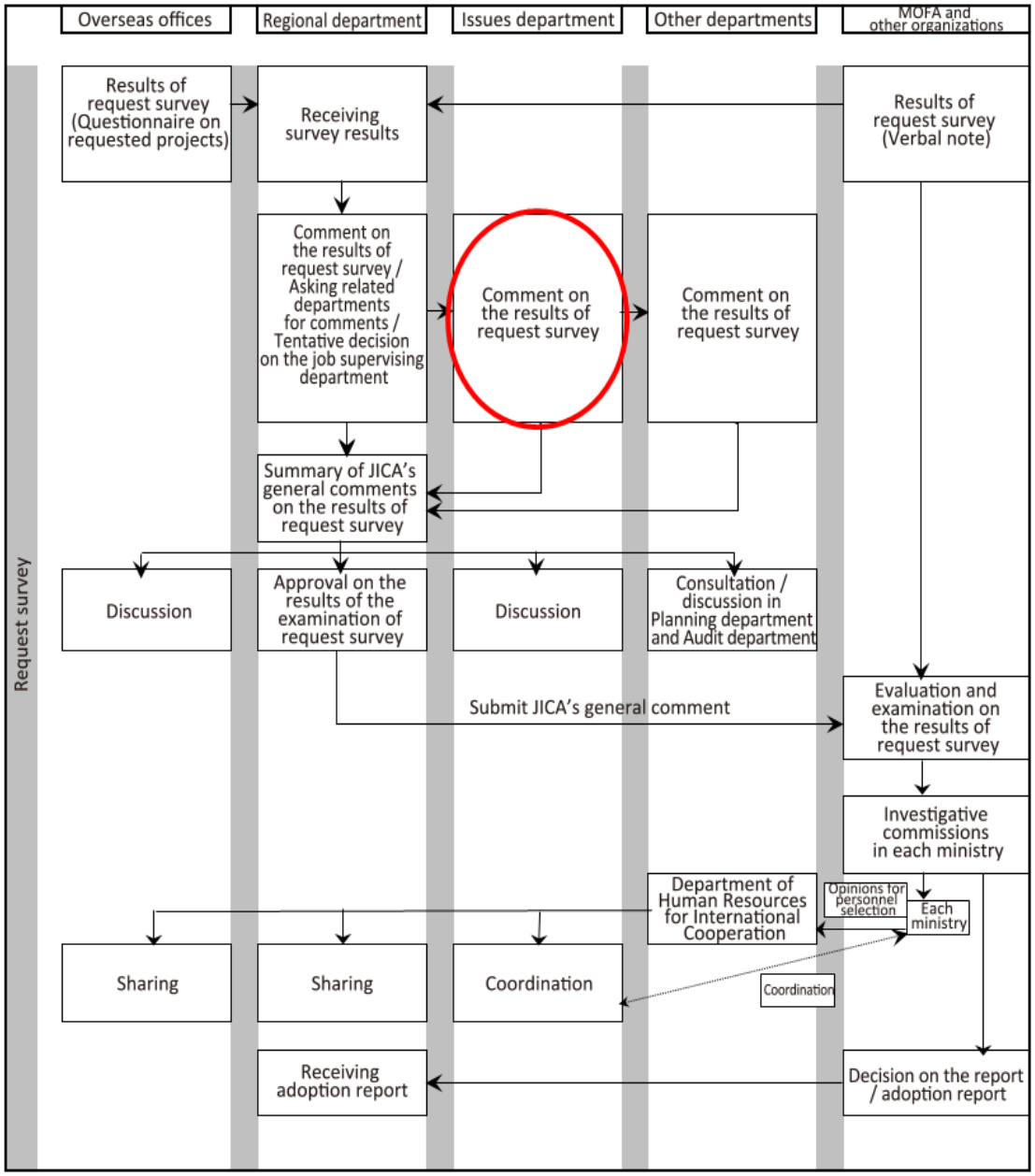
ICT-use can be highlighted within pre-implementation stage operation, it will help to notify the competent unit the stored information for the later ex-ante evaluation within JICA.

As a principle, it is considered important to have EITG input all the highlighted projects from a quality control point of view. Yet, since the number of projects that come from requested surveys all over the world is over 1,000; even only 10% of highlighted ICT-use will make more than 100 cases to be input. Therefore, debating a realistic form of response through trials is a crucial problem to tackle for the entire organization.

Table 5.1.1 indicates ex-ante evaluation process for technical cooperation through request survey (The point mentioned above is circled on the table).

51 Repository: Storage. Could also be called toolbox or database

52 System that notes 'Even the assignment is not from one's own department at the time, if it is strongly related to one's expertise, and if there is a need for him/her to share his/her specialist capability and knowledge internally or externally, upon the superior's approval, the assignment can be adapted as one of the annual objectives, which one shall give no more than 10% of one's work load.' JICA Implemented in 2013. It encourages it from the perspective of promoting knowledge sharing and transmission



*Requests are submitted any time.
*Adoption is conducted according to the above described flow even if the adoption takes place in the middle of the year.
*Requests based on demands, mid-year decision-making will also follow the procedure above

Table 5.1.1 Pre implementation stage evaluation steps for technical cooperation (in case of request survey project adoption)

(d) Collaboration among organizations in planning stage

In the implementation stage for technical cooperation, JICA develops PDM with the implementing agencies based on the project plan. At this stage, it will be important to examine the relevance of the project within the plan of the partner country, developmental issue range JICA offers and its regional operation plans as well as availability of possible ICT use methods to the project.

Thus, the examination of those methods such as referring to the repository, inquiring ICT Group aforementioned will be routine. ICT Group will advise on prospective methods to be adopted in projects.

Those JICA has never utilized before should also be actively considered for use in projects. Information collected on those methods will be as follows:

-Identifying necessary conditions for the ICT use (fees, specifications, personnel)
-Search for a possible tool vender for the adaptation to the project (location, the number)
-In case no vender is specified, setting conditions for bid
-Deciding sufficient details for bidders to estimate necessary functions, equipment, software, work amount, software, and expenses
-Setting a milestone that will show software development process and planned duration (if the development size is big)

After the decision is made on tool adoption, ICT Group will participate in the internal project planning process. Yet, if the related workload increases and goes beyond the group's work capacity, an independent unit or an adequate in-house consultant will be established.

The PDM will reflect all those points of information and brief them in a note section for Japan and partner country input.

Moreover, a project overview, particular specifications, and an estimate will be developed followed by preparation and operation of bidding for consultants and equipments. In case of a direct technical project, specialists shall be prepared.

(e) Collaboration among organizations in implementation stage

Implementation stage mainly consists of monitoring of the contractors (consultants or venders) and implementing agencies. Collaboration among organizations and adjustments will be done in following matters.

*Confirming the order specifications for re-contract

Confirmation will be done by the competent issue department/office etc. contacting ICT Group as needed.

*Maintenance planning assistance and confirmation

Request the implementing agency to create a maintenance plan and assist the development. Also, the main branch of the issue department/office etc. contacts ICT Group to notify and confirm its content. If necessary, comments or adjustment request will be made.

*Status confirmation at the project completion

At the project completion, the competent issue department/office etc. will examine maintenance system and finance. Record the knowledge as information tool with ICT Group, and store it in the repository.

Also, even in cases it is not initially noted to be adopted on PDM, it is possible to utilize ICT as needed, thus, the response structure should be flexible.

(f) Regular information sharing about ICT use in the organization

As stated above, ICT KMN is established in EI to enable wide trend recognition. On the other hand, currently, there are not many opportunities for official exchange of information regarding ICT use in projects. Creating a structure where information exchange regarding ICT use in projects is offered within implementation process will deliver a chance for identifying realistic and specific ways of ICT use on sites.

For instance, currently, ICT is used in work process capacity building projects, e.g. data collection and management, accounting, office functions. It is possible to think of ICT as a management tool that assures achievement, e.g. improved understanding of work process, regulated work processing, or visualized development progress, not merely a work efficiency tool.

Following that perspective, the successful cases of ICT use in projects should be actively reported in briefing sessions etc. in and out of JICA. For internal promotion, for instance, knowledge and new technology from project can be occasionally presented in KMN Brown Bag Lunch (hereafter referred to as BBL).

In order to proceed with the idea, commitment from JICA management will be necessary. Therefore, it is preferable to establish a system where ICT use will be monitored and promoted by management.

5.1.2. Collaboration with domestic research institutions

The collaboration with domestic research institutions has been done through SATREPS and with JST, Japan Science and Technology Agency. The collaboration is research cooperation among research institutions in Japan and developing countries run by joint-investment from JICA and JST. SATREPS projects have numerous ICT use cases including those that are unfamiliar to the standard technical cooperation projects. Also, NIED (National Research Institute for Earth Science and Disaster Prevention) has shared projects before in a thematic issue, disaster prevention.

There are other collaboration possibilities as well with ministerial National Research and Development Agencies (hereafter NRDA), e.g. through verifying/proving new technology in developing countries. Especially, NICT (National Institute of Information and Communications Technology) has developed a new ICT such as a communication network for disasters, manages standard time, and has numerous technologies, e.g. multi-language speech translation technology. Specifically, NICT leads U-STAR, Universal Speech Translation Advanced Research Consortium, and its multi-language speech translation technology is a technology that could be utilized in fields such as sightseeing, medicine, airport guidance, and accessibility assistance. Also, super high frequency imaging technology visualizes the interior of historic sites or architectures by using super high frequency waves, e.g. microwave, millimeter wave, terahertz wave. Although this institution's successes require numerous conditions, they have already been verify-tested, and some have been productized, e.g. Nervenet, which easily realizes rural telecommunication, mesh connection corresponding cognitive wireless router which uses both cognitive and mesh wireless networks, or NariTra that uses the multi-

language speech technology. There are cases that some companies have participated in some of those implementations or production using the technologies. Therefore, incorporating those technologies could be done in a structure where, in each project, commissioned consultants or college researchers collaborate with the manufacturing company accepting indirect assistance from NICT. Thus, although it is not a direct collaboration, it is beneficial in a sense that Japan's research resource being efficiently utilized in developmental assistance, therefore, it is an ODA in a wide view. In Public Works Research Institute (hereafter referred to as PWRI) for instance, ICT use delivers excellent technology in disaster prevention and infrastructure O&M. Also, JAXA is expected to maintain and expand the collaboration link not only in their specialized field, e.g. satellite launching, but also general-purpose technology.

When technical cooperation arises, the competent issue department shall thoroughly examines which of these specified technologies from NRDAs can be applicable or if they will be functional in developing countries, and should actively decide to use adequate technologies. Furthermore, having the adopted technology as a base, create a technical cooperation case to present to developing countries as a proposal may be possible, too.

Each NRDA has its own international activities. JICA could also cooperate with those in various ways. For example, CAESAR (Center for Advanced Engineering Structural Assessment and Research) concluded a technical cooperation agreement with Thailand Ministry of Transport, Department of Rural Roads in 2011 and has maintained requisite communication ever since. It is possible for JICA to operate a technical cooperation project upon request under that framework. Also, in ICHARM, Global Centre of Excellence for Water Hazard and Risk Management, at PWRI, water hazard related research (including development of e.g. hazard map, flood analysis system) takes place. JICA co-operates a training project related to those research activities. It is possible for JICA to expand the collaboration to technical cooperation projects.

53 A decentralized network and application with wireless multihop technology. Base stations can be automatically interconnected. At the time of disaster, if one route experiences a problem, it immediately switches to a different route and secures communication line. Base stations can accumulate and synchronize data. In case of a communication failure, necessary information can still be acquired from accessible base stations.

54 Router uses cognitive wireless technology; which senses the surrounding radio wave condition accordingly and reconfigures the device-setting and connection with base stations for better wireless transmission without interfering with other systems, and wireless mesh network technology.

55 The travel speech translation application, which translates speech dialogue to different languages, can be used in Narita airport. The software can be downloaded to iPhones and Androids.

5.1.3. Collaboration with private enterprises

As a principle, JICA believes that 'the growth of enterprises' activity is crucial for sustainable development in developing countries and around the world. How much ODA can do by itself is limited, and collaboration between ODA and private enterprises will lead to achieve the development,' and it has raised the importance of collaboration with private enterprise. Therefore, JICA's basic policy is to 'reinforce the partnership with private enterprise and businesses, and to install/assist private enterprise activity environment in developing countries in a prompt manner to aim for win-win-win relationship among the developing country, private enterprise, and ODA.'

Following the policy, as private collaboration schemes, JICA has structured overseas investment/loan, preparatory survey: PPP Infrastructure project, preparatory survey: BOP business cooperation enhancement, Assistance Utilizing Private-Sector Technologies for social and economic development in developing countries, Small and Medium Enterprises (SMEs) Overseas Business Development, grassroots technical cooperation (based on a proposal from a community) and promotes private enterprise's participation. Within those schemes, there are ICT uses in Small and Medium Enterprises (SMEs) Overseas Business Development, preparatory survey: BOP business cooperation enhancement, and Assistance Utilizing Private-Sector Technologies.

Currently, cases of ICT use in projects are not so many, however, the fields it is used in are in variety, e.g. education, health, water resources/disaster prevention, transportation, natural resources and energy, economic policy, agricultural/rural development, urban/regional development. Those projects' main purposes are as various as business model development, project planning, possibility-analysis of product/technology/system, verification and evaluation, or BOP business project preparatory survey, and the content of ICT use very much varies for the projects being proposal-based. There are twenty some cases e.g. promotion of efficiency in agricultural product-distribution and traffic observation, traffic control/planning using traffic simulation, smart agriculture using ICT, distance learning, finance and information infrastructure using e-money, and solar power generation/wireless communication. There are numerous advanced ICT cases also, and those can be good references for future project planning.

SMEs Overseas Business Development has many cases featuring local companies' participation. While Japan's ICT business opportunities tend to concentrate in the capital sphere, giving local ICT related companies chances to expand, especially, giving SMCs chances to expand overseas leads to regional revitalization. Also, opportunities for local companies to develop solutions for local problems and to seek business chances in developing countries widen the range of ODA participation.

Grassroots technical cooperation (based on a proposal from a community) scheme is a development aid that uses knowledge and experience gained in process of collaboration among public government, local universities, and companies in locally cultivated medical system, regional development, or agricultural/rural development. It is a development aid that initiates locally.

Preparatory survey (BOP business cooperation enhancement) delivers chances for companies that are interested in BOP business and cooperate and make a progress together. In Assistance Utilizing Private-Sector Technologies, JICA assists private enterprises with promotion opportunities of their products, technology, system etc. to developing country governments, to which they usually do not have chances for promotion. It is a valuable scheme for private enterprises.

Private enterprises can choose adequate schemes for their company size and

utilize them.

Meanwhile, in recent years, many large or middle-size domestic ICT related companies are involved in CSR activities. Many of those big companies locate it as one of their main operations and clearly state their motivation for involvement. While there are many types of social issues, active use of advanced ICT and many proven implementation cases are especially seen in areas of environment, disaster prevention, agriculture, and health.

These companies are interested in expanding delivery of their technology based on many successes as problem-solution to developing countries, and they present JICA proposals when chances arise. Using companies' knowledge is necessary for taking ICT trends into development aid. It is difficult for JICA to develop a specific technology on its own and apply it. Therefore, JICA acknowledges the necessity of having private enterprise (ICT venders etc.) participate in the development regardless of the type of contribution and company sizes. However, not all the proposals are necessarily becoming projects. Efficiency in matching needs must be debated. An issue can be partially caused when the company does not efficiently understand the concerned developmental issue in the partner country.

Through data collection and reporting on the development country's issue from regional and issue departments and overseas offices, JICA has been attempting matching-reinforcement. Although country choices can be limited, the company's affiliate company collects information for the company's correct understanding of the developing country's needs.

Also, in a project that involves system development, O&M needs to be arranged. Development of an O&M system in collaboration with the company's regional branch or local companies also can be in vision. Grasping the local needs accurately is crucial in overseas operations. There have been some cases of Jagaad Innovation 56: Export of distinctive market environment of newly developing countries, or the localized products and solution to developed countries. Yet, in Japan, due to excessive burden from resources, without some exceptions, companies that practice this are scarce. If that is possible, it may enable companies to propose a project to JICA that have aspects of problem-solving in developing countries.

JICA and companies sharing their local needs information and the information the companies have may lead to both a detailed image of ICT use that the developing country needs, and more effective development aid. Thus, it could be a good idea to establish a space for thorough discussions on matching for ICT use, e.g. COP 57, Community of Practice, with a theme, 'Today's ICT use in Development Aid and its Future', a forum with a theme,

'ODA and ICT use' and invite development consultants, ICT and other related companies. Establishing a space for more open discussions such as those above is desirable. Matching of development consultants and ICT venders/software houses and listing human resources that could participate in research can also be an effective strategy for collaboration with private enterprises.

There are numerous collaboration schemes in foreign organizations and private enterprises. USAID runs GDA, Global Development Alliance (business collaboration program), where personnel from public and private sectors cooperate, and others where it collaborates with companies in wide area (refer to 2.3.6). Also, in the World Bank, there is a channel that introduces knowledge on the latest ICT based on General Framework Agreement (refer to 2.3.1). This agreement initially focuses on the internal work efficiency improvement, yet, aims to collaborate with private enterprises. World Bank also has a case of a competition regarding Big-Data. It can be a reference for adapting external knowledge.

JICA has various collaboration schemes for private enterprises, which have been utilized by many companies. Yet, placing a space for discussions with private enterprises, which was mentioned here would be beneficial for further success with improved results in developing countries and efficiency in development aid.

56 Jugaad Innovation: Jugaad stands for 'an innovative fix; improvised solution born from ingenuity and cleverness' in Hindi. There is a book titled 'Jugaad Innovation- A frugal and flexible approach to innovation for the 21st century'

57 COP: Communities of Practice- 'an informal or formal group of practitioners that shares knowledge on common development problems while pursuing joint solutions.' Regardless of professional affiliation, in the group, people actively share their work-related knowledge and experience to stimulate learning and promote professional development (Refer to Communities of Practice Questions and Answers: World Bank). World Bank utilizes COP for various assessments.

5.2. Cooperation with international institutions and bilateral assistance institutions

5.2.1. Multilateral Development Banks

In collaboration with MDBs (Multilateral Development Banks), e.g. World Bank, Asian Development Bank, in an effective ICT ground design (e.g. master plan, road map – called differently depending on the country), based on the donor's agreement, a project will be shared. This manner is also applied for other areas.

As one type of Technical Assistance (TA) by MDBs, there is ICT policy planning assistance (e.g. institution-building). Our technical cooperation (e.g. specialist dispatch) could be run, for example, before or after TA or in parallel.

However, from past experiences, it seems fairly difficult to combine a loan project of a MDB such as World Bank and Japan's technical cooperation project.

5.2.2. ITU-D

There have been several cooperation cases such as when MIC cooperated in the

Philippines regarding a disaster or Japanese government response to Ebola (refer to Appendix 2-6), yet, there is not a cooperation case with JICA in a project. Therefore, regarding cooperation, plenty is uncertain. However, since ITU-D has many medical projects, the possibility of cooperation remains in that specific field. Japan has potential vendors that would offer technology. JICA technical cooperation has medical projects that focus on specific diseases. Whether ITU-D can offer tools shall be debated. Also, if the JICA project means to mainly work at central government level and not at a medical practice site, it is possible that a network made by ITU-D will be utilized in policy application and publicity.

5.2.3. Bilateral assistance institutions

In a bilateral assistance institution such as USAID or DFID, there is a unique ICT use in projects by ICT venders in each country. Cooperation policy is debatable.

On the other hand, a field whose software and equipment standardization, e.g. disaster prevention, weather, GIS, is fairly done, has a high possibility of cooperation. It is necessary to examine cooperation potential through each organization assistance adjustment.

Appendix

Appendix1: Examples of JICA Technical Cooperation Projects utilization and application of Information and Communication Technology (ICT)

Appendix 1-1 ICT

Classification	ICT: ICT
Project name	The Feasibility Study on Establishment of the E-Government Platform
Scheme	Development Study
Target country	El Salvador
Present stage	Completed [2006]
Objective	By conducting a feasibility study towards establishment of an e-government platform in El Salvador, following a project identification and development survey carried out by the Japan Bank for International Cooperation, a concrete plan for building the platform is formulated and a project (ODA loan and the like) for implementing the plan is assisted. A feasibility study regarding e-government platform, as well as system and application to be built preferentially are conducted.
Use & Application of ICT	Designing the outline of the e-government platform, Designing the outline of application

Classification	ICT: ICT
Project name	E-Government Development: strategy and policies (Vietnam)（一

	般訳）
Scheme	Technical cooperation project
Target country	Singapore
Present stage	Completed [2006-2007]
Objective	By providing trainees with an opportunity to acquire the knowledge and techniques of the e-government development, the project aims to contribute to human resource development in the said field in Vietnam.
Use & Application of ICT	E-government development training

Classification	ICT: ICT
Project name	Database Management (Myanmar)（一般訳）
Scheme	Technical cooperation project
Target country	Singapore
Present stage	Completed [2006-2007]
Objective	By providing trainees with an opportunity to acquire the knowledge and techniques of information management, the project aims to contribute to ICT human resource development in Myanmar.
Use & Application of ICT	Presenting information management system, Relations between data models and SQL, Training for database development

Classification	ICT: ICT
Project name	Development of the foundation for nurturing IT industry（一般訳）
Scheme	Technical cooperation project
Target country	Singapore
Present stage	Completed [2006-2007]
Objective	Trainees can apply the knowledge and skills acquired during training courses to their own countries. It aims to contribute to the improvement and the development of the IT industry foundation in the Asian countries.
Use & Application of ICT	Providing the following training to the middle and the high administrative officers in charge of development of the infrastructure for IT industry: lectures, field visits/observation, case studies, panel discussions, country report presentations.

Classification	ICT: ICT

Project name	Telecommunications technology (Third-Country Training)
Scheme	Technical cooperation project
Target country	Vietnam
Present stage	Completed [2006 -2008]
Objective	The knowledge and skills of those technicians who play a central role in maintaining and operating the digital telecommunication networks in CLMV countries (Cambodia, Laos, Myanmar and Vietnam) are improved.
Use & Application of ICT	Intensive training courses on maintenance and operation of the telecommunication network.

Classification	ICT: ICT
Project name	Project on Informatics Curricula Modernization in Bosnia and Herzegovina Phase 2
Scheme	Technical cooperation project
Target country	Bosnia and Herzegovina
Present stage	Completed [2010-2014]
Objective	Improving the quality of IT education in local gymnasia, in collaboration among the education authorities of three ethnic groups.
Use & Application of ICT	IT education

Classification	ICT: ICT
Project name	Project for Improving IT Education at Secondary School Level
Scheme	Technical cooperation project
Target country	Bosnia and Herzegovina
Present stage	Being implemented [2014-2016]
Objective	Improving the quality of IT education in general courses of higher secondary schools, in collaboration among the education authorities of the three ethnic groups.
Use & Application of ICT	IT education

Classification	ICT: ICT
Project name	Advanced IT Human Resource Development Project
Scheme	Technical cooperation project

Target country	Philippines
Present stage	Completed [2011-2012]
Objective	By providing training courses which match the needs of the IT industry demanding high-level IT technicians, the organization of the University of the Philippines IT Training Center (UP-ITTC) as the base for human resource training is strengthened, as well as the technical and financial independence and expansiveness of the UP-ITTC's operation become more sustainable.
Use & Application of ICT	Newly establishing courses aiming to sophisticate the education contents, such as courses on programing in-car devices, programing devises to be installed in movable robots, programing smartphone devises, and high-level network security.

Classification	ICT: ICT
Project name	Project on Capacity Building for Information Security
Scheme	Technical cooperation project
Target country	Indonesia
Present stage	Being implemented [2014-2017]
Objective	The capacity of the Indonesian Ministry of Information Technology to employ the information security measures are improved. Building the system to assist the introduction of Index KAMI (Indonesian version of ISO27001). Building the system to assist the introduction of CSIRT (Computer Security Incident Response Team).
Use & Application of ICT	Information security, Indonesian version of ISO27001, CSIRT

Classification	ICT: ICT
Project name	Technical Cooperation Project for Optical Fiber Techniques in Telecommunications Engineering
Scheme	Technical cooperation project
Target country	Bhutan
Present stage	Being implemented [2014-2017]
Objective	The capacity of the Bhutan Telecom technicians to design, execution-manage, operate, and maintain the optical fiber networks is developed.
Use & Application of ICT	O&M system of the network of the optical fiber users

Classification	ICT: ICT
Project name	Support for NICI-2015 implementation
Scheme	Individual project (Expert)
Target country	Rwanda
Present stage	Completed [2011-2012]
Objective	By actively developing the ICT and ICT-related fields, socio-economic development in Rwanda is accelerated. The system for implementing the third strategic plan of the National Information Communication Infrastructure (NICT) (2011-2015) is strengthened.
Use & Application of ICT	NICT (National Information Communication Infrastructure) process

Classification	ICT: ICT
Project name	System Management for e-Government Promotion
Scheme	Individual project (Country-Focused Training)
Target country	Rwanda
Present stage	Completed [2012]
Objective	High reliability of the Information system is ensured, in order to computerize the central government ministries and municipalities. Trainees become able to identify solutions for the problems related to the system operation of the institution they belong to.
Use & Application of ICT	Training of system management for e-government promotion

Classification	ICT: ICT
Project name	IP Network Development and Management for E-Government Promotion
Scheme	Individual project (Country-Focused Training)
Target country	Rwanda
Present stage	Completed [2012]
Objective	For computerization of the central government ministries and local municipalities, a reasonable IP network development is promoted. An appropriate internal network is developed for e-government promotion.
Use & Application of ICT	Training of IP Network Development and Management for e-Government Promotion

Classification	ICT: ICT
Project name	ICT Private Sector Development & Policy Development Support
Scheme	Individual project (Expert)
Target country	Rwanda
Present stage	Completed [2013-2015]
Objective	Promoting the use and application of ICT in the Ministry of Youth & ICT and the Private Sector Federation of ICT Chamber of Commerce for contributing to the policy making, operational capacity building and industrial development.
Use & Application of ICT	Industry-standard guidelines and framework in the ICT industry.

Classification	ICT: ICT
Project name	Earth Observation Advisor
Scheme	Individual project (Expert)
Target country	South Africa
Present stage	Being implemented [2014-2017]
Objective	The knowledge and techniques of the Earth observation using satellite are improved in South Africa and the Southern African Development Community.
Use & Application of ICT	Rader satellite ALOS-2 (On-board synthetic aperture radar)

Appendix 1-2 Education

(1) Primary Education

Project name	Capacity Development of Learning Resources Centers（LRCs）for Science Education utilizing ICT
Scheme	Technical cooperation project
Target country	Jordan
Present stage	Completed [2006-2009]
Objective	Making functional the center to train teachers who can implement the science education utilizing ICT (from the 7th to the 10th grades), and train teachers.
Use & Application of ICT	Science education utilizing ICT
Post-fact evaluation	Regarding the effectiveness and impact, it was initially aimed to diffuse in a cascade system the teaching methods developed by this

	project. However, QRC (the implementing agency) not being able to operate and manage the training in cooperation with FD (local boards of education)/LRC, LRC is simply providing a training venue and equipment. It was confirmed that this project brought about a ripple effect; for example, the teaching methods utilizing ICT under this project are now applied to classes other than those in the trial schools and science, which were the subject for this project; FY2012 Third-Country Training course "student-centered science education teaching methodologies for Palestine" (一般訳) in Jordan was implemented and the ICT utilization is spread to the neighboring countries too. Therefore, effectiveness and impact is moderate. With regard to sustainability, many of the teachers and staff trained in the project continue their work and training of trainers using the pedagogy developed by the project is continued to be implemented even after the project was over. However, while the portal site for providing information by Internet is present, there is not sufficient IT infrastructure such as personal computers and Internet accessibility outside of the trial schools in the pilot area. Moreover, even some of the trial schools (schools where trainer-level teachers work) did not have Internet accessibility. Lessons learnt for JICA: 1) While education using ICT is effective in poor and/remote areas, establishment of the IT infrastructure is imperative for its diffusion. Therefore, having a good IT infrastructure at the school should be a requirement for introducing the e-learning. 2) When objectives are human resource development and training system establishment, it is necessary that the institutions concerned have management capacity. In this project, central QRC lacked sufficient management capacity to expand trainer training in cooperation with local governments, teacher training center involving QRC and local FD/LRC was not established. Therefore, when trying to establish a human resource development system, it is necessary to include in the project a component of capacity-building to operate and manage the system, not only human resource training itself.

Classification	Education: Primary Education, Citizen participation: Citizen participation
Project name	Sustainable use of ICT for improving the quality of primary education in rural Mongolia
Scheme	JICA Partnership Program (Partner)
Target country	Mongolia

Present stage	Being implemented [2012-2017]
Objective	By effectively applying digital teacher-training materials which are adapted to the local needs, local primary school teachers' in-class leadership and teaching skill are improved. As a result, 1) The system of Mongolian State University of Education (MSUE) for supporting production of digital training material for digital teachers is enhanced, and; 2) Trainers of primary school teachers from 21 states in Mongolia as well as teachers in charge of training representing each state acquire knowledge and skills necessary for developing digital teaching materials.
Use & Application of ICT	Production of the digital training materials

(2) Lower Secondary Education, Upper Secondary Education

Classification	ICT: ICT, Education: Upper secondary education
Project name	The Project on Informatics Curricula Modernization
Scheme	Technical cooperation project
Target country	Bosnia and Herzegovina
Present stage	Completed [2008-2010]
Objective	A system to formulate and update a common IT education curriculum in collaboration among education authorities from the three ethnic groups is established.
Use & Application of ICT	IT education

(3) Higher Education

Classification	Education: Higher Education, ICT:ICT, Peacebuilding: rehabilitation and reconstruction of socioeconomic infrastructure
Project name	The Project for training e-Learning engineers (Third-Country Training and In-Country Training Program) （一般訳）
Scheme	Technical cooperation project
Target country	Sri Lanka
Present stage	Completed [2005-2010]
Objective	High quality e-Learning engineers are trained in Sri Lanka and its neighboring countries and e-Learning is implemented in those countries.
Use & Application of	Distance learning

ICT	

Classification	Education: Higher Education, ICT:ICT
Project name	The Project for Research and Education Development on Information and Communication Technology in Institut Teknologi Sepuluh Nopember
Scheme	Technical cooperation project
Target country	Indonesia
Present stage	Completed [2006-2010]
Objective	By enhancing the research capacity of Institut Teknologi Sepuluh Nopember in the field of ICT, it becomes possible to provide human resources holding advanced skills in ICT to the industry, universities and governmental research institutes located mainly in the eastern Indonesia.
Use & Application of ICT	Training high-level human resources in the domain of ICT

Classification	ICT-ICT, Education: Higher Education, Peacebuilding: rehabilitation and reconstruction of socioeconomic infrastructure
Project name	International Training Course on Information Technology based Electric Engineering Education (Third-country Training)
Scheme	Technical cooperation project
Target country	Indonesia, Target country (others): Uzbekistan, Bangladesh, Nepal, Timor-Leste, Kenya, Tanzania, Zambia, etc.
Present stage	Completed [2007-2010]
Objective	Instructors of the higher education institutions in the Asia and Africa utilize the IT technology in their educational activities and the methodologies and quality of education in the regions are improved.
Use & Application of ICT	Educational activities using IT

Classification	ICT:ICT, Education: Higher Education
Project name	Human Resource Development in IT Service Industry at NUOL
Scheme	Technical cooperation project
Target country	Laos
Present stage	Completed [2008-2013]
Objective	IT service industry is developed in Laos. Human resources adapting to the needs of the IT service market are developed, through the

	ITSC (Master course in IT Specialist) in IT division of the Faculty of Engineering of the National University of Laos (NUOL).
Use & Application of ICT	Software engineering skills and business skills

Classification	ICT:ICT, Education: Higher Education
Project name	USP-JICA ICT for Human Development and Human Security Project
Scheme	Scheme Technical cooperation project
Target country	Fiji
Present stage	Completed [2010-2013]
Objective	The University of the South Pacific (USP) contributes to ICT human resource development in the Pacific. Attractive Computer Science (CS) / Information System (IS) courses are offered across the region. ICT-related service-providing capacity of the USP is enhanced.
Use & Application of ICT	Distance learning

(4) Vocational training/ Industrial technology education

Classification	ICT – ICT, Education – vocational training/ industrial technology education
Project name	IT & Mechatronics System Technology
Scheme	Technical cooperation project
Target country	Singapore
Present stage	Completed 2006-2007
Objective	Trainees will learn applied knowledge on mechatronics technology mainly using IT application programs.
Use & Application of ICT	IT application programs, mechatronics technology

Classification	Education – vocational training/ industrial technology education, Gender and development – gender and development, Poverty reduction – poverty reduction
Project name	Project for Strengthening the Capacity of Training Management of Vocational Training Corporation (VTC)
Scheme	Technical cooperation project
Target country	Jordan
Present stage	Completed 2006 – 2010

Objective	An efficient VTC operating model will be established to ensure that training programmes are in tune with the needs of the industry. The Project will establish a database on the support activities as well as evaluation data management of the model training centre.
Use & Application of ICT	Database
Post-fact evaluation in 2014 (Internal evaluation)	It was concluded that although the project had some challenges, overall, most objectives were achieved. At the beginning of the project implementation, there were some problems on monitoring and evaluation in terms of data volume/ processing which made it difficult to acquire necessary information for decision making or data analysis. In order to solve this problem, a database was introduced based on the basic information on training courses. This enabled effective information management on the collected data and improved satisfaction level on the monitoring and evaluation system.
Mission team's comments	This is a good example in which the database has been operated sufficiently and as a result became useful for monitoring and evaluation and led to improving work efficiency.

Classification	ICT – ICT, Education – vocational training/ industrial technology education
Project name	Project on Implementation of Mid-Level ICT Diploma Course in Mozambique Information and Communication Technology Institute (MICTI)
Scheme	Technical cooperation project
Target country	Mozambique
Present stage	Completed 2007-2009
Objective	Mozambique Information and Communication Technology Institute (MICTI) will be able to provide a middle-level diploma course on information technology to fit the needs of Mozambique's ICT industry.
Use & Application of ICT	Network, website design course, programming, multi-media course

Classification	Education – vocational training/ industrial technology education, ICT – ICT, Poverty reduction – poverty reduction
Project name	The Project on Strengthening the Program of Expanding Industrial Automation Technologies Department
Scheme	Technical cooperation project
Target country	Turkey
Present stage	Completed 2007 – 2010
Objective	Training system for teachers will be established in Teacher

	Training Centre (TTC)
Use & Application of ICT	Vocational training course on industrial automation technologies

Classification	ICT – ICT, Education – vocational training/ industrial technology education, Governance – public safety
Project name	Project on the capacity development of New CNS/ ATM system (Third Country Training) （一般訳）
Scheme	Technical cooperation project
Target country	Philippines
Present stage	Completed 2007 – 2009
Objective	Basic knowledge and skills on the new CNC/ATM will be shared among air traffic controllers and air traffic control engineers in each ASEAN country
Use & Application of ICT	New Communications/Navigation/Surveillance and Air Traffic Management Systems (New CNS/ATM system)

Classification	ICT – ICT, Education – vocational training/ industrial technology education
Project name	Project on ICT Human Resource Development at ICT Training Institute in the Union of Myanmar
Scheme	Technical cooperation project
Target country	Myanmar
Present stage	Completed 2006 – 2011
Objective	Information and Communication Technology Training Institute (ICTTI) under the Ministry of Science and Technology will be able to provide exercise based ICT training
Use & Application of ICT	ICT training

Classification	ICT – ICT, Education – vocational training/ industrial technology education
Project name	Capacity Building on ITEE Management Project
Scheme	Technical cooperation project
Target country	Bangladesh
Present stage	Being implemented 2012 – 2015
Objective	IT Engineers Examination Center (ITEE) will be established as Bangladesh's national certification examination system to be operated sustainably and appropriately.
Use & Application of ICT	IT Engineers Examination Center

(5) Educational administration

Classification	ICT – ICT, Education – educational administration
Project name	IT Human Resources Development Advisor
Scheme	Expert
Target country	Rwanda
Present stage	Completed 2011 – 2012
Objective	IT human resources development policy will be established in Rwanda
Use & Application of ICT	IT human resources development policy

(6) Education (Others)

Classification	Education – education (others), Peace building – public/social infrastructure services support
Project name	Education Media Advisor
Scheme	Expert
Target country	Papua New Guinea
Present stage	Completed 2009 – 2011
Objective	Distance learning policy will be formulated and the capacity of the Ministry of Education will be strengthened to implement the policy.
Use & Application of ICT	Distance learning

In addition, some activities from assistance on the overseas expansion of SMEs projects and preparatory surveys (BOP business promotion) will be introduced as examples of proposal based projects.

Project name	Preparatory survey on BOP business for the Information Technology Engineers Examination (ITEE) using e-learning system which can be operated under vulnerable network environment （一般訳）
Scheme	Assistance on the overseas expansion of SMEs
Target country	Bangladesh
Present stage	Completed 2014
Objective	・To provide education information services using video editing program 'ThinkBoard' (in-house development). This will be customised to be used for the teaching materials for ITEE in Bangladesh. At the same time, the use of learning management system aims to monitor the progress of learners, resolve the problem of lack of teaching materials, improve examination pass rates through more effective learning as well as human resource development of IT engineers in Bangladesh. ・During this survey, possibilities of using the product in Bangladesh as well as future business development will be

	considered through demonstrations at local universities.
Use & Application of ICT	E-learning system

Project name	Preparatory Survey on BOP Business on hybrid education business in Indonesia
Scheme	Preparatory Survey (BOP Business Promotion)
Target country	Indonesia
Present stage	Completed 2011-2013
Objective	To develop hybrid education system (combination of distance learning using mobile phones and face to face education) and provide its services.
Use & Application of ICT	Distance learning system using mobile phones

Project name	Preparatory Survey on BOP business on developing leaders in rural area with remote e-education systems
Scheme	Preparatory Survey (BOP Business Promotion)
Target country	India
Present stage	Completed 2011-2012
Objective	To provide education programs for farmers using tablets and distance learning via tele-centres. At the same time, entrepreneurs will be trained and educated to provide services for farmers. These entrepreneurs will provide agricultural information services to farmers as a business.
Use & Application of ICT	Distance learning

Project name	Preparatory survey for Educational Service Business for BOP
Scheme	Preparatory Survey (BOP Business Promotion)
Target country	India
Present stage	Being implemented 2013 – 2015
Objective	To provide educational service business by combining multi-media contents and projectors and easy to understand teaching method in order to improve the quality of education for children in BOP.
Use & Application of ICT	Multi-media contents

Project name	Preparatory survey on BOP business to establish e-learning education services for children（一般訳）
Scheme	Preparatory Survey (BOP Business Promotion)

Target country	Sri Lanka
Present stage	Being implemented 2014 – 2016
Objective	To expand opportunities for female employment/ empowerment as well as provide opportunities for education for children. By collaborating with Sri Lanka Women's Developmental Services Cooperative Society, women in BOP with certain education level will be selected to become facilitators. E-learning system using Ogawa method for primary school level mathematics will provide high quality and efficient education not dependent on the quality of teachers.
Use & Application of ICT	E-learning system

Project name	Preparatory survey on BOP business for the utilisation of e-learning for secondary education and capacity development of professionals（一般訳）
Scheme	Preparatory Survey (BOP Business Promotion)
Target country	Bangladesh
Present stage	Being implemented 2015 – 2018
Objective	To provide education/ learning services using ICT by combining online materials and text books to secondary education students (junior high school and high school students), university students and local IT company staff. This will result in improvement of education quality and promotion of employment.
Use & Application of ICT	E-learning

Below are summaries of interviews on the initiatives for the education sector (primary education).

Interviews to the Human Development Department

i) Possibilities and outlook of ICT utilisation

- In India, there are examples such as Ricoh's collaboration with an NGO Save the Children to provide projectors without the use of external power supply or participation to the public-private partnership seminars by private companies such as Hitachi and Sony. Therefore there are high expectations on the use of ICT among private sector partnership and BOP business. Currently in Bangladesh, NetLearning, Inc. and PADECO are implementing a BOP business on e-learning.
- There are request for use of ICT under the Grant aid. For example, ICT related equipment could be installed with the construction of schools.
- There is no need to mention about ICT in PDM. It is more appropriate to mention the use of ICT in either Plan of Operation (PO) or instruction manual.
- For the education sector, different types of ICT could be used according to each target.
- For example, use of ICT could be categorised as below
  1. Students: Mainly in classes such as use of tablets or electronic blackboards (concerns on the availability of electricity or the Internet)
  2. Teachers: Provision of trainings or materials (expected to use smartphones)
  3. Administration: Resource management using EMIS (more efficiency and cutting down on cost anticipated)

  In terms of the use of ICT in administration, 'The Project for Support for Improvement of School management Phase II in Nepal' is currently collecting information to improve school management. The project team is considering the use of ICT to alleviate burden on information collection efforts for the end users or information management.
- Since ICT can create network, there is a possibility to connecting above categories of students, teachers and the administration.
- In general, former colonial powers have advantages than Japan in terms of language and contents of teaching curricula. In terms of consistency with curricula, it may be difficult to apply ICT. However, rather than provision of full on use, supplementary use is also possible.
- In recent years, Japanese education have attracted attention from the world in terms of activities other than teaching such as sports day, students cleaning their own school, outside class activities and so on. The Ministry of Education, Culture, Sports, Science and Technology has expectations for the export of Japanese style education system. JICA also wishes to contribute to promoting Japan's education system to developing countries and thus collaborates with private sector to implement projects as a team Japan (currently ICT related companies are not yet partners). However since participating companies are also competitors within Japan, it is difficult to reveal all their resources to each other.
- There are difficulties for private companies to participate in public education sector. At the same time, it is difficult for private companies to make profits only

with education services. For example, it might be possible to promote provision of funding, building facilities or provision of maintenance services if a school was utilised as a community centre to provide services such as health check-ups.

- On the whole, technology has made great advancements. JICA needs to research on various case studies to include them in our activities.

ii) Possible use of ICT related equipment/ application programs

Examples of utilisation of Education Management Information System (EMIS)

- EMIS (various basic information, information on location etc.) is used by organisations such as the World Bank in Laos, Afghanistan etc. However, in many cases the system is not utilised effectively or lack maintenance. JICA hopes to utilise the system so that the collection of statistics and integration of existing data are utilised effectively for the educational administration (In the past JICA has dispatched EMIS Expert).

Tablets

- In many cases, the quality of teachers in developing countries is in question. However, there is a possibility for the teachers to use tablets to provide teaching content or use them as a supplementary item to provide quality classes. In addition, tablets can be used for individual lessons or for those wanting to study at their own pace. SuRaLa Net Co. Ltd. is implementing such BOP business in Sri Lanka.
- For example, the benefit of KUMON program is that the tasks are set according to the level of each student. Use of tablets allows selecting the most appropriate level automatically. This allows students to study at home and at schools the students can focus on group works or discussions. This learning style changes the role of teachers as facilitators. It is not yet known if this learning style is appropriate in developing countries. However, teachers in developing countries are more likely to accept new style than teachers in Japan who are more conservative and have a strong resistance to new things.
- In terms of social inclusion programs such as education for persons with disabilities, there are high expectations on the effectiveness of the use of tablets. The use of ICT allows overcoming physical difficulties. The use of tablets is also being considered in a large scale project in Mongolia. Since the number of target group is small and the market is small-scale, it may be difficult to make a profit as a business. Therefore this is an area the public should make a commitment.

Electronic blackboards

- A certain company is considering an introduction of electronic blackboards. Electronic blackboards not only function as a blackboard but they can also be used as a multi-media display unit to project various images. The teachers can provide more visually interesting lessons.

Mobile phones

- Many people in developing countries possess mobile phones. Therefore there are discussions on the ways to make use of mobile phones.

SNS and others

- There are various free educational contents on YouTube and there are discussions on whether these could be utilised in any way. NHK makes all of their educational programs available to the public free of charge. In Bangladesh, there is a project to create educational contents in collaboration with NHK International (This is a cultural grant assistance project to create TV programs similar to that of NHK's educational programs. ICTs are used for some cultural grant assistance programs such as provision of shooting equipment).
- There are possibilities for teachers to share their teaching materials or conduct group discussions on teaching methods/ contents via SNS. In Japan, there is a SNS dedicated for teachers as well as virtual class rooms to comment on each other's classes or teaching materials to improve teaching quality. Although it might be difficult to use SNS as the main tool, it could be introduced as a part of a technical cooperation project.

iii) Challenges on the use of ICT

- Challenges in terms of introducing the use of ICT in developing countries are lack of electricity or communication network. Even if these are available, in many cases the supply is unstable. There are also concerns on who should bear the cost of purchasing tablets, how to provide maintenance, whether teachers can handle the technology and equipment etc. For example, Samsung implements a project in Ghana to provide a tablet for each student. It is necessary to provide trainings to teachers to master its use.
- Since there are limited case studies, there are no reports on the problems arising from lack of knowledge in using ICT. In fact the problem is the lack of ideas on how to make use of ICT in various programs.

Appendix 1-3 Health Sector

(1) Healthcare System

Classification	Health-Healthcare system, Poverty Reduction-Poverty Reduction
Project name	Project for Strengthening Medical Logistics
Scheme	Technical Cooperation Project
Target country	Laos
Present stage	Completed 2005-2008
Objective	Obtain the situation where the system is established in order to effectively and appropriately manage and use the medicines, medical supplies and devices at the central and the provincial

	level. Establish the facilities of the Logistics Center as a project activity. Build the database to manage the medicines, medical supplies and medical devices. The Medical Devices Maintenance Service Center (MES) should check the operational status of the central and the respective provincial hospitals and input them into the database. The Logistics Center should monitor the inventory status of the warehouses of the health bureau in the 4 target provinces by utilizing the database.
Use & Application of ICT	Database
Post-fact evaluation (2011,Internal evaluation)	When judged in a comprehensive manner, this project is evaluated to be partially accomplished. It was confirmed that the project targets were achieved at the time of the-end-of-the project evaluation, but it cannot be said that the effects of these achievements are maintained after the project completion. There was no dead stock found both in the central Logistics Center and in the warehouses of each province. However, the data about the utilization ratio of the medical devices in the central and provincial hospitals were not monitored, thus it cannot be verified. As for the database, MPSC (Medical Products Supply Center) should build the information management system which can cover the information of all the provinces.
Comments of the delegation	Even though the respective hospitals were managing their inventories, it was not sufficiently governed on the database of the central hospital. Therefore, it seems that the established system could not be fully utilized.

Classification	Healthcare System, Poverty Reduction
Project name	Project for Improvement of Medical Service in the Central Region
Scheme	Technical Cooperation Project
Target country	Vietnam
Present stage	Completed 2005-2010
Objective	The training activities for the improvement of the medical services, which are conducted by Fue Central Hospital toward provincial hospitals, should be expanded and improved based on the medical services training management cycle. The database of the provincial hospitals should be kept and managed in order for Hue Central Hospital to understand the situation of medical services in each provincial hospital.
Use &	Hospital Database

Application of ICT	
Ex-post evaluation (2014,Internal evaluation)	When judged in a comprehensive manner, this project is evaluated to be highly accomplished. The project goal was achieved through the implementation of the model medical services such as trainings for the medical staff members, the total care, countermeasures against the in-hospital infection and the system for the patient information. The improvement of the medical services in the provincial hospitals is gradually getting achieved. As for the sustainability, the Ministry of Health has approved to facilitate the model medical services introduced by this project, and the medical staff members of the provincial hospitals in the central region have necessary skills to conduct this model. On the other hand, some problems were found; the provincial hospitals do not have sufficient staff members to implement the model medical services, and do not have enough budget to burden the training fee at the Fue Central Hospital.
Comments of the delegation	It is assumed that the countermeasures against in-hospital infection, the system for the patient information and the database of the provincial hospitals contributed to the improvement of the model medical services, however, the sustainability remains questionable.

Classification	Healthcare System, Gender and Development, Poverty Reduction
Project name	Project for improvement of health service delivery at community level
Scheme	Technical Cooperation Project
Target country	Bolivia
Present stage	Completed 2007-2012
Objective	Have the health service network strengthened for the residents of the target region so they can have the high-quality prevention, promotion and the medical examinations. As one of the project achievements, the office work and financial management system should be introduced in the healthcare facilities and it should function well.
Use & Application of ICT	Office Work and Financial Management System

Classification	Health-Healthcare System, Poverty Reduction
Project name	Project on health promotion & preventive care measures of

	Chronic NCDs
Scheme	Technical Cooperation Project
Target country	Sri Lanka
Present stage	Completed 2008-2013
Objective	Formulate an effective and efficient implementation model for the prevention of non-communicable diseases.
Use & Application of ICT	The Database for the Utilization of the Registry and Risk Factor Survey

Classification	Healthcare System, Poverty Reduction
Project name	The District Health Information System Project For Evidence-Based Decision Making and Management
Scheme	Technical Cooperation Project
Target country	Pakistan
Present stage	Completed 2009-2013
Objective	Collect, input, aggregate, analyze and utilize the data for the Ministry of Health/National Health Information Resource Center (NHIRC) / Provincial Health Bureau / Provincial healthcare offices. The training regarding the administration/instruction for the District Health Information System (DHIS)
Use & Application of ICT	Healthcare Information System

Classification	Health-Healthcare System, Poverty Reduction
Project name	The Project on Strengthening of Medical Equipment Management in Referral Hospitals
Scheme	Technical Cooperation Project
Target country	Cambodia
Present stage	Completed 2009-2014
Objective	The base of the network should be formed for the consultation, support and supervision of medical equipment management. Strengthen the abilities which are necessary to provide information by utilizing the network as well as the ability to provide consulting
Use & Application of ICT	Management System of the Medical Equipment

Classification	Health-Healthcare System
Project name	Support to Human Resource Development in health sector of DRC
Scheme	Technical Cooperation Project
Target country	Democratic Republic of the Congo
Present stage	Completed 2010-2013
Objective	The organizational operation ability of the authorities which are related to the healthcare-personnel should be enhanced. As a project achievement, an information management system of the healthcare manpower should be installed. As a concrete project activity, determine the definition of the healthcare manpower information database, and create it with the healthcare manpower registration lists as a base. Establish the data renewal system of the healthcare manpower information in each province.
Use & Application of ICT	Database for the Healthcare Human Resource

Classification	Health-Healthcare System
Project name	Enforcement of Management of Health System in Tambacounda and Kedougou
Scheme	Technical Cooperation Project
Target country	Senegal
Present stage	Completed 2011-2014
Objective	Organize the management of the healthcare information system in the provincial medical bureau and the healthcare districts.
Use & Application of ICT	Healthcare Management Information System, Database

Classification	Healthcare System
Project name	Strengthening Development of Human Resource for Health
Scheme	Technical Cooperation Project
Target country	Tanzania
Present stage	Completed 2011-2014
Objective	The human resource development plan should be formulated at the central, provincial and district levels, and the education, cultivation and the training of the healthcare staff should get improved in order to offer the high-quality healthcare services. As for the establishment of Training Institution Information System (TIIS), JICA dispatched individual experts of “Strengthening Development of Human Resources for Health” since November,

	2008, to the Ministry of Health and Welfare. JICA has been developing and supporting the operation of Human Resource for Health Information System (HRHIS) as well as cultivating human resources with the approach of 5S-KAIZEN-TQM for the Total Quality Management (TQM) targeting to the hospital managers. In this Technical Cooperation Project, promotional activities of HRHIS were conducted so it spreads to the provinces and districts nationwide.
Use & Application of ICT	Human Resource for Health Information System (HRHIS)

Classification	Health-Healthcare System
Project name	Project on Health Systems Strengthening
Scheme	Technical Cooperation Project
Target country	Myanmar
Present stage	Being implemented 2014-2018
Objective	Improve the quality and efficiency of the medical services in Myanmar. Project activities include enhancement of Health Information Management System (HIMS), preparation of the database for the healthcare staff training, enhancement of information analysis ability based on HIMS.
Use & Application of ICT	Healthcare Management Information System, Database related to the Training of Healthcare Human Resources

(2) Infectious Diseases

Classification	Health-HIV/AIDS, Gender and Development-Gender and Development, Peace Building-Public Infrastructure Social Services
Project name	HIV/AIDS Collaborating Center among GMS countries
Scheme	Technical Cooperation Project
Target country	Thailand
Present stage	Completed 2005-2008
Objective	Obtain the situation where the HIV/AIDS Regional Coordination Center functions as a regional coordination center to support the cultivation of the staff against AIDS in Cambodia, Laos, Myanmar and Vietnam, receiving recognition from the related agencies. Activities of this project include collecting of information, building of the database of human resources, studies and activities and its update on a regular basis, launching of the website and its management, submission of newsletters/annual reports, and the

	dispatch of information about RCC as well as its activities through other media.
Use & Application of ICT	Database, Website
Ex-post evaluation (2013,Internal evaluation)	When judged in a comprehensive manner, this project is evaluated to be highly accomplished. This project pursued to establish RCC as a regional coordination center to offer trainings and information about countermeasures against HIV/AIDS. In general, it is assumed that the expected effect is being produced because RCC has established the network for the ability development in Thailand and the CLMV countries regarding the countermeasures against HIV/AIDS.
Comments of the delegation	Through its activities targeted to the CLMV countries and Thailand (Building of a manpower database of experts and people in practical businesses in the field of HIV/AIDS, training course for trainers, information services on the website and newsletters), RCC has built up the contacts with 66 related agents by the end of the project, and with this fact, it can be said that this was a case where people were widely connected by the information shared by ICT and thus had an effective operation.

Classification	Other Infectious Diseases, Poverty Reduction
Project name	Project for the Control of Chagas Disease Phase 2 (Establishment of Sustainable Surveillance System)
Scheme	Technical Cooperation Project
Target country	Guatemala
Present stage	Completed 2009-2013
Objective	The Chagas disease surveillance system with the participation of the local residents (hereafter ‘surveillance system’) should be strengthened. As one of the project achievements, the department in charge of Chagas disease should be equipped with the ability to plan and operate the surveillance system, and to M&S and send out the information. Design the information system which are composed of the communication and reporting structure, the reporting modality, the selection criteria of the measures to be taken and the database etc..
Use & Application of ICT	Infectious Disease Surveillance System

Classification	Health-Other Infectious Diseases

Project name	The Project for Development of Rapid Diagnostics and the Establishment of an Alert System for Outbreaks of Yellow Fever and Rift Valley Fever
Scheme	Technical Cooperation Project- Science and Technology (SATREPS: Science and Technology Research Partnership for Sustainable Development)
Target country	Kenya
Present stage	Being implemented 2012-2017
Objective	The containment system of outbreaks for yellow fever and Rift Valley fever should be strengthened through the development of the rapid diagnosis and the establishment of the sustainable outbreak warning system. It is an achievement that the interactive (between Ministry of Health and the targeted medical institutions) early-warning/immediate action mechanism model was established against yellow fever and Rift Valley fever. On top of oral communications, build the mobile phone network with SMS as an outbreak alert system of infectious diseases.
Use & Application of ICT	mobile SMS-based infectious disease Outbreak alert System

Classification	Health-Malaria
Project name	Project for Establishment of an Early-warning System for Infectious Diseases in Southern Africa Incorporating Climate Predictions
Scheme	Technical Cooperation Project- Science and Technology (SATREPS: Science and Technology Research Partnership for Sustainable Development)
Target country	Republic of South Africa
Present stage	Being implemented 2014-2019
Objective	The early-warning system to prevent the epidemic of Malaria, pneumonia and diarrheal disease should be developed, enforced and evaluated in the low-veld area along the borders between Northern Mozambique and Zimbabwe including the province of Limpopo of the South Africa. The models of the climate and infectious diseases and the surveillance system should get combined, and verifications should be made by using the data of the past and present. The early-warning system of the infectious diseases for the quarter term should be prepared and offered to the governmental agencies in the target areas.

Use & Application of ICT	Infectious Diseases Early-warning System

(3) Maternal and Child Healthcare / Reproductive Health

Classification	Health-Maternal and Child Healthcare / Reproductive Health, Poverty Reduction-Poverty Reduction
Project name	Project for Improvement of Health Services with a focus on Safe Motherhood in the Kisii and Kericho Districts
Scheme	Technical Cooperation Project
Target country	Kenya
Present stage	Completed 2005-2008
Objective	The maternal healthcare should improve in the target area of the project with HC (Health Center) and the communities in center. Achievement 1: Maternal care services improve at the HC level. Achievement 2: Management ability at the HC level improves. Achievement 3: The district healthcare bureau's support anf supervision system for HC get strengthened. Achievement 4: Appropriate measures to be taken at the community level regarding the maternity care. Achievement 5: Referral System (between HC and district hospitals) gets prepared and functions well.
Use & Application of ICT	Communication Devices (wireless radio or mobile phones)
Ex-post evaluation (2013,Internal evaluation)	The sustainability of the project effect is moderate level. When planning a project where the technical equipment and devices are used (ICT equipment etc.), it is necessary to pay full attention to the trend of technical innovation and avoid the equipment to be obsolete before it produces the expected effects. In this project, a community telephone called Simu ya Jamii was introduced and the communication between HC and referral hospitals were aimed to improve while creating an income at the same time (phone charge). However, this equipment became the surplus in a short period as the mobile phones rapidly spread in Kenya.
Comments of the delegation	It was the time of drastic change for the mobile environment and the project witnessed the obsolescence, but it is assumed that the base of the mobile environment would not change in a drastic way for the near future. It is essential to pay attention to the future trend of ICT related devices, on top of the mobile environment.

For the implementation situation of this project, information collected by the hearings shall be included.

Classification	Maternal and Child Healthcare / Reproductive Health, Healthcare System
Project name	A Collaboration Project for the Development of ICT Telemedicine for Perinatal Care and Diabetes in Thailand
Scheme	Grassroots Technical Cooperation Project (Community Proposal type)
Target country	Thailand
Present stage	Being implemented 2014-2016
Objective	By introducing the healthcare/medical system utilizing the telemedicine network system, the medical standards of the targeted areas should get aimed to be improved. ・ Procured the English version of mobile CTG (cardiotocograph) systems and diabetic community critical pathway system (Large hospitals and primary care doctors work in collaboration to provide the medical care) and introduced and build them in into the Kagawa Medical Internet eXchange (K-MIX) (standard system of the Japan Association of Obstetricians & Gynecologists). ・Create the Thai language version of electronic medical charts (perinatal period, diabetes)
Use & Application of ICT	CTG (cardiotocograph) system, Diabetic community liaison pathway system, Electronic medical chart (perinatal period, diabetes)
Attentions paid upon ICT utilization	・Smooth introduction and operation of ICT in the realistic medical settings such as Chiang Mai University Hospital. ・Considerations and actions toward the increased amount of the works at the medical front
Problems encountered and to be improved	・ Coordination with TOT (Telephone Organization of Thailand) to secure the network environment ・Selection of the business entity of medical ICT (on referral from Chaing Mai University) ・Understanding of the specifications of ICT devices by the local people ・ Complication and difficulties to export equipment and devices (customs declaration)
Measures to take for the solution	・Careful explanation through the detailed demonstration about the operation by using the sample equipment ・The customs declarations were done with a cooperation from

	C/P (Chaing Mai University)
Know-hows that can be applied to other similar projects, matters to be careful with	・Introduction and operation of ICT to the medical front (The local sites do not wish a major change of the existing condition) ・Care to the medical front that have increased amount of work (Basically the work increase is not welcomed) ・It is recommended to introduce system server etc. in collaboration with the local computer devices manufacturer (it was a Japanese business entity for this project)
Existence of problems regarding information security and the measures to take if any	There are no particular problems. It is possible to meet the requests from the local side with no difficulty because the personal data protection and information security regarding the medical system is stronger (encryption technology etc.) in Japan.
Positive(Negative) impact due to the use of ICT	It is not possible to continue operation without maintenance management skills on the local side regarding the highly-developed systems and equipment.

The 4 projects of Support for Japanese SMEs Overseas Business Development will be described here as samples of the proposal type projects.

Classification	Telediagnosis
Project name	Project formation survey for enhancing medical cooperation driven by telemedicine and distance training
Scheme	Support for Japanese SMEs Overseas Business Development
Target country	Vietnam
Present stage	Completed 2012
Objective	・A real time interactive system where the images created by the diagnostic imaging unit including MRI and CT can be operated remotely ・Equipped with the function of video conference, doctors can discuss diagnoses as if they were talking face-to-face ・Improvement of the diagnosis efficiency as well as the in-hospital efficiency by making the filmless images
Notes	It is the case of a diffusion and proof project in Vietnam with the aim of eliminating the patients' congestion at the hospitals in the urban areas, improving the medical service quality at the community clinics, and utilizing IT in the healthcare and medical sector.

Classification	Telediagnosis
Project name	Medical information exchanging network system for quality medicals services
Scheme	Support for Japanese SMEs Overseas Business Development
Target country	Vietnam
Present stage	Completed 2013
Objective	・Build a network system of community medical information which connects medical institutions in Nghệ An Province. The medical information network system “Mame net” (being operated in Shimane pref.) is used. Mamenet is in conformity to the standards for the exchange of health information (HL7) where the health information of patients are shared between the medical institutions. - Implementation of the system operational training for the doctors and staff members in the hospitals, clinics, and health centers. - Modified the specifications of the electronic medical chart and the functions of teleradiology in order to fit in Vietnam, and conducted the on-site application survey. - Formulate the draft of guideline regarding the exchange of health information.
Use & Application of ICT	Community Medical Information Network System, Electronic Medical Chart/Teleradiology

Classification	Measuring Instrument for the Medical Use
Project name	The feasibility Study concerning Improvement of Neonatal Healthcare through Introducing Inspecting Equipment for Neonatal Jaundice
Scheme	Support for Japanese SMEs Overseas Business Development Feasibility Study
Target country	Vietnam
Present stage	Completed 2013
Objective	Conduct a feasibility research on the measuring instrument dedicated to the measuring function for the neonatal jaundice in Vietnam, where there are some issues about neonatal jaundice.
Use & Application of ICT	Neonatal Jaundice Diagnostic Device
Notes	The business entity that went through this research is offering a

	suggestion to form a Technical Cooperation Project with a purpose to transfer the neonatal management technology including the jaundice (neonatal care, improve the regional medical care level, ability improvement of the health professionals). .

Classification	Telemedicine
Project name	Diffusion and proof Project on Mobile Car Clinic (Dr. Car)
Scheme	Support for Japanese SMEs Overseas Business Development (Diffusion and proof Project)
Target country	Sudan
Present stage	Completed 2013-2015
Objective	・Mobile car clinic equipped with medical instruments necessary in the rural areas of Africa ・Work in cooperation with the doctors of major hospitals through the telemedicine system ・Create a database of the medical history by using authentication instruments and the PHR (Personal Health Record) system. "Dr. Car" in general means a medical vehicle which get dispatched to the site with a doctor on board, and it often functions as an ambulance in case of emergency. By contrast, Dr. Car proposed in this project functions as a mobile clinic with full-time doctors and nurses of the base hospitals on board, for the rural and remote areas where there are no doctors permanently. It can also share the diagnosis data with the base hospitals via the Internet, thus it can offer the mechanism where medical examinations, treatments and diagnoses can be conducted remotely yet continuously from the base hospitals even after the doctors left. It is a "Large terminal unit for the medical care". Yet another characteristics of Dr. Car is that it can provide drinking water because it is equipped with the water purification system.
Use & Application of ICT	Telemedicine, DB, USB ultrasound imaging equipment, Simplified electronic medical charts, Water purification system, Utility self-supplement system
Special Notes	AXIOHELIX Co. Ltd., which conducts proof tests in Gezira state for the MOFA and proceeds a diffusion project in Khartoum state for JICA, is planning to establish its local subsidiary in Sudan in order to start full-fledged businesses.

The below is the information collected by the hearings about the issues in the health sector in general.

Summary of the hearings to the Human Development Department (Healthcare)

There are only a few projects where the ICT is utilized since the ICT is a tool, not the purpose itself.
In the field of healthcare system, it is valued to develop a structure such as the national healthcare system, or the resident/birth registration (to secure the measuring method for the Universal Health Coverage) and thus such parts are focused. It is not yet the time to discuss ICT utilization as a major factor.

i) Current status

- In the healthcare sector, there are only a few projects where the ICT is utilized.
- ICT is a tool and not the purpose. The first issue to think about is how the components of the healthcare system can be utilized. Only after solving these issues, it becomes possible to use ICT as well. There is no way to form a project with the base that ICT will be there.
- When bringing ICT in the project, pay attention to the resource allocation within the partner country's government and within JICA upon selecting the technology. The decisions should be made with the viewpoint if it is the most appropriate in the whole resource allocation.
- Maintenance is considered to be a major issue for the sustainable system operation. Also, it is understood that it is important not to make the system operation an end itself.
- In the field of healthcare system, preparation of resident registration and birth registration have been valued (to secure the measuring method for the Universal Health Coverage) and it is not necessarily a question about ICT use.
- There are some promotional projects against NCDs targeted to the local communities, or the project where a part of medical examinations and diagnoses are made, but more projects deal with the structures such as development of the national healthcare system.
- Within the Human Development Department, there are not very many cases where the ICT resources or tools are shared (apply what was used for other project to another project etc.) or the knowledge management is implemented. Although it is not ICT, the approach methods are shared in the department (e.g. Promotion of the use of Maternal and Child Health Handbook. Promotion of the use of Maternal and Child Health Handbook or the introduction of the Maternal and Child Health Handbook model with the aim of improving the healthcare system).
- What are conducted in the schemes such as JICA Partnership Program or the Support Projects for Japanese SMEs are not conducted in the Technical Cooperation Projects (no cross development), and this is because of the difference of the project types, which are proposal type and the request type.
- When you see the projects of the international or bilateral institutions where ICT is utilized, you might have the impression that it is not easy to use ICT (e.g. even though the commodities management system was introduced, it lost consistency of its data, thus the desired use cannot be

realized etc.). “Sector issues” allocated to each project are determined by the person in charge based on the contents and purpose of the project. In the healthcare sector, “ICT” rarely get selected as a sector issue because there are only a few projects where the ICT is the project purpose itself, or the projects where the ICT is embedded.

- Projects such as constructions of large hospitals, which are quite common recently, consist of the building (hard) and the in-hospital information communication system (soft) components and they are not separable.
- It happens from time to time that the private business entities market themselves to JICA. JICA would never instruct to ”use this technology in this project” in response to this.
- There is an idea of business cycle where the achievement of the project is confirmed with the evaluation, by the third party included, and this will lead to the acquiring of the next budget as well as the project expansion/development (e.g. the use of mobile devices in the SATREPS projects “The Project for Development of Rapid Diagnostics and the Establishment of an Alert System for Outbreaks of Yellow Fever and Rift Valley Fever”. It is highly-evaluated, including the cost. The project is currently prepared for the expansion).

ii) Examples of ICT utilization in the healthcare sector

- Strengthening Development of Human Resource for Health
  - Tanzania: “Strengthening Development of Human Resource for Health” project covers the human resources information of the training schools of all the country. It is a successful case.
  - Democratic Republic of the Congo: “Support to Human Resource Development in health sector of DRC” is a project that developed a database of workforce information.
- Measures against Infectious Diseases/Early-warning System
  - Kenya: an early-warning system of infectious diseases (SMS was used to collect information to the central from the regional areas when the outbreak of infectious diseases occured)
  - South Africa: Project for Establishment of an Early-warning System for Infectious Diseases in Southern Africa Incorporating Climate Predictions (utilization of satellite technology)
- Example of ICT utilization in the departments other than Human Development Department in the field of healthcare
  - ICT is well used in the PPPs (including the Support for Japanese SMEs Overseas Business Development Projects and the) (e.g. Telemedicine, diffusion and proof project of medical information system)

Appendix 1-4 Water resources/disaster prevention

(1) Comprehensive water resources management, urban water supply and regional water supply

Classification	Water resources/disaster prevention-comprehensive water resources management
Project name	Comprehensive Study on Water Resources Development and Management for Bali Province
Scheme	Technical cooperation project
Target country	Indonesia
Present stage	Completed 2004-2006
Objective	To develop a master plan for comprehensive water resources development and management for Bali Province. To develop a framework for water resources development and management. The activities include: (1) collection and analysis of the existing data, (2) study of the local situation, (3) local survey, and (4) meteorological and hydrological analyses.
Use & Application of ICT	GIS software, GIS spatial analysis software, database software, GPS

Classification	Water resources/disaster prevention-comprehensive water resources management, environmental management-environmental administration in general, poverty reduction-poverty reduction
Project name	The Study on Integrated Water Management in the Republic of Bulgaria
Scheme	Development survey
Target country	Bulgaria
Present stage	Completed 2006-2008
Objective	To establish national guidelines on the GIS system, monitoring planning and development of integrated basin analysis approaches in collaboration with C/P.
Use & Application of ICT	GIS, database

Classification	Water resources/disaster prevention-comprehensive water resources management
Project name	Capacity Building of the Water Quality Management in Sava River Basin in the Republic of Serbia
Scheme	Technical cooperation project
Target country	Serbia
Present stage	Completed 2006-2007
Objective	For the related organizations including the Republic

	Hydrometeorological Service of Serbia (RHMS) to acquire the capacity to protect citizens from potential threat of drinking water pollution in order to protect the environment and conduct sustainable water resources management.
Use & Application of ICT	Automated water quality monitoring system

Classification	Water resources/disaster prevention-regional water supply, ICT-ICT
Project name	Capacity Development on Groundwater Development and Management for Climate Change Adaptation
Scheme	Technical cooperation project
Target country	Cuba
Present stage	Completed 2008-2012
Objective	To use water resources appropriately in the eastern region. To improve the capacity of the National Water Resources Institute and other organizations to develop and manage groundwater.
Use & Application of ICT	GIS

Classification	Water resources/disaster prevention-comprehensive water resources management, water resources/disaster prevention-flood control
Project name	Integrated Study Project on Hydro-Meteorological Prediction and Adaptation to Climate Change in Thailand
Scheme	Technical cooperation project - SATREPS
Target country	Thailand
Present stage	Completed 2009-2014
Objective	To select an observatory for near-real-time observation, incorporate the telemetry system and observe on a continuous basis. To develop an integrated system of hydrological and meteorological data from near-real-time surface rainfall map using satellite images, weather radar, rain gauge and meteorological models.
Use & Application of ICT	Integrated system of hydrological and meteorological data from near-real-time surface rainfall map, simulations
Classification	Water resources/disaster prevention-comprehensive water

	resources management
Project name	Water Resources Information Center Project Phase 2
Scheme	Technical cooperation project
Target country	Syria
Present stage	Completed 2010-2014
Objective	For the General Commission for Water Resources (GCWR), Ministry of Irrigation, to use information on water resources effectively.
Use & Application of ICT	Management of information on water resources, intranet
Classification	Water resources/disaster prevention-comprehensive water resources management
Project name	Study on Impact of Glacier Retreat on Water Resource Availability for cities of La Paz and El Alto
Scheme	Technical cooperation project - SATREPS
Target country	Bolivia
Present stage	Being implemented 2010-2015
Objective	To develop a system to support development of water resources policies adapted to climate change, provide policy makers with information and expertise based on the system and consider measures of adaptation. (System: system to collect and analyze data on water resources, operate different models, carry out simulations, share information and expertise based on simulations and renew and apply such information)
Use & Application of ICT	System to support development of water resources policies, simulations

(2) Flood control/landslide measures

Classification	Water resources/disaster prevention-flood control, resources/prevention-landslide measures, poverty reduction-poverty reduction
Project name	Strengthening the Flood Management Function of DPWH
Scheme	Technical cooperation project
Target country	Philippines
Present stage	Completed 2005-2010
Objective	To strengthen the flood control capacity of the Department of Public Works and Highways (DPWH) by implementing research

	and development, trainings, information management system and pilot projects and by constructing an internal support system, and thereby construct an information management system for effective administrative functions of flood control.
Use & Application of ICT	Information management system, database
Post-fact evaluation (2013, external evaluation)	Assessment result (rating: B). “To construct an information management system for DPWH’s effective administrative functions of flood control”, which was one of the goals, has been more or less achieved without any problems. Information on locations and types of flood control structures was collected, and the relevant data were renewed in 2009. The compiled database has been used by the Bureau of Maintenance of the DPWH headquarters for investigation of maintenance budgets requested from regional offices.
Comment from survey team	Development and management of the databases related to flood control have enabled to acquire highly accurate maps, and database technologies are advancing remarkably. The DPWH expects that it will be enabled to collect, transmit and share more accurate data timely among several offices by making good use of GPS, GIS and mobile phone terminals. The revised version of database is appreciated as the infrastructure of the future flood control, and the information management system centering on the database has been apparently established. Facility management based on facts from the information management system and budget requests are implemented, which reflects achievements of IC application.

Classification	Water resources/disaster prevention-flood control, ICT-ICT, peace building-assistance for public, infrastructure and social services
Project name	The Study on Monitoring and Early Warning System for Landslides and Floods
Scheme	Technical cooperation project
Target country	Columbia
Present stage	Completed 2006-2008
Objective	To establish a monitoring and early warning system for landslides and floods in river basins, and to improve the disaster prevention capacity of landslides and floods in the selected areas.
Use & Application of ICT	Monitoring and early warning system for landslides and floods

Classification	Water resources/disaster prevention-flood control, poverty reduction-poverty reduction
Project name	Study on GLOFs（Glacial Lake Outburst Floods）in the Bhutan Himalayas
Scheme	Technical cooperation project - SATREPS
Target country	Bhutan
Present stage	Completed 2009-2012
Objective	To strengthen Bhutan's capacity to research glacial lake outburst floods and plan measures against disasters. To construct a system to share satellite data for joint research. The activities include evaluation of potentials of glacial lake outburst floods and compilation of database of dangerous glacial lakes. To restore the original geographical and water level conditions of the glacial lakes that have experienced GLOFs in the past, study the details of the outbursts and thereby establish indexes for danger criteria. To create inventories of histories on how glacial lake have been enlarged by analyzing satellite data.
Use & Application of ICT	Satellite data sharing system, hazard map, early warning system
Classification	Water resources/disaster prevention-flood control, water resources/disaster prevention-landslide measures, poverty reduction
Project name	Project on risk identification and land-use planning for disaster mitigation of landslide and floods
Scheme	Technical cooperation project - SATREPS
Target country	Croatia
Present stage	Completed 2009-2014
Objective	To develop methods to create integrated hazard maps of landslide and floods that are applicable in Croatia as well as methods to establish land use guidelines for disaster mitigation of landslide and floods based on hazard maps, and thereby develop simulation models of flash flood and debris flow adapted to the hydrological and geological conditions.
Use & Application of ICT	Integrated hazard maps of landslide and floods, early warning system

Classification	Water resources/disaster prevention-flood control

Project name	Development of Landslide Risk Assessment Technology along Transport Arteries in Viet Nam
Scheme	Technical cooperation project - SATREPS
Target country	Vietnam
Present stage	Being implemented 2011-2016
Objective	To jointly develop landslide risk assessment technology for reducing landslide disasters along transport arteries in Viet Nam, and develop human resources who are capable of applying the relevant technology. The objectives are to: 1) develop technology to make landslide maps of potentially risky locations in the target areas of the study and identify areas with risks of landslide, 2) develop landslide risk assessment technology by soil test and computer simulation, and 3) implement risk assessment by landslide monitoring in the target areas of the study and construct an early warning system.
Use & Application of ICT	Landslide measurement and early warning system, computer simulation, automated data logger and observation sensor, GPS

Classification	Water resources/disaster prevention-landslide measures, water resources/disaster prevention-flood control, ICT-ICT
Project name	Research and Development for Reducing Geo-Hazard Damage in Malaysia caused by Landslide and Flood
Scheme	Technical cooperation project
Target country	Malaysia
Present stage	Being implemented 2011-2016
Objective	To suggest a trial version of high-level disaster risk management system including the comprehensive database of landslide and flood disasters to the Malaysian government in order to promote implementation of disaster management programs.
Use & Application of ICT	Remote sensing and GIS, UAV equipped CP-SAR and optical sensor, integrated management system of spatial information, early warning system

Classification	Water resources/disaster prevention-flood control
Project name	A Simple and Community Friendly Independent Floods Observation System for the Laguna Lake District and National Capital Region in the Republic of Philippines
Scheme	Technical cooperation project
Target country	Philippines
Present stage	Being implemented 2013-2016

Objective	To establish a simple and community friendly independent floods observation system that can function as a model project of operation and management in the Philippines.
Use & Application of ICT	Simple independent floods observation system, wireless disaster prevention system

Classification	Water resources/disaster prevention-flood control, water resources/disaster prevention-climate
Project name	Project on Establishment of End to End Early Warning System
Scheme	Technical cooperation project
Target country	Myanmar
Present stage	Being implemented 2013-2017
Objective	To establish a revised model of system, ensures communication to residents for early warning on natural disasters at the pilot project site, and create plans for development to other areas. To improve the IC system of early warning of natural disasters.
Use & Application of ICT	Early warning system (wireless SSB, wireless LAN, I-com, megaphone, etc.)

Classification	Water resources/disaster prevention-flood control, water resources/disaster prevention-climate
Project name	Research Project on Disaster Prevention/Mitigation Measures against Floods and Storm Surges
Scheme	Technical cooperation project - SATREPS
Target country	Bangladesh
Present stage	Being implemented 2014-2019
Objective	To suggest prevention and mitigation measures against floods and storm surges in order to construct a society with the capacity to prevent local disasters. The activities include simulations of storm surges in different scenarios considering influences of rise in sea level and creation of hazard maps based on the results. To implement simulations of cyclones and storm surges in different scenarios considering influences of rise in sea level and create hazard maps based on the results.
Use & Application of ICT	Hazard map, GIS data map of levee vulnerability, simulations of cyclones and storm surges

(3) Measures against earthquake disaster

Classification	Water resources/disaster prevention-earthquake disaster prevention, ICT, peace building-public order restoration
Project name	Project on Capacity Development for National Center of Indonesian Tsunami Early Warning System
Scheme	Technical cooperation project
Target country	Indonesia
Present stage	Completed 2007-2009
Objective	To construct a new tsunami early warning system in the Bureau of Meteorology and Geophysics, Indonesia. Main ICT tools such as information monitoring, GIS and database are incorporated for the issues of this area in which the capacity of the staff members of the BMG Headquarters and other BMG offices engaged in tsunami prediction and warning announcement is expected to be improved. This project was intended to realize a series of functions of disaster prevention such as tsunami early warning system, tsunami simulation database, monitoring, warning and preparatory simulations. However, the strengthening of tsunami early warning system assisted by Germany was postponed and the plan was changed.

Summary of hearing on the Project on Capacity Development for National Center of Indonesian Tsunami Early Warning System

i) Background and outline of the project

- Because of the enormous tsunami damages caused by the Sumatra Earthquake in 2004, the international society and the Indonesian government were then highly motivated to strengthen disaster prevention. Under such situation, a plan to construct a tsunami monitoring system covering Indonesia entirely was started. However, during the same period, Germany offered assistance incorporating a similar system, which the Indonesian government eventually agreed to accept.
- On the other hand, the Indonesian side was intended to incorporate the model of the Japanese Meteorological Agency for "method of selecting data necessary for tsunami prediction". In order to satisfy that request, the project formation was performed in collaboration with the German system.
- However, the system construction that was planned to be provided from Germany was delayed, and it failed to be completed by the time when the project was terminated. Therefore, the activities of this project were forced to be changed partially. The reasons for Germany's tardiness are unknown.

ii) Opinions and lessons concerning the project and disaster prevention in general from the viewpoint of ICT

- The project contained the external factor of completion of the German system as a precondition. It was a risky project in the first place.
- The experts working locally put pressure to make up for the delay, to no avail.

- It could have been extended if the situation on the part of Germany was observed a little more closely, but the experts had been sent from the Meteorological Agency and had to return to the domestic services. Therefore, extension was considered to be virtually difficult.
- While projects for disaster prevention are increasing recently and there are many researchers, in reality, human resources who are capable of operations are absolutely lacking. It is difficult to secure human resources in these areas, because they can be developed only in the public sector such as the Meteorological Agency.
- Although strong support is currently provided by the Ministry of Internal Affairs and Communications, disaster prevention ICT was not encouraged as much then.
- Disasters are not classified appropriately in **developing** countries, which is making it impossible to organize statistical information accurately in many countries. There might be requests to organize disaster information and compile a database.
- Research is advancing in Japan concerning application of big data in disaster prevention such as analysis of evacuation routes and building collapse levels. There are apparently many researchers who want to apply such research in **developing** countries. However, the sector is yet to be established among assistance projects, and it is difficult to apply immediately.
- Cases of ICT application in disaster education are often reported recently. The trend includes tablet, remote education and application in assistance for the vulnerable in disaster (children, persons with disabilities, etc.). There are cases of consultation more about business collaboration than ODA. Japanese companies seem to be interested in overseas development.
- Potential ICT application has to be taken into consideration at the stage of project formation in order to secure budget.

iii) Activities after the project was completed

- The database was compiled without completion of the German system, on the assumption of preparing the data for now and using it when the German system is completed.

Classification	Water resources/disaster prevention-earthquake disaster prevention, water resources/disaster prevention-comprehensive disaster prevention, poverty reduction-poverty reduction
Project name	Project for Enhancement of the Volcano Monitoring Capacity
Scheme	Technical cooperation project
Target country	Ecuador
Present stage	Completed 2004-2009
Objective	To improve the capacity of Ecuador to mitigate volcano disasters. To improve the capacity to monitor the volcanoes of Cotopaxi and

	Tungrahua.
Use & Application of ICT	Development of software that can process data including long-period seismic waves
Post-fact evaluation (2013, internal evaluation)	The overall evaluation of the project is very high. The project improves the capacity to collect data of volcano activities, accumulate and analyze data and analyze pre-eruption symptoms as well as the quality of report on volcanic activities and communications to the persons concerned. As for the overall goal, the capacity of disaster-related organizations has been improved concerning measures against volcano disasters, the communication system of volcano information and the system to monitor other volcanoes. As for the durability, crisis management including volcano disaster is prioritized by law and the National Development Plan, and necessary budget is secured for volcano observation, disaster system and volcano monitoring. The communication protocol has been strengthened, which enables to acquire real-time information of volcanic activities. Warning information is distributed based on the guidelines and evacuation is carried out based on the warning information in case of a debris avalanche. The policy of the Ecuadorean government has been implemented to organize the volcano monitoring and early warning system at the national level. Communications have been secured by making use of different channels.
Comment from survey team	It has been apparently spread nationwide by strengthening the communication protocol, collecting data of volcanic activities, announcing relevant warning and evacuation guidance and verifying the effects of ICT applications. It is a project in which a series of ICT applications have proven to be effective.

Classification	Water resources/disaster prevention-earthquake disaster prevention, poverty reduction-poverty reduction
Project name	Strengthening of Earthquake Monitoring Observation System
Scheme	Technical cooperation project
Target country	Chile
Present stage	Completed 2008-2009
Objective	To strengthen the capacity of the National Geography and Mining Service of the Ministry of Mining to collect and analyze data of volcanic earthquakes and diastrophism.
Use & Application of ICT	System to monitor volcanic earthquakes and diastrophism

Classification	Water resources/disaster prevention-comprehensive water resources management
Project name	Project for Seismic Risk Assessment and Risk Management Planning
Scheme	Technical cooperation project for development planning
Target country	Armenia
Present stage	Completed 2010-2012
Objective	To evaluate risks of earthquake disaster in the Yerevan Metropolis and develop earthquake disaster prevention plans.
Use & Application of ICT	System to display real-time seismic scale distribution
Supplementary information	Based on the lessons of the Great East Japan Earthquake, enlightenment activities through disaster prevention education were prioritized so that residents can act being aware of the necessity of evacuation.
Classification	Water resources/disaster prevention-earthquake disaster prevention
Project name	Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information Project
Scheme	Technical cooperation project
Target country	Philippines
Present stage	Being implemented 2010-2015
Objective	To improve the capacity of the Philippine Institute of Volcanology and Seismology, the Department of Science and Technology, to monitor earthquakes, tsunami and volcanoes, and apply highly accurate information on earthquake and volcano among organizations engaged in disaster prevention. The activities include incorporation and operation of a sophisticated hypocenter analysis system and construction of a tsunami warning system.
Use & Application of ICT	Sophisticated hypocenter analysis system, tsunami warning system, sea level observing system, GPS data real-time transmission/analysis system

Classification	Water resources/disaster prevention-earthquake disaster prevention
Project name	Observational Studies in South African Mines to Mitigate Seismic Risks
Scheme	Technical cooperation project

Target country	Republic of South Africa
Present stage	Being implemented 2010-2015
Objective	To deepen understanding of preparations for and generation of earthquake, and improve the disaster risk management system against gold mine earthquakes.
Use & Application of ICT	Improvement of the earthquake analysis system

Classification	Water resources/disaster prevention-earthquake disaster prevention
Project name	Project for Enhancement of Earthquake and Tsunami Disaster Mitigation Technology in Peru
Scheme	Technical cooperation project - SATREPS
Target country	Peru
Present stage	Being implemented 2010-2015
Objective	To develop technologies and policies to predict and mitigate earthquake and tsunami damages caused by great subduction earthquakes along the Peruvian coast. The activities include creation of digital surface models (DSMs) of the target areas based on satellite images, tsunami speed/runup simulations of great subduction earthquake scenarios, estimation of tsunami damages and creation of tsunami hazard maps of the target areas.
Use & Application of ICT	Geographical information system, remote sensing, hypocenter modeling, seismic microzoning, estimation of earthquake damages, tsunami simulation

Classification	Water resources/disaster prevention-earthquake disaster prevention
Project name	Research Project on Enhancement of technology to develop tsunami-resilient community
Scheme	Technical cooperation project - SATREPS
Target country	Chile
Present stage	Being implemented 2012-2016
Objective	To develop expertise and technology to establish tsunami-resistant communities and residents in the tsunami vulnerable areas. The activities include compilation of a database on the damages of the 2010 Chile earthquake and the 2011 Great East Japan earthquake in order to understand and estimate possible tsunami damages in the future, as well as development and improvement of a highly accurate model of tsunami damages.

Use & Application of ICT	Compilation of a database of damages, tsunami numerical simulation system

(4) Comprehensive disaster prevention

Classification	Water resources/disaster prevention-comprehensive disaster prevention, gender and development, governance-public safety
Project name	The Project on Capacity Development in Disaster Management in Thailand
Scheme	Technical cooperation project
Target country	Thailand
Present stage	Completed 2006-2008
Objective	To strengthen the capacity of the Department of Disaster Prevention and Mitigation on disaster prevention administration in order to function as the government organization in charge of disaster affairs. To improve the educational services at the government and municipal level. To improve the capacity of disaster measures at the municipal and community levels by strengthening the functions of local offices of the Department of Disaster Prevention and Mitigation and the Ministry of Education. The activities include compilation of a GIS database.
Use & Application of ICT	GIS database

Classification	Water resources/disaster prevention-comprehensive disaster prevention, ICT-ICT
Project name	Information Network for Natural Disaster Mitigation and Recovery
Scheme	Technical cooperation project - SATREPS
Target country	India
Present stage	Completed 2010-2015
Objective	To establish infrastructure of information network in order to collect earthquake and meteorological data on a continuous basis. To establish technical infrastructure to support disaster relief, restoration and reconstruction. To develop an emergency communication system that enables prompt distribution during and immediately after a disaster as well as a solid communication system to disseminate data for restoring activities. The executing organization on the Japanese side consists of the following five institutes, represented by Keio University.
Use &	Sensor network, communication system (during and immediately

Application of ICT	after disaster), data processing system, database, security

Classification	Water resources・Disaster management-CDM
Project name	Project for Capacity Development on Natural Disaster-Resistant Techniques of Construction and Retrofitting for Public Buildings
Scheme	Technical cooperation project
Target country	Bangladesh
Present stage	2011-2015 Being implemented
Objective	To improve capability of PWD, Public Works Department, to construct/repair natural disaster-proofed buildings. Building inventory will be developed through using GIS.
Use & Application of ICT	GIS, database

Classification	Water resources・Disaster management-CDM
Project name	Capacity Development toward Effective Disaster Risk Management
Scheme	Technical cooperation project
Target country	Turkey
Present stage	2013-2017 Being implemented
Objective	To improve capacity of disaster management at AFAD, The Disaster and Emergency Management Authority, and AFAD Bursa.
Use & Application of ICT	GIS

(5) Weather

Classification	Water resources, Disaster management-Weather, Gender and Development-Gender and Development, ICT-ICT
Project name	Development of Human Capacity for Weather Forecasting and Data Analysis
Scheme	Technical cooperation project
Target country	Mongolia
Present stage	2005-2008 Completed
Objective	Through developing capacity of meteorological service practitioners and environmental experts, provide more reliable, timely, and useful weather information (including yellow sand

	data).
Use & Application of ICT	GIS, radar image analysis, networking
Post-fact evaluation (2013) (No quantitative evaluation)	Weather forecast, climate change prediction, necessary environmental information for nomadic grazing (e.g. grazing capacity map), and yellow sand monitoring data are provided accordingly to nomads that use weather information, and the level of satisfaction towards the service is increasing. By implementing the project, its objective: Through developing capacity of meteorological service practitioners and environmental experts, providing more reliable, timely, and useful weather information (including yellow sand data) has been achieved. Since the completion of the project, NAMEM has been widely providing the following to Mongolian public: timely production of weather information, climate change estimate, and drought and dzud information when they are updated. Access to NAMEM website is increasing. Responding to prioritized objectives, a national climate change response program based on the weather and climate change information produced by NAMEM and policies and programs on natural disaster prevention are developed and implemented, and a firm budget is secured. This budget is also secured privately for sustaining the program, e.g. purchase of new equipment, planning, and running human resource training. On the technical side, a majority of the counterparts who were involved in the process of technology transfer still are actively playing leading roles at NAMEM; it shows stable continuity and progress of the project result. Therefore, there is no issue as far as policies, systems in implementing agency, technology, and finances. The expected sustainability of the result derived from the project is relatively high.
Research team's remarks	Adequate procedure is seen in operation and maintenance. Its sustainability is highly anticipated.

Classification	Water resources, Disaster management-Weather, Agricultural/rural development-Other agricultural development/rural development, Poverty reduction-Poverty reduction
Project name	Meteorological and Hydrological Services Improvement Project
Scheme	Technical cooperation project
Target country	Laos
Present stage	2006-2011 Completed

Objective	For Water Resource and Environment Administration to timely and adequately collect, analyze, and deliver meteorological and hydrological information. Observation capability of the administration staff running weather radar system will be improved as a result. Also, precipitation and related data will be consecutively and timely developed.
Use & Application of ICT	Weather radar system
Post-fact evaluation (Internal evaluation 2015)	The project receives a high mark. It is acknowledged that weather forecast, early-warnings, and other meteorological and hydrological information issued by the administration are utilized by the related institutions, e.g. general public, regional governments, agricultural organizations, aviation services. This project's sustainability aspect is based on the developmental policy suggested by its post-fact evaluation. The organizational structure has been strengthened. Also, distribution of a national budget for the project as well as for weather radar system O&M has been increasing.
Research team's remarks	There were several issues in installation of equipment parts into hydrological observation facilities and frequency interference which affected the climate radar system operation. Possible risk management countermeasures for anticipated system operation issues should have been discussed at pre-project stage.

Classification	Water resources, Disaster management-Weather, ICT-ICT, Poverty reduction-Poverty reduction
Project name	Meteorology Training
Scheme	Technical cooperation project
Target country	11 countries in total: Fiji , Other target countries:-Kiribati, Nauru, Tuvalu Melanesian and Polynesian countries
Present stage	2007-2010 Completed
Objective	To diminish climate disaster e.g. cyclones in the island countries by increasing weather forecast/warning capability there. Project objective: To run training on weather forecast/warning in Fiji and surrounding island countries.
Use & Application of ICT	Weather forecast/warning

(6) Others

Cases from Operation for Supporting Japanese SMEs and Assistance Utilizing Private-Sector Technologies will be presented here as other propose-based cases.

Project name	Request survey: Water Disaster Reduction Operation by River observation system utilizing solar power and wireless communication （一般訳）
Scheme	Operation for Supporting Japanese SMEs
Target country	Bangladesh
Present stage	2013 Completed
Objective	River observation system utilizing solar power and wireless communication ・Cloud still image smart camera: Enables real-time river observation by acquiring images and data through the Internet ・Can be installed in future electrified locations, easily installed and maintained, and can be operated at reasonable cost ・Proven installation result in Japanese communities, e.g. Nagaoka city, Sanjo city
Use & Application of ICT	River observation camera system

Project name	Promotion of Sustainable ICT Disaster Prevention/Reduction System （一般訳）
Scheme	Assistance Utilizing Private-Sector Technologies
Target country	Viet Nam
Present stage	2014-2015 Completed
Objective	To implement a CDM information system and develop a comprehensive service platform aiming to assist efficiency improvement in maintenance or training management etc. for assisting with sustainable disaster prevention/reduction.
Use & Application of ICT	CDM information system

The result from audit of Global Environment Department regarding overall matters such as water resources, weather disasters, and seismic disasters will be stated below:
Global Environmental Department-Water resources group

Audit overview: Global Environmental Department-Water Resources Group (Water and sewerage maintenance etc.)

ⅰ)Current status of Use and Application of ICT

- GIS and database are frequently used, and there are no remarkable issues.

- SCADA, Supervisory Control And Data Acquisition, an operating system is used. The system content shall be referred to the operating consultants. There are no issues concerning collaboration in operation.
- Knowledge on water resources tends to stay with the community or consultants.
- There are no cases with software development
- There are occasions where developed data cannot continue to be used for software update fees cannot not be secured on site.

ii) Cases that need improvement

- Tools such as GIS or CAD were used. There was no specifically assigned result format, place of submission, or management method, and it was impossible for other consultants to extend the created CAD data etc. in a subsequent project.

iii) Future Possibility of Use and Application of ICT

- Mobile-phone use is assumed for using clean water or fare collection etc.

Audit Overview: Global Environment Department (weather disasters e.g. sediment disasters, floods)

i) Current Situation of Use & Application of ICT in Disaster Management

- Many disaster management cases have use and application of ICT (e.g. infrastructure export, private-propose-based-operations).
- The group has recognition that they must start discussing regarding ICT use and application
- In observation and weather field, majority of the cases require equipment, thus, always expect many ICT use and application cases. Also, cases that only involve equipment installation are scarce. They usually require technical cooperation through an expert dispatch which might be accompanied by maintenance
- Equipment content follows patterns and is becoming regularized. Thus, equipment to be installed have not changed in about ten or twenty years. Therefore, there are not many cases that install Japan's latest technology.
- The best to be consulted about use and application of equipment are the experts from the field.
- In case of a request in meteorological field for installation of a comprehensive system, first it starts with equipment installation by Grant Aid followed by technical cooperation or maintenance. Grant Aid can be categorized in two types. One is a pattern of weather radar installation in two or three locations. In the other, automatic weather observation technology will be installed in twenty or thirty locations for improvement of weather observation network. Observation is a process that requires

constant steady effort, and it can have various issues. Technical cooperation or maintenance is crucial for follow-up.

- Observation equipment provider will be selected from several companies (there may be a competition). Previously, information comes from local agencies was evaluated, yet not anymore. Instead, today, maintenance structure is evaluated
- Simulation methods (e.g. precipitation) in JICA projects can be roughly divided into two types. One is the analysis method using Meteorological Agency's system. The other one is composite analysis by an expert using rain gauge (cases in technical cooperation). Use of computer data results combined with forecast/warning data (called guidance) has also been attempted.
- In Japan's meteorological field, observation and collected data by Meteorological Agency is shared with private companies through Japan Meteorological Business Support Center. Next, private companies assemble the data and their own collected-data to analyze and issue forecasts. In countries where it practices disaster management, the government first of all initiates the operation, thus, there are not many occasions for private sector to promote their technology or assigned to function as the main role.
- In project planning, if a simulation model needs to be selected, it may be determined by JICA, yet, primarily, consultants shall propose the model. The continuation of the use after the project completion is important, thus, the selection is made considering usability for the partner government.
- JICA has developed its unique simulation model in a project, and it has been used in actual simulation cases.

ⅱ) Use and Application of ICT in Each Sector

- Observation area-River observation etc.
  · Examples of Used technologies:
  Flow rate observation by telemeter system, data collection/model analysis/forecast and warning by flood forecast/warning system.
  · Case:
  There are numerous requests of comprehensive flood forecast/warning system from the partner governments. The installation took place in a project in Chao Phraya, Thailand (development program research-based technical cooperation. It was operated as a disaster response as part of a pilot project).
- Weather area- It requires a lot of ICT equipment, and numerous cases are from Grant Aid.
  · Examples of Used technologies:
  System that centralizes collected data from accordingly located automatic observation systems (the centralized data are shared internationally (following each country's rules) by GTS and through WMO, World Meteorological

Organization.

・Points to be improved:

There are several issues such as frequent malfunction, inability to pay communication cost, or inability to secure distributed radio wave area, and experiencing difficulty resolving them. There are cases where disaster makes data communication impossible and, thus, unable to collect data for the system use. Recently, securement of redundancy of communication methods is receiving more and more attention from weather practitioners. It has not been secured in JICA projects either. Utilizing the weather satellite Himawari may be one way of securing redundancy (by each country setting up Himawari receiver and communicate through a different line. Several lines shall be secured).

iii) Other Cases of Use & Application of ICT or ICT-related Cooperation

- Other Cases of Use & Application of ICT
  - ・System that collects and analyzes data through equipment and issues warnings in distant places as needed is one of very typical forms of Grant Aid cooperation. It has been utilized in various places though JICA projects (e.g. a project in Uganda).

- JICA Cooperation cases in Disaster Prevention
  - ・It has been assisting AHA Center, ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management. At first, JICA's assistance was in the communication equipment area, followed by technical cooperation such as expert dispatch accordingly (It was not always necessarily ICT related, however, there is a case of satellite technology use).
  - ・Since a fair amount of weather forecast can be made (except focal forecast due to the mesh size) by using analysis model that WMO provides (and open to public), cooperation that builds links to WMO is also done in developing countries.

iv) Possibility and Needed Improvement for Use & Application of ICT

- There are only a few cases where data is stored in an organized manner in developing countries, thus, even if the system is installed, it is possible the data could not be sufficient for the system use.
- Therefore, it is difficult to bring Japan's latest technology into practice (e.g. disaster information system: centralizes information from each location to utilize).
- Data format follows WMO standards. Based on the observation standards and the assigned data format (GTS : Global Telecommunication System and MS: Message Switching System), each country collects and shares data. It is important to unify formats for data accumulation.
- Governments of developing countries show tremendous interest in Japanese

technologies, and there are many companies that receive offers, however, it may be difficult to utilize those in ODA projects.

- As a promotion of use & application of ICT, there is an attempt to grasp disaster damage status through collected photos of the disaster taken by citizens or sharing the result of citizens' eye observation via smart phones (Trials run by Fujitsu in Indonesia and Viet Nam). However, it is still at its trial stage due to an issue in data accumulation. It is not yet ready for practical use.
- A crucial matter is capability to accumulate and correctly analyze data, also capability to determine a need of issuing a warning based on the analysis result. In other words, the crucial matter to know is "What needs to be done", and only having an answer to that leads to accurate use and application of ICT.
- Use and application of ICT has its future potential in evaluation warnings and communication with citizens. It could deliver highly accurate information to the citizens. There are cases where development of smart phone website or application for disaster communication took place in developing countries.
- Meteorological field has strong and regular use of ICT, thus, the potential of its use and application is high. However, since a 'production of effect'; a proven effect in a real disaster setting during a project (e.g. Did the warning system convey the information effectively for the citizens to evacuate?-Necessary to have a proven record) needs to be presented for ODA project planning; visualizing it as a project could be difficult.
- It is difficult to issue real-time forecasts and warnings. There may be a possibility of use and application of ICT in long-term projects.
- Since there are not many standards or rules regarding local community disaster warnings in developing countries as in Japan, it can limit the system's potential.

Audit Overview: Global Environment Department (terrestrial disaster, earthquake, tsunami, volcano, CDM, Community disaster management, disaster management authority)

ⅰ) Projects with Use & Application of ICT

- Additional technology cases to those mentioned on disaster management project list:

  Disaster information sharing system (e.g. use of DB), disaster record sharing system (e.g. affected population, date, size, location, type of disaster), responder (disaster response personnel: e.g. Red Cross, health department) information system (connects government and community), Hazard map development guideline sharing system (all technical cooperation projects).
- In a project in the Philippines, consultants on contract through the technical cooperation project developed a responder information system (e.g. IMS : Information Management System) from scratch. The consultant also instructed on how to use the system as well as provided quality control throughout the project. The system uses an application with versatility, and it was developed to

be fairly easy to maintain and repair.

ii) Approach and Issues of Use & Application of ICT

- Technical cooperation projects in disaster management area can be roughly divided into two types. One involves monitoring/analysis by equipment used for observation and forecast/warning. The other one involves ICT-use training as disaster management authority does. Technologies frequently utilized are GIS, satellite, and DB. Use of Japanese technology (sensors or analysis technology) is seen relatively a lot in SATREPS (Science and Technology Research Partnership for Sustainable Development) projects (research program in collaboration with JST).
- Technology installation always has easy maintenance/repair after the project completion under consideration (e.g. using free application that has GIS information and versatility)
- For thematic-issue departments, success in projects is 'human capability development.'
- It is difficult for Disaster Risk Reduction Team to instruct ICT use and application in detail in instructional documents.
- It does not respond to new technologies that are utilized in international organizations or bilateral aid organizations. At project implementation, debates on approach through comparison with international organizations/bilateral aid organizations will be preferable.
- Development of engineers (e.g. SE) by JICA needs to be improved.
- Following ICT application methods may be possible.
  1) Information sharing/accumulation at disaster management authority: It is important to accumulate all the disaster records in a database for the following steps (e.g. disaster management planning, hazard map development). Small but frequent disasters could be dismissed from the record compared to big-scale ones, thus, its data accumulation is especially important.
  2) For earthquakes and tsunami, observation/monitoring through ICT equipment is a possible application.
- There are cases where the projects proceeded as use & application of ICT in international organizations/bilateral aid organizations are researched (e.g. disaster management through digital terrestrial broadcasting by MIC, Ministry of Internal Affairs and Communications, disaster prevention platform by MLIT, Ministry of Land, Infrastructure, Transport and Tourism).
- Views on ICT of ministries and JICA are different. Ministries perceive it in the point of 'Japanese technology promotion and Japanese brand export' whereas JICA perceives it as simply a tool. In the latter perspective, technology (particularly new technology or Japanese technology) needs more than just installation in order to succeed, it requires knowing 'How it will be used.'
- Disaster management authority projects are technical cooperation projects, and the agent is people. Therefore, the system is merely a tool, and what is important

is disaster prevention capability improvement ('How does this system use enhance the capability?'), not installation of technologies. Moreover, it is crucial to first fully understand its purpose ('How is the technology needed?', 'What is the technology used for?') to use the technology and carry out the operation (Observation and warnings are of course important, however, in disaster management, without having an approach towards people, use of technology does not produce an effective result).

- Sharing ICT roadmap in the target country etc. beforehand makes it easer to consider effective ICT use.
- Since disaster management involves the national government, it may be needed to debate whether the system O&M should be done by personnel from the providing company or internally. Currently, for example, in a project in the Philippines, database maintenance is done by personnel from a local disaster management organization that was trained in the technical cooperation project.
- Consultants are requested to develop a system that is easily maintained. It is expected to receive advice from Infrastructure and Peacebuilding Department concerning the procedure, e.g. collaboration among actors that are involved in the system use.
- Many Grant Aid projects in disaster management utilize equipment, and, comparing to other scheme projects, there are many cases where advice from Infrastructure and Peacebuilding Department can be very useful. In these projects, receiving advice from consultants may be difficult.
- There are cases where several disaster-relief smart phone applications are developed for one country. Thus, collaboration among existing applications and systems is expected in the future.

Appendix 1-5 Governance

(1) Statistics

Classification	Governance-statistics
Project name	Strengthening the Capacity of Central Statistical Organization of the Union of Myanmar
Scheme	Technical cooperation project
Target country	Myanmar
Present stage	Completed 2005-2007
Objective	The Central Statistical Organization (CSO) generates statistics of its statistical surveys accurately and promptly, which enables to offer highly reliable data to users including policy developers, administrative officers and researchers, and thereby improves the management system of the statistical database as well as the maintenance/management/operation system of LAN system.
Use & application of ICT	Management system of statistical database, maintenance/management/operation system of LAN system

Classification	Governance-statistics
Project name	Project on Improving Official Statistics in Cambodia
Scheme	Technical cooperation project
Target country	Cambodia
Present stage	Completed 2005-2008
Objective	To improve the capacity concerning government statistics of the staff members of the National Institute of Statistics (NIS) and staff members in charge of statistics in provincial offices of the Ministry of Planning and other related ministries and agencies.
Use & application of ICT	Economic statistics

Classification	Governance-statistics, ICT-ICT, peace building-assistance for infrastructure and social services
Project name	Project for Developing the Information System of Small Area Statistics

Scheme	Technical cooperation project
Target country	Indonesia
Present stage	Completed 2006-2008
Objective	Budan Pusat Statistik (BPS) develops an information system of small area statistics, which enables to offer various types of statistical data and maps of small areas in a timely and applicable manner.
Use & application of ICT	Information system of small area statistics

Classification	Governance-statistics, private sector development-industrial infrastructure system, ICT-ICT
Project name	Trade Statistics Development Project
Scheme	Technical cooperation project
Target country	People's Republic of China
Present stage	Completed 2006-2008
Objective	To maximize the compatibility between the Chinese standards and the international standards as well as the international comparability of data of commercial statistics in accordance with definitions, classification criteria and methods of international commercial statistics. To develop human resources.
Use & application of ICT	Processing of statistical information

Classification	Governance-statistics, private sector development-industrial infrastructure system, ICT-ICT
Project name	The Project for Establishment of New Industrial Statistics in the Socialist Republic of Vietnam
Scheme	Technical cooperation project
Target country	Vietnam
Present stage	Completed 2006-2009
Objective	To offer statistics of new industries in a timely and internationally comparable manner.

Use & application of ICT	Processing of statistical information

Classification	Governance-statistics, peace building-governance, poverty reduction-poverty reduction
Project name	Project for Enhancement of Monitoring System for PRSP
Scheme	Technical cooperation project
Target country	Bolivia
Present stage	Completed 2007-2008
Objective	To strengthen the capacity of regional offices of the National Institute of Statistics of Bolivia (INE) to generate statistical information. To implement trainings concerning integrated approaches of collecting, processing and analyzing statistical information in Bolivia. To systemize and validate generation of statistical information applying the integrated approaches.
Use & application of ICT	Processing of statistical information

Classification	Governance-statistics, ICT-ICT, poverty reduction-poverty-reduction
Project name	Capacity Building for National Bureau of Statistics in Data Providing Service
Scheme	Individual project (Expert)
Target country	Tanzania
Present stage	Completed 2007-2009
Objective	The National Bureau of Statistics acquires the capacity to manage statistical information appropriately which contributes to poverty monitoring.
Use & application of ICT	Statistical database

Classification	Governance-statistics, ICT, peace building-governance
Project name	Project on Improving Official Statistics in Cambodia (Phase 2)
Scheme	Technical cooperation project
Target country	Cambodia
Present stage	Completed 2007-2010
Objective	The National Institute of Statistics (NIS) of the Ministry of Planning, the Department of Planning of each province and agencies in charge of statistics in each ministry or agency acquire the basic capacity of planning, tabulation, analysis, provision and application for population census and other statistical surveys.
Use & application of ICT	Aggregation system, statistical database

Classification	Governance-statistics, poverty reduction-poverty reduction, urban development/regional development-other types of urban development/regional development
Project name	Human Resource Development for Monitoring of The Poverty Reduction Strategy of Honduras
Scheme	Technical cooperation project
Target country	Honduras
Present stage	Completed 2008-2012
Objective	To improve and strengthen the INE's capacity of generating government statistics with indices related to population statistics. The activities include trainings on statistical analysis, theory and practice of sample research, approach of population projection and database construction system centering on population analysis.
Use & application of ICT	Population statistics, database

Classification	Governance-statistics
Project name	Project on Improving Official Statistics in Cambodia (Phase 3)
Scheme	Technical cooperation project
Target country	Cambodia

Present stage	Being implemented 2010-2015
Objective	The National Institute of Statistics (NIS) of the Ministry of Planning and the Department of Planning of each province improve the capacity to carry out economic census, the Cambodia Inter-censal Population Survey, statistical survey on economy and other statistical activities. To construct an aggregation system of statistical survey concerning economic census by the NIS.
Use & application of ICT	Aggregation system of statistical survey

(2) Administrative infrastructure

Classification	Governance-administrative infrastructure, assistance approach-capacity development, poverty reduction-poverty reduction
Project name	Project on Capacity Development of ODA Planning Project
Scheme	Technical cooperation project
Target country	Vietnam
Present stage	Completed 2005-2008
Objective	To improve the ODA operation and management capacity (at the stage of planning and evaluating a project) of the Vietnamese government (MPI/FRRD and related ministries and agencies). Implementation of simple surveys and baseline surveys for improving the IT environment in PI/FRRD concerning ODA operation and management. To improve the convenience of the existing ODA project database. To provide the information necessary for project planning to related ministries and agencies through improved ODA website and strengthened collaboration with donors.
Use & application of ICT	ODA project database, ODA website
Post-fact evaluation	The project has been assessed as having some issues. After the project was completed, some IT systems including the ODA information management system have not been used on a continuous basis. There are problems of continuity also on the

	technical and financial aspects due to the budget deficit and the shortage of MPII members to maintain the IT system.
Comment from survey team	Many other projects have the same problem of budget deficient for maintaining software components such as software, database and IT network. Therefore, in case of incorporating IT-related software components in a project, sufficient considerations from the viewpoint of continuity should be made at the planning stage, which has been also pointed out as a lesson for JICA. It is important to share the importance of maintenance as well as that of the developed ICT infrastructure.

Classification	Governance-administrative infrastructure, poverty reduction-poverty reduction, peace building-governance
Project name	The Capacity Development Project for the Office of the Auditor General
Scheme	Technical cooperation project
Target country	Uganda
Present stage	Completed 2008-2012
Objective	To improve the knowledge and skills of the auditing staff of the Office of the Auditor General and thereby improve the auditing system including IT auditing (revision of the IT strategy plan, capacity reinforcement of the IT technical staff and IT assessment).
Use & application of ICT	IT auditing, IT assessment

Classification	Governance-administrative infrastructure
Project name	Project for Improving Public Services through Total Quality Management
Scheme	Technical cooperation project
Target country	Bangladesh
Present stage	Being implemented 2012-2017
Objective	To establish a system to improve operational performance on a continuous basis at the regional (Upazila) level based on TQM trainings. To organize TQM information through media such as

	website, newsletter, SNS, poster and video.
Use & application of ICT	Website, SNS

Classification	Governance-administrative infrastructure, economic policy-finance (management of government spending and public expenditure)
Project name	Project for Capacity Enhancement in Public Sector Investment Programming Phase 2
Scheme	Technical cooperation project
Target country	Malawi
Present stage	Being implemented 2013-2016
Objective	To operate the Public Sector Investment Programming (PSIP) in a more effective and coordinated manner in the framework of public financial and economic management.
Use & application of ICT	Information management system (database, manual, handbook, etc.)

(3) Public safety

Classification	Governance-public safety, ICT-ICT, peace building-restoration of public order
Project name	The Project to Build up the Operation of Automated Fingerprint Identification System (AFIS)
Scheme	Technical cooperation project
Target country	Philippines
Present stage	Completed 2006-2010
Objective	To perform input, trace, image identification and judgment of fingerprints using AFIS appropriately.
Use & application of ICT	Automated fingerprint identification system

Classification	Governance-public safety

Project name	Project on Enhancing the Capacity for Collection and Application of Fingerprints
Scheme	Technical cooperation project
Target country	Philippines
Present stage	Completed 2010-2013
Objective	To strengthen AFIS application by strengthening the system to collect and send fingerprints that are collected from suspects and left at crime scenes.
Use & application of ICT	Automated fingerprint identification system

Appendix 1-6 Transportation

(1) Transport administration

Classification	Transportation-transport administration
Project name	Project for the improvement of Public Transportation Management System
Scheme	Technical cooperation project
Target country	Rwanda
Present stage	Completed 2006-2007
Objective	To establish a reliable public transportation management system by improving the bus operation and management. The activities include establishment of bus database for bus maintenance.
Use & application of ICT	Bus database

Classification	Transportation-transport administration
Project name	Modernization of Cargo Transportation Project
Scheme	Technical cooperation project
Target country	Syria
Present stage	Completed 2007-2008
Objective	To improve efficiency of port operations of Port of Latakia. The activities include incorporation of port financial management system and development of relevant human resources.

Use & application of ICT	Financial management system

Classification	Transportation-transport administration, water resources-comprehensive disaster prevention, poverty reduction-poverty reduction
Project name	The Project for Capacity Development of Road Disaster Prevention and Bridge Management and Maintenance
Scheme	Technical cooperation project
Target country	Bolivia
Present stage	Completed 2009-2012
Objective	To improve the Bolivian Road Agency (ABC)'s capacity of road disaster prevention and bridge management and maintenance. The activities include establishment and renewal of database of information on road disaster prevention.
Use & application of ICT	Database of information on road disaster prevention

Classification	Transportation-transport administration, transportation-urban transportation
Project name	Database of Road Disaster Prevention Information （一般訳）
Scheme	Technical cooperation project
Target country	Indonesia
Present stage	Completed 2009-2012
Objective	To improve the management capacity concerning the Jabodetabek Urban Transportation Policy Integration Project. To improve the capacity and technology of the target group engaged in development of urban transportation planning. The activities include renewal and maintenance of the SITRAMP database (update to the 2008 version).
Use & application of ICT	Database of Study on Integrated Transportation Master Plan (SITRAMP) in Jakarta

Classification	Transportation-transport administration, peace building-assistance for public infrastructure and social services
Project name	The Project for the Capacity Development of Road Works in Timor Leste
Scheme	Technical cooperation project
Target country	East Timor
Present stage	Completed 2010-2014
Objective	To improve the technical and maintenance capacities concerning road works and management by East Timor's human resources (DRBFC, IGE). The activities include renewal of the database of road maintenance and management as well as expansion of the database of bridge registration for enabling budget request concerning bridge restoration.
Use & application of ICT	Database on road maintenance and management, database of bridge registration

Classification	Transportation-transport administration
Project name	The Project for Improvement on Aviation Safety Policy
Scheme	Technical cooperation project
Target country	Indonesia
Present stage	Completed 2010-2015
Objective	To improve the capacity of Directorate General of Civil Aviation, Air Transport Human Resource Development Center and Indonesian Civil Aviation Institute in the areas of New CNC/ATM and supervision of aviation safety. To develop human resources concerning the New CNS/ATM system.
Use & application of ICT	New CNS/ATM

Classification	Transportation-transport administration
Project name	The Project for Capacity Development on Transportation Planning and Database Management in the Republic of the Philippines
Scheme	Technical cooperation project

Target country	Philippines
Present stage	Being implemented 2010-2015
Objective	To improve the system to develop plans of public transportation network in Metro Manila by DOTC and thereby improve the management capacity of transportation database in Metro Manila. The activities include renewal of the transportation database that was established by Metro Manila Urban Transportation Integration Study (1999).
Use & application of ICT	Transportation database

Classification	Transportation-transport administration
Project name	The Project for Enhancement of Operation and Management Capacity of Inland Waterway in Southern Sudan
Scheme	Technical cooperation project
Target country	South Sudan
Present stage	Being implemented 2010-2015
Objective	To continue strengthening the port management capacity of Juba Port. The activities include construction of database system of port statistics for Juba Port and establishment of statistical manual.
Use & application of ICT	Database system of port statistics

Classification	Transportation-transport administration
Project name	Study on Introduction of Intelligent Transport Systems (ITS)
Scheme	Technical cooperation for development planning
Target country	Brazil
Present stage	Completed 2013-2014
Objective	To develop plans of short-term ITS incorporation in the urban area of Rio de Janeiro.
Use & application of ICT	Development of ITS master plan, consideration of outline of ITS incorporated system

(2) International transportation

Classification	Transportation-international transportation, ICT-ICT
Project name	The Feasibility Study for the Strategic Implementation of CNS/ATM (Communications, Navigation, Surveillance and Air Traffic Management) Systems in the Republic of Indonesia
Scheme	Development survey
Target country	Indonesia
Present stage	Completed 2006-2007
Objective	To develop establishment policy of CNS/ATM systems in accordance with the guidelines of ICAO
Use & application of ICT	CNS/ATM systems

(3) National transportation, urban transportation, local transportation and others

Classification	Transportation-urban transportation
Project name	Mega Manila Region Highway network ITS Integration Project
Scheme	Technical cooperation for development planning
Target country	Philippines
Present stage	Completed 2012-2013
Objective	To develop plans of systems for incorporating and operating ITS on a long-term, mid-term or short-term basis combining domestic and international ITS related technologies considering the traffic situation in Metro Manila and Mega Manila.
Use & application of ICT	ITS, ETC system

Classification	Transportation-urban transportation
Project name	District and Urban Roads（DUR）Mapping and Roads Database Project
Scheme	Technical cooperation project
Target country	Uganda
Present stage	Being implemented 2012-2015
Objective	To improve the capacity of the Ministry of Works and Transport

	and municipalities to survey and manage provincial and urban roads through effective application of the database of district roads including geographical information and road inventories.
Use & application of ICT	GIS, digital base map of district roads

Classification	Transportation-urban transportation
Project name	Master Plan Study on the Introduction of Intelligent Transport System（ITS） in Bengaluru and Mysore
Scheme	Technical cooperation for development planning
Target country	India
Present stage	Being implemented 2014-2015
Objective	To develop plans of systems for incorporating and operating ITS on a long-term, mid-term or short-term basis combining domestic and international ITS related technologies considering the traffic situation in Metro Manila and Mega Manila.
Use & application of ICT	ITS, ETC system

Classification	Transportation-urban transportation
Project name	The Capacity Development Project for Improvement of Dar es Salaam Transport （phase-2）
Scheme	Technical cooperation project
Target country	Tanzania
Present stage	Being implemented 2014-2017
Objective	To improve the transport situation of Dar es Salaam City (Region). To improve the capacity of the Conference and the Secretariat and implement selected projects through appropriate coordination. The activities include incorporation of the parking lot management system (cashless fee collection and parking lot management using contact tag), cashless fee collection and operational management system using mobile phone account.
Use &	Parking lot management system, cashless fee

application of ICT	collection/operational management system
Supplementary information	Machinery and instruments used in the systems are made in the US. The selection of the manufacturer was open also to domestic companies, but no information was offered locally, while European and American companies actively carried out briefings locally.

(4) Others

Following are cases of SMEs overseas development assistant project introduced as sample cases of proposal-based project. It is worthy of attention that considerations for continuity are made such as a business model of incorporating corporate advertisements on traffic information boards.

Project name	ITS Promotion and Verification Project in Major Cities of Gujarat State （一般訳）
Scheme	SMEs overseas development assistant project
Target country	India
Present stage	Being implemented 2013-2015
Objective	To generate information on traffic congestion by mobile communications, distribution system of information on traffic congestion using GPS information such as the cloud, traffic information sensor and mobile phones. To offer road information of congestion and detour on the traffic information boards displayed on roads.
Use & application of ICT	Distribution system of traffic congestion information

Following are cases of private sector technology promotion project:

Project name	Project for Promoting Maintenance and Management of Traffic Control Systems for Alleviating the Traffic Congestion Problem in Bangkok Province （一般訳）
Scheme	Private sector technology promotion project
Target country	Thailand

Present stage	Being implemented 2015-2016
Objective	To encourage local municipalities to promote components of traffic control system such as signal controller, vehicle detector and center device and offer consulting services for solving problems of urban transportation (congestion).
Use & application of ICT	Traffic control system

Project name	Project for Promoting the Technology of Traffic Flow Simulation for Developing Road Plans in Yangon City （一般訳）
Scheme	Private sector technology promotion project
Target country	Myanmar
Present stage	Completed 2014-2015
Objective	To verify and disseminate traffic planning solutions with traffic flow simulation (including probe processing technology and image traffic counter) as the core.
Use & application of ICT	Traffic flow simulation

Project name	Project for Promoting Ho Chi Minh City Public Transport Bus ICT System （一般訳）
Scheme	Private sector technology promotion project
Target country	Vietnam
Present stage	Being implemented 2015-2016
Objective	To introduce ICT for bus incorporating automated fee collection by IC card to the Department of Transportation, Ho Chi Minh City, and promote understanding of its effectiveness by developing demonstration software adapted to the locality.
Use & application of ICT	Automated fee collection by IC card

Appendix 1-7 Natural Resources and Energy

(1) Renewable energy

Classification	Natural Resources and Energy: Renewable energy
Project name	Project for Operation and Management of regional electrification plan using small-scale hydropower in Mondulkiri Province （一般訳）
Scheme	Technical cooperation project
Target country	Cambodia
Project stage	Completed [2008-2011]
Objective	At the electric power company of Mondulkiri Province (EUMP), the system for appropriate management as well as for operation of civil engineering structures, power generating facilities and power transmission and distribution facilities is developed. In consequence, the management system for EUMP is developed and becomes functional. Billing system is developed. Various data on such item as customers, electricity sales volume, and income and expenditure details are recorded and organized.
Use & Application of ICT	Billing system

Classification	Natural Resources and Energy: Renewable energy
Project name	Project for Technology Development of Steam-spot Detection and Sustainable Resource Use for Large Enhancement of Geothermal Power Generation in Indonesia
Scheme	Technical cooperation project (Science and Technology Research Partnership for Sustainable Development, SATREPS)
Target country	Indonesia
Project stage	Being implemented [2015-2020]
Objective	By integrating the most advanced techniques of remote sensing, geochemistry and mineralogy, the following technologies are developed: - a technology to detect, with high accuracy, steam spots which are most suitable for generating electricity; - a broad-area environment monitoring technology around geothermal plants, and; - a technology to design optimization system in order to enable a long-term, sustainable use and production of geothermal energy.
Use & Application of ICT	Remote sensing

(2) Energy Supply

Classification	Natural Resources and Energy: Energy supply, Natural Resources and Energy: Energy conservation, poverty reduction
Project name	Rural Electrification Promotion Project
Scheme	Technical cooperation project
Target country	Malawi
Project stage	Completed [2006-2009]

Objective	The planning and implementation capacity of the Malawi Rural Electrification Program (MAREP) is improved. As a result, an appropriate management capacity of the rural electrification fund is developed and maintained. The operation and management capacity of Rural Electrification Section of the Energy Bureau is developed and maintained. The project includes a database update of the rural electrification master plan.
Use & Application of ICT	Database

Classification	Natural Resources and Energy: Energy supply, Natural Resources and Energy:
Project name	Project on the Formulation of Self-Sufficient Energy Supply System
Scheme	Technical Cooperation for Development Planning (commissioned project)
Target country	Marshall Islands
Project stage	Being implemented [2013-2015]
Objective	To make a proposal on introduction of renewal energy towards construction of energy self-sufficiency system in Marshall Islands, as well as on operation improvement of existing diesel generators. The project includes following activities: collection and analysis of related data and information, and technical support related to the simulation tools.
Use & Application of ICT	Energy Self-sufficiency System

(3) Mining

Classification	Natural Resources and Energy: Mining
Project name	Remote Sensing and GIS for Urban and Regional Development (Third-Country Training Project)
Scheme	Technical cooperation project
Target country	Turkey
Project stage	Completed 2006-2008
Objective	Trainees from the third countries master new techniques of remote sensing and GIS.
Use & Application of ICT	Remote sensing, GIS

Classification	Natural Resources and Energy: Mining, Private Sector Development: others, ICT-ICT
Project name	Project of reinforcement of mineral resources development research
Scheme	Technical cooperation project
Target country	Mauritania
Project stage	Completed [2007-2008]
Objective	Human resource development for improvement of mineral exploration capacity at Mauritanian Office of Geologic Researches is promoted.
Use & Application of ICT	Remote sensing

Classification	Natural Resources and Energy: Mining
Project name	Country-focused Training “Basics of resource exploration using remote-sensing technology” （一般訳）
Scheme	Individual project (Country-focused Training)
Target country	Angola
Project stage	Completed [2011-2011]
Objective	The skills of geological engineers in Angola are improved.
Use & Application of ICT	GIS, GIS database

Classification	Natural Resources and Energy: Mining
Project name	The Geological Mapping and Mineral Information System Project for Promotion of
Scheme	Technical Cooperation for Development Planning (commissioned project)
Target country	Madagascar
Project stage	Completed [2011-2012]
Objective	Information on geological and mineral resources is developed for promoting the mining industry of Madagascar.
Use & Application of ICT	Remote sensing、GIS

Classification	Natural Resources and Energy: Mining
Project name	Capacity Building in GIS Database Management
Scheme	Individual project (Expert)
Target country	Zambia
Project stage	Completed [2011-2012]
Objective	At the Geological Survey Department, the capacity to digitally organize and renew mineral resources information and to effectively manage it for investment promotion is reinforced. Mineral resources database using GIS is constructed.
Use & Application of ICT	Remote sensing of geological conditions, satellite image analysis, GIS

Classification	Natural Resources and Energy: Mining, ICT:ICT
Project name	Project for Establishment of Integrated Geographic Information System (GIS) Database for Mineral Resources
Scheme	Technical Cooperation for Development Planning
Target country	Malawi
Project stage	Completed [2012-2013]
Objective	Human resources capable of construction and maintenance of database/GIS for mineral resources which contributes to future development investment in mining industry are developed.
Use & Application of ICT	Remote sensing, Mineral resources database, GIS, Satellite image analysis

Classification	Natural Resources and Energy: Mining

Project name	Project for Research on the Integration System of Spatial Environment Analyses and Advanced Metal Recovery to Ensure Sustainable Resource Development
Scheme	Technical cooperation project (Science and Technology Research Partnership for Sustainable Development, SATREPS)
Target country	Serbia
Project stage	Being implemented [2015-2020]
Objective	Three-dimensional environment evaluation and analysis using a combination of advanced remote sensing and surface data is integrated with an advanced metal recovery technology. This is to conduct research and development of system for broad-area environment evaluation and recovery aiming to balance development and environment which is indispensable for sustainable resource development.
Use & Application of ICT	Remote sensing

(4) Natural Resources and Energy

Classification	Natural Resources and Energy: other Natural Resources and Energy, ICT-ICT, Peacebuilding: rehabilitation and reconstruction of socioeconomic infrastructure
Project name	Human resource development for Remote-sensing and GIT for Palestine (Third-Country Training Project)
Scheme	Technical cooperation project
Target country	Turkey, (Others) Palestine
Project stage	Completed [2006-2009]
Objective	The Palestinian Authority's capacity to make products (geographical information and topological information) using remote-sensing and GIS technics is improved.
Use & Application of ICT	Remote sensing, GIS, Mapping information database

The case mentioned below is an example of preparatory survey (BOP business promotion) project.

Project name	Preparatory Survey for project of regional electrification and new business creation using Digital Grid（一般訳）
Scheme	Preparatory Survey (BOP business promotion)
Target country	Kenya
Project stage	Completed [2014-2015]
Objective	By utilizing the Japan-made electricity control technology called "Digital Grid", a new system of remotely controlling and managing electricity is introduced. At the same time, retail sales of electricity for rechargeable electronic devices for BOP people is carried out through the owners of kiosks – who are of BOP themselves – to be established in the electrified areas. Moreover, the project aims, not only to supply electricity to the BOP level in the region, but also to nurture new businesses using electricity.

Use & Application of ICT	Remote control and management of electricity utilizing the Digital Grid.

Appendix 1-8 Economic policy

(1) Transition to market economy, Money and banking, other economic policy, Macroeconomic operational foundation

Classification	Economic Policy: transition to market economy, Economic Policy: money and banking
Project name	Establishment of Tax Administration Project
Scheme	Technical cooperation project
Target country	Mongolia
Project stage	Completed [2005-2008]
Objective	1) The human resource development and training systems of the National Tax Administration is improved by implementing the short-term action plan developed by the "Study for Establishment of Tax Education System", and the operational capacity of the personnel of the administration is enhanced. 2) Taxation services (levy and inspection) are improved. 3) Services for taxpayers are improved. As activity results, coordination with other agencies and functionality of information system, including that of the third party, are improved, and operations are better implemented.
Use & Application of ICU	Information system, website
Post-fact evaluation	Evaluation result (Rating: A). The overall framework for the project of strengthening the organizational capacity of the taxation authorities, carried out in four phases since 1998, was evaluated.
Comments of the monitoring mission	With regard to ICT, cooperation with other agencies regarding the third-party information system has progressed. The number of cooperating agencies jumped to 20 as of 2012. The number of access to the website increased significantly too thanks to the improvement of the usability of the website for entering the invoices of VAT, as well as the spread of the Internet. In addition, introduction of declaration procedure using digital signature was planned from 2013. Moreover, the distant learning was continuously conducted and it later shifted to an online training. In summary, (the beneficiary) made a continuous progress in use and application of ICT. It seems that they maintain and manage it autonomously.

Classification	Economic Policy: other economic policies, private sector development: promotion of trade and investment
Project name	Risk Management System
Scheme	Technical cooperation project
Target country	Malaysia
Project stage	Completed [2006-2008]

Objective	With the introduction of a risk management system, it becomes capable to promptly judge risks (the necessity for inspection) of imported goods.
Use & Application of ICT	Risk management system

Classification	Economic policy: Money and banking
Project name	Project for strengthening capacity of the central bank （一般訳）
Scheme	Technical cooperation project
Target country	Vietnam
Project stage	Completed [2010-2011]
Objective	Implementation system of the State Bank of Vietnam (SBV) is strengthened towards the development of banking infrastructure. Basic managerial ability of the SBV personnel to handle currency-handling practices (including cash-demand forecasting models) is reinforced. The know-hows on various operations of central bank, such as 1) financial policies, 2) foreign exchange policies 3) researches and statistics, 4) external affairs, are shared.
Use & Application of ICT	Operation system for central banking

Classification	Economic policy: Money and banking
Project name	Project for Modernizing the Funds Payment and Securities Settlement Systems in Myanmar
Scheme	Technical cooperation project
Target country	Myanmar
Project stage	Completed [2014-2017]
Objective	The environment for smooth operation and maintenance of the ICT system for central banking is developed. The service system users acquire knowledge and skills necessary for adequate use of IT. The organizational structure necessary for adequate operation and maintenance of the service system is reviewed.
USE &	Operation system for central banking

(2) Fiscal administration (annual revenue), Fiscal administration (annual expenditure, public expenditure control)

Classification	Economic policy: Financial administration (annual revenue), ICT:ICT, Public Sector Development: Trading and investment promotion
Project name	Project on Philippine Customs Intelligence System (PCIS) for Enhancement of its System Environments and Training of Customs Officers
Scheme	Technical cooperation project
Target country	Philippines
Project stage	Completed [2007-2011]
Objective	The capacity of the Bureau of Customs (BOC)to operate costumes services and to formulate relevant policies is increased. The environment to effectively utilize the Philippine Customs Intelligence System is developed within BOC. The project also assists acquisition of ISO27001 and ISO9001.

Use & Application of ICT	Customs intelligence system

Classification	Economic policy: Financial administration (annual revenue), Public Sector Development: Trade and investment promotion
Project name	Project for promoting E-customs in Vietnam
Scheme	Technical cooperation project
Target country	Vietnam
Project stage	Being implemented [2012-2015]
Objective	The environment for smooth operation and maintenance of VNACCS/VCIS is developed. As a result, customs officials acquire knowledge and skills necessary for adequate use of VNACCS/VCIS. The system to appropriately operate and manage VNACCS/VCIS is developed and staff needed for it is trained.
Use & Application of ICT	VNACCS・VCIS

Classification	Economic policy: Financial administration (annual revenue)
Project name	Project of Capacity Development for National Single Window and Customs Modernization by Introducing Automated Cargo Clearance System in Myanmar
Scheme	Technical cooperation project
Target country	Myanmar
Project stage	Being implemented [2014-2018]
Objective	The environment for smooth operation and maintenance of new Automated Cargo Clearance System (MACCS/MCIS) is reinforced. MACCS/MCIS is a system for customs reform and modernization using Japan's Nippon Automated Cargo and Port Consolidated System (NACCS) and Customs Intelligence Database System (CIS). Outcome 1: Preparation for appropriate introduction of MACCS/MCIS is made. Outcome 2: Customs officials acquire the knowledge and skills necessary for adequately use the MACCS/MCIS. Outcome 3: The system to properly operate and maintain MACCS/MCIS is developed and necessary human resources are trained. Outcome 4: Non-governmental users acquire knowledge and skills necessary to properly use MACCS. Outcome 5: Legal provisions adapted to the use of MACCS/MCIS are developed. Outcome 6: The information control system necessary for adequate operation of MCIS is developed. Outcome 7: By prompt and appropriate customs clearance using MACCS/MCIS, the capacity to carry out core businesses for customs administration such as customs classification, customs valuation, post-customs survey, customs risk management is improved.
Use & Application of ICT	MACCS/MCIS
supplement	This project is planned together with a Grant Aid entitled “The Project for National Single Window and Customs Modernization by Introducing Automated Cargo Clearance System”.

(3) Others

The case mentioned below is one of Partnership with Japanese Private Sector Projects. It is a service system to contribute to governmental revenue.

Classification	Vocational training and fostering industry

Project name	ODA Feasibility Study for VAT collection and management system
Scheme	Partnership with Japanese Private Sector (Project formulation survey)
Target country	Myanmar, Vietnam
Project stage	Completed [2012]
Objective	The objective is to curb tax evasion by transferring sales and tax data to the national server using the latest VAT collection and management system and by managing the revenue of the revenue agency. The terminals should be simple and low-cost; it should be enough to connect to POS or cash registers.
Use & Application of ICT	VAT collection and management system

Appendix 1-9 Field of Private Sector Development

(1) Trade and Investment Promotion

Classification	Private Sector Development-Trade and Investment Promotion, Poverty
Project name	Project on Support to Trade Promotion
Scheme	Technical cooperation project
Target country	Laos
Present stage	Completed 2009～2012
Objective	Improvement of trade-related functions of The Department of Production and Trade Promotion. Perform a needs assessment to plan and implement activities appropriate to needs by way of activity. Organize, analyze, and process the collected data (including database).
ICT utilization	Needs database

Classification	Private Sector Development-Trade and Investment Promotion
Project name	Project on Service Improvement of NAFED
Scheme	Technical cooperation project
Target country	Indonesia
Present stage	Being implemented 2010～2015
Objective	Export-related services of Directorate General of National Export Development (DGNED) have improved. Review of human resource management systems (education and training system, performance evaluation system, personnel transfer system, etc.) by way of activity. Analyzing the problems of service functions and the needs expected to DGNED concerning the market information service and the information providing service.
ICT utilization	Human Resources Management System, Information Providing Service

(2) Industrial Base System

Classification	Private Sector Development-Industrial Base System, ICT-ICT Governance-Law and Judiciary

Project name	Utilization of Intellectual Property Information Project
Scheme	Technical cooperation project
Target country	Vietnam
Present stage	Completed 2005～2009
Objective	Efficient processing, management and information service of intellectual property rights through the utilization of Intellectual Property (IP) Information System within National Office of Intellectual Property of Vietnam (NOIP)
ICT utilization	IP Information System, Search System, Electronic Application Filing System

(3) Tourism

Classification	Private Sector Development-Tourism, Governance-Local Administration,
Project name	Capacity Development on Tourism Statistics in Local Government Units (LGUs)
Scheme	Technical cooperation project
Target country	Philippines
Present stage	Completed 2009～2012
Objective	Development of the capacity to create the Tourism Development Plan within the Department of Tourism and the Local Government Units through enhancement of tourism data, statistics collection, and analytical abilities. Create a standard format for the collection and analysis of tourism statistics data by way of activity.
ICT utilization	Tourism statistics

Appendix 1-10 Agricultural development and rural development

(1) Agricultural policy and institution

Classification	Agricultural/Rural Development-Agricultural Policy and System, Poverty
Project name	Institutional Support for Food Security Project
Scheme	Technical cooperation project
Target country	Indonesia
Present stage	Completed 2005～2008
Objective	Enhancement of the Food Security System function in Indonesia. Food supply and demand policy simulation model is developed and used as a result. Improvement and administration of Web-based Food security information management system.
ICT utilization	Food supply and demand policy simulation model, Food security information management system

Classification	Agricultural/Rural Development-Agricultural Policy and System
Project name	Project for Strengthening Capacity of Inspection System for Ensuring Safety of
Scheme	Technical cooperation project
Target country	Vietnam
Present stage	Completed 2011～2014
Objective	Enhancement of the system to regularly control the safety of agricultural and marine food products in National Agro-Forestry-Fisheries Quality Assurance Department. As a result, National Monitoring Program concerning agricultural and fishery food Make a database of monitoring results, and create a revised plan for National Monitoring Program, based on it's evaluation results.
ICT utilization	Monitoring Database

Classification	Agricultural/Rural Development-Agricultural Policy and System
Project name	Project for Capacity Development for the ASDP Monitoring and Evaluation System Phase II
Scheme	Technical cooperation project
Target country	Tanzania
Present stage	Being implemented 2011～2015
Objective	The monitoring and evaluation of ASDP can be correctly conducted by using agricultural data collected from all over the country through the improvement of Agricultural Routine Data System (ARDS).
ICT utilization	Monitoring and database of ASDP

(2) Agricultural development

Classification	Agricultural development and rural development-Agricultural development
Project name	Valorization of Bio-resources in Semi Arid and Arid Land for Regional Development
Scheme	Technical cooperation project - Science and technology
Target country	Tunisia
Present stage	Being implemented 2010～2015
Objective	Establishment of technical basis to integrally implement a set of processes such as search, functionality assessment, production, and commercialization of the useful components of bio-resources in semi arid and arid lands (olives, pharmaceutical plants, salt-resistant plants). A integrated database including a library for bio-resources in semi arid and arid lands (olives, pharmaceutical plants, salt-resistant plants) would be constructed.
ICT utilization	Integrated database

Classification	Agricultural/Rural Development-Agricultural Development, ICT-ICT
Project name	Database Management for E-Government Promotion
Scheme	Individual project (training by country)
Target country	Penang
Present stage	Completed 2011～2011
Objective	This project aims that participants of the training courses can develop knowledge on database management, reconstruct the database of AfricaRice, and enhance the maintenance function.
ICT utilization	Database, enterprise architecture, open source

Classification	Agricultural development, rural development, south-south cooperation
Project name	The Project for Improving Research and Technology Transfer Capacity for Nacala Corridor Agriculture Development
Scheme	Technical cooperation project
Target country	Mozambique
Present stage	Being implemented 2011～2016
Objective	Develop appropriate agricultural technologies in Nacala Corridor region and engage in technology transfers. Collection and analysis of data(meteological data, water resources data, and topographic data) by way of activity.
ICT utilization	Meteorological Data, Water Resources Data, Topographic Data

Classification	Agricultural/Rural Development-Agricultural Development

Project name	Project for Establishing Business Oriented Agricultural Cooperative Model
Scheme	Technical cooperation project
Target country	Cambodia
Present stage	Being implemented 2014～2019
Objective	Establish a business-oriented agricultural cooperative model in the target area. For this purpose, development and establishment of database (data acquisition, data processing, and data analysis) related to Agricultural Cooperatives.
ICT utilization	Information Management System, Database

Classification	Agricultural/Rural Development-Agricultural Development
Project name	The Project for Improving Operations and Maintenance of National Irrigation Systems
Scheme	Technical cooperation project
Target country	Philippines
Present stage	Being implemented 2013～2017
Objective	Establishing O&M structure of National Irrigation System (NIS) operated by National Irrigation Administration (NIA) (at 212 areas in the country). Listing, collecting and updating the information required for the O&M activities.
ICT utilization	Irrigation System

Rural Development Department Hearing: "Project for the management and maintenance improvement of National Irrigation System" in Philippines

i) About this project

- The condition of the collection of water charge, serving as a basis of the operating cost of NIS (National Irrigation System) by NIA(National Irrigation Administration), is not good, therefore facility maintenance budget is insufficient, leading to the danger of a vicious cycle of bringing about functional decline of the irrigation facilities.
- Until now, information has been collected through self declarations, and no survey was conducted to collect accurate information. Thus, there is a significant gap with actual cropping acreage (underestimated relative to the reality) For this reason, appropriate drainage plan has not been developed, thus, maintenance was inadequate.

Summary

- Phase 3 of this project has 3 objectives: the collection of basic data concerning farmland for adequate O&M(Operation & Maintenance) of NIS, utilization of collected data for the asset management, and the formulation of water distribution management plan.
- A system was established to grasp and verify basic information (cropacreage, etc.) regarding situation of water charge collection or farmland. The regional offices have collected information by using GIS, then gathered them to the Headquarter to make them available. Implemented with 10 out of the 217 sites as pilot models.
- Open source softwares (QGIS) are also used because the license fee of ArcGIS is expensive equipment for the system configuration are procured locally (Pasco Philippines : local subsidiary of Pasco Inc.). Procurement procedures of equipment: Demand from experts to local

agency ⇒ Order from local agency to manufacturer ⇒ Acceptance validation and assembling ⇒ To C/P. Experts take charge of Quality Management.

- The project contains a training concerning GIS to provide capacity building to the personnel of RIO(Regional Irrigation Office).
- Technical concerns have been resolved through the consultations with an expert. Fortunately, this expert had also a good knowledge of GIS, and engaged in the quality management and the system requirement definition. If there had been no expert on GIS,the Infrastructure and Peacebuilding Department of the Headquarter would have provided advices.

Issues

- This matter is being implemented with a background of not being able to collect and store data of farmland division topography data based on measurements, but the lack of data is also a big problem for the system operation. At present, the framework is already prepared, and the system can be operated as soon as data is collected and is ready for utilization.

ii) Possibility of ICT utilization in rural areas.

Utilization performance

- There are a lot of GIS utilization case in various projects.
- Water Level Monitoring System : Water level can be verified by using a mobile phone (proven by Fujitsu Ltd.). Similar projects are mainly implemented with Yen loan.

Utilization possibilities

- IoT and sensing technologies : It would be fine if these technologies can be used, but there is no data assuming the utilization. Data collection by sensing is conducted in cooperation studies. Also, in thescheme of Private Sector Partnership, there exist cases such as strawberry cultivation by NEC in India, however, they are still on the model validation phase.
- Satellite images : If data of planting situation of farmland of past few years or data of damage situation in a time of disaster can be collected, it may be useful for a evaluation or a survey phase. For example, also with ex-post evaluation projects, there were some cases where the projects couldn't be fully evaluated. Data accumulation is important in this sense, too.

Phase for considering utilizations

- In the projects utilizing satellite technologies, some attempt were made to include a utilization method of satellite technologies from the direction phase, consulting with Japan Aerospace Exploration Agency (JAXA).

(3) Others

Although not technical cooperation projects, the following three cases serve as a useful reference of new ICT utilization model for agricultural and rural development such as access to agricultural information, strawberry cultivation, or Farming & Marketing Support Platform.

Classification	ICT-ICT
Project name	Income generation project for farmers at the BOP by using ICT
Scheme	JICA Partnership Program (Partner type)
Target country	Bangladesh
Present stage	Completed 2011～2013
Objective	Telecenter is utilized as a rural general information center, so that farmers can use ICT to access agricultural information at any time, acquire appropriate agricultural production techniques, and thus increase their income.
ICT utilization	Telecenter, Agricultural Information System

Classification	
Project name	Preparatory survey on Smart Village business contributing to improve the lives of BOP population in India (一般訳)
Scheme	Preparatory Survey (BOP business cooperation)
Target country	India
Present stage	Completed 2012～2013
Objective	Using ICT, Japanese corporations aiming to convert villages, where BOP (Base of Pyramid) population live, to smart villages, along with NPO Corporate Entity ICA Cultural Enterprise Association that assists the improvement in living conditions in Indian farming villages, in cooperation with Limited Company GRA of Yamamoto town of Miyagi Prefecture, who has the High-Raised Soil-less Cultivation technology and after the Great East Japan Earthquake was able to restore the strawberry industry for the locals who received devastating damages as a result of Tsunami within a year, propose to commercialize the strawberry cultivation in India.
ICT utilization	Cultivation Management, Remote Monitoring System

Classification	Poverty Reduction-Poverty Reduction
Project name	Support to establish a new society of BOP farmers by using the power of ICT
Scheme	JICA Partnership Program (Partner type)
Target country	Bangladesh
Present stage	Being implemented 2014～2017
Objective	by utilizing iFarM (ICT based Farming & Marketing Support Platform) realize the organization of farmers and the development of new community with consumers to find direction of creating production and distribution business of high quality brand vegetables.
ICT utilization	Farming & Marketing Support Platform

Moreover, as examples of partnership type project, projects to support SMEs in overseas business, preparatory Surveys, and projects for promoting private sector technology will be mentioned.

Project name	Project for Implementation, Diffusion, and Demonstration of IT in the Agricultural Products Distribution (一般訳)
Scheme	Project to Support SMEs in Overseas Business
Target country	Philippines
Present stage	Completed 2015
Objective	Cultivation Management System “Farm Chronicle": a system distributing agricultural products cultivation history to be recorded in digital form by the producer, and this information to be provided to distributors, retailers and other related parties as well as consumers via the Internet. Increase the value of agricultural products as a result of production monitoring (pesticides and fertilizers) information disclosure, and product PR function. A system to manage purchases and sales, and a management system where the producer, production company, and intermediary distributors can use shared code to manage sales, processing, and shipping. Order entry, inspection, stock, processing, sorting, and delivery of products. Understand commercial flow, logistics, and information flow in a timely manner and utilize them for a efficient trading.
ICT Utilization	Cultivation Management, Purchase and Selling Management System

Project name	Preparatory survey for Finance and information infrastructure project by using E-money technology
Scheme	Preparatory Survey (BOP Business Cooperation)
Target country	Mozambique
Present stage	Being implemented 2015～2017
Objective	By offering finance and information infra-service, lack of access to information and finance can be solved for Mozambique BOP (Base of Pyramid) population that are mainly consisted of marginal farmers.
ICT utilization	Financial and Information Infrastructure Services

Project name	Project for Promoting Smart Agri (Livestock and Greenhouse Horticulture) utilizing ICT (一般訳)
Scheme	Project for promoting private sector technology
Target country	Turkey
Present stage	Being implemented 2014～2016
Objective	Providing Smart Agri ICT system to agricultural corporations and farming families as cloud service through the cooperation with Republic of Turkey Ministry of Food, Agriculture and Livestock or associations of livestock industry.
ICT utilization	Smart Agri ICT system, Cloud service

Project name	Project for promoting Complex Sensing Technologies to improve agricultural productivity.
Scheme	Project for promoting private sector technology
Target country	Indonesia
Present stage	Being implemented 2015～2016

Objective	Operating local experimental proof activities on the "Comprehensive Support Program" based on Agricultural remote sensing technology, Agriculture weather data analysis technology, and satellite positioning system applied technology.
ICT utilization	Agricultural remote sensing technology, agriculture weather data analysis technology, and satellite positioning system

Appendix 1-11 Nature and environment conservation division

(1)Sustainable Use of Natural Resources

Classification	Nature Conservation-Sustainable Use of Natural Resources,
Project name	The Project for the Support on Forest Resources Management through Leveraging Satellite Image Information
Scheme	Technical cooperation project
Target country	Indonesia
Present stage	Completed 2008～2011
Objective	Applying the same related technology used in PALSAR (microwave sensors installed on JAXA ALOS satellite) and MODIS (optical sensors installed on American AQUA/TERRA satellite that can study forest resources in wide areas), the Forestry Planning Agency can acquire capabilities to study forest resources with a high degree of reliability.
ICT utilization	Remote Sensing

Classification	Nature Conservation-Sustainable Use of Natural Resources, Poverty Reduction-Poverty Reduction
Project name	Wild Fire and Carbon Management in Peat-forest in Indonesia
Scheme	Technical Cooperation Project-Science and Technology Research Partnership (SATREPS)
Target country	Indonesia
Present stage	Completed 2010～2014
Objective	A model for managing wild fire and carbon of Peat-forest can be constructed. Fire detection and fire prediction system can be constructed by way of activity. Carbon content estimation system can be constructed. Carbon management system can be constructed.
ICT utilization	Fire Prediction System, Carbon Amount Estimation System, Carbon Management System

(2) Biodiversity Conservation

Classification	Nature Conservation-Biodiversity Conservation
Project name	Qurm(Mangrove)Environment Information Center (QEIC) Development
Scheme	Technical Cooperation Project
Target country	Oman

Present stage	Completed 2012～2013
Objective	Preparing as a center for promoting sustainable management of the Mangrove ecosystem in Oman.
ICT Utilization	Database, Homepage

Classification	Nature Conservation-Biodiversity Conservation
Project Name	Project for Sustainable Management of Coral Reef and Island Ecosystems： Responding to the Threat of Climate Change
Scheme	Technical Cooperation Project-Science and Technology (SATREPS)
Target country	Palau
Present stage	Being implemented 2013～2018
Objective	The research capabilities regarding the coral reef and insular ecosystem in Palau and continued maintenance management capabilities can be strengthened. Scientific data system required for the continued monitoring of coral reef and insular ecosystem and ocean environment can be organized. Building a management system for the basic living organism database(organism species list)by way of activity. 1-7 To create basic living organism database (organism species list)and a genome database, and disclose the information.
ICT Utilization	Basic living organism database(organism species list), genome database

(3) Revegetation of Degraded Land

Classification	Nature Conservation-Revegetation of Degraded Land, Water Resources and Disaster
Project name	Project on Development of Integrated System for Prevention and Early Warning of Forest Fires
Scheme	Technical cooperation project
Target country	Former Yugoslav Republic of Macedonia
Present stage	Completed 2011～2014
Objective	Providing information regarding prevention of forest fires and early warning to the concerning parties in the country, and strengthening the ability of coordination between the parties.
ICT utilization	GIS, hazard map, and remote sensing

Classification	Nature Conservation-Revegetation of Degraded Land, Environmental
Project name	Project for Facilitating the Implementation of REDD+ Strategy and Policy
Scheme	Technical cooperation project
Target country	Cambodia
Present stage	Being implemented 2011～2016
Objective	To increase the capabilities of related parties to smoothly implement the greenhouse effect gas emission reduction(REDD+)strategies and policies. Designing of land monitoring systems via satellites to provide activity data for activities, and designing of National Forests Inventory that determines the causes of the greenhouse effect gas emission and absorption are included.
ICT utilization	Forest Monitoring System, Land Monitoring System, Remote sensing, GIS

(4) Other Nature Conservation

Classification	Nature Conservation-Other Nature Conservation
Project name	Carbon Dynamics of Amazonian Forests
Scheme	Technical Cooperation Project-Science and Technology (SATREPS)
Target country	Brazil
Present stage	Completed 2010～2014
Objective	A wide area evaluation technology for Amazon's varied forests carbon dynamics can be developed. Using continued forest inventory system, remote sensing technology and satellite data by way of activity, a map representing the carbon accumulation dynamics can be created.
ICT utilization	Forest Inventory System, Remote Sensing Technology, Satellite data

Classification	Nature Conservation-Other Nature Conservation
Project name	Capacity Development Project for Establishing National Forest Information System for Sustainable Forest Management and REDD+
Scheme	Technical cooperation project
Target country	Laos
Present stage	Being implemented 2013～2015
Objective	Preparing the components required to establish the National Forest Information System. Designing National Forest Information Database by way of activity.
ICT utilization	National Forest Information Database

Appendix 1-12 Field of Fisheries

(1) Fisheries Administration, Fisheries Resource Management

Classification	Fisheries-Fisheries Resource Management
Project name	Project on Co-management of Coastal Fisheries in the Gulf of Gabes
Scheme	Technical cooperation project
Target country	Tunisia
Present stage	Being implemented 2012～2016
Objective	Continuously implementing the co-management of coastal aquatic resources in target areas of the Gulf of Gabes.
ICT Utilization	Statistical Data of Fisheries, GIS

(2) Fishing Villages Development, Aquaculture, Other fisheries, others

Classification	Fisheries-Aquaculture, Poverty Reduction-Poverty Reduction
Project name	The Comprehensive Outreach and Fish Breeding Project

Scheme	Technical cooperation project
Target country	Philippines
Present stage	Completed 2006～2010
Objective	To make the structure of fish breeding diffusion work well in the pilot municipalities. To support establishing PBDP Hatchery Information Network regarding breeder among hatchery operators by way of activity.
ICT utilization	Hatchery Information Network

Appendix 1-13 Urban development/regional development area

(1) Urban development

Classification	Urban development/regional development-Urban development, ICT-ICT, Peace building-Public/infrastructure social service support
Project name	Study for GIS Database Improvement Project in the Principal Cities along the Atlantic Coast in Columbia(一般訳)
Scheme	Development study
Target country	Columbia
Present stage	Completed, 2005 - 2008
Objective	To prepare a digital urban map of three cities along the coast of the Pacific Ocean with a high priority of GIS database in Columbia, among 103 cities in Columbia where urban development needs to be improved, and to improve GIS database.
Use & application of ICT	GIS

Classification	Urban development/regional development-Urban development, ICT-ICT
Project name	Study for Digital Mapping in Georgia (一般訳)
Scheme	Development study
Target country	Georgia
Present stage	Completed, 2005 - 2008
Objective	To possess expertise so that Georgia can continuously improve geographical information in the future.
Use & application of ICT	GIS, database

Classification	Urban development/regional development-Urban development, Urban development/regional development-regional development, Urban development/regional development-Other urban development/regional development
Project name	Project for Assisting in Strengthening Space Plan Monitoring System (一般訳)
Scheme	Technical cooperation project
Target country	Indonesia
Present stage	Completed, 2007 - 2010
Objective	To operate the special use monitoring system and develop human resources for the monitoring system. As a result, the special use monitoring system will be established and the database for a special use map and others in the model city will be improved.
Use & application of ICT	Database for the map and others

Classification	Urban development/regional development-Urban development, Environmental management-Global warming
Project name	Enhancement of Urban Development Management in the Mamminasata Metropolitan Area
Scheme	Technical cooperation project
Target country	Indonesia
Present stage	Completed, 2009 - 2012
Objective	To improve urban development/management capability in the Mamminasata Metropolitan Area. As a result, the tools necessary for urban development management will be improved. To develop the urban data management system (model).
Use & application of ICT	Urban data management system

Classification	Urban development/regional development-Urban development
Project name	Project for Urban Development Management
Scheme	Technical cooperation project
Target country	Laos
Present stage	Being implemented, 2013 - 2016
Objective	To improve the urban development capability of the urban development staff in Vientiane. As a result, the basic information (land use map) improvement capability for urban development will be enhanced.
Use & application of ICT	Database (GIS)

Classification	Urban development/regional development-Urban development, governance-administrative infrastructure
Project name	Project for Improvement of Planning and Implementation Skills of Ulaanbaatar Master Plan
Scheme	Technical cooperation project
Target country	Mongolia
Present stage	Being implemented, 2014 - 2018
Objective	To clarify the function/role sharing of each bureau and agency, improve the capability of each agency and staff member, formulate the medium-term strategic policy (for four years) and financial plan, and strengthen the implementation skills of Ulaanbaatar Master Plan through the introduction of software. As a result, the integrated software for the development policy and urban planning will be developed (produced) and general information will become available to the public.
Use & application of ICT	Releasing information to the public, software for the investment plan, effect measurement, financial management, and progress management.

(2) Regional development

Classification	Urban development/regional development-Regional development, ICT-ICT, City development/regional development-Geographic information

Project name	Geographic Information Management Strengthening Project
Scheme	Technical cooperation project
Target country	Senegal
Present stage	Completed, 2005 - 2008
Objective	To develop human resources engaging in geographic information management so that a regional coordinated/integrated relationship in West Africa can be promoted. As a result, the participants can share technology transferred by the Japanese experts to the Senegalese C/P and expertise on organizational operation. Standardization of procedures for the acquisition, management, and diffusion of map information in West Africa can be promoted.
Use & application of ICT	Geographic information management

Classification	Urban development/regional development-Regional development,
Project name	Project for Sustainable Regional Development through Eco-Tourism
Scheme	Technical cooperation project
Target country	Bothnia and Herzegovina
Present stage	Completed, 2007 - 2009
Objective	To develop human resources and strengthen organizational capability for promoting regional development through eco-tourism for the government and residents in the target area. To operate a website as an activity.
Use & application of ICT	Website

Classification	Urban development/regional development-Regional development, Governance - Local government, Peace building - Governance
Project name	Local Governance and Rural Empowerment Project for

	Davao Region
Scheme	Technical cooperation project
Target country	The Philippines
Present stage	Completed, 2007 - 2010
Objective	To improve the water supply capability of the local government in the Davao region. As a result, the collected data and analysis results are compiled into a database.
Use & application of ICT	Database of collection/analysis results
Post-fact evaluation (2014, external evaluation)	Evaluation results (Rating: A). Before implementing the project, the staff had made measurements and carried out facilities design by rule of thumb. However, the staff began to use a new method: evaluating the groundwater quality and estimating potential reserves to conduct a pipe network analysis for the optimum design of water facilities. Also, the community organization was created to conduct the maintenance of small-scale water supply facilities. The staff gained the facilitation skills through the preparations of the establishment and technical assistance provided after the facilities were put into operation. On the basis of these experiences, guidelines for the process of the water supply project based on the scientific measurements under the cooperation system with local residents were set. The project goal was achieved because all of the criteria were met at the completion of the project. Later, as well, a small-scale water supply service project was carried out through the application of an improved technique.
Research team's comment	Current information about 1000 water supply facilities (Information on hydraulic structures, water source, organization, statistics in the community, geography) was compiled into a database and the data was effectively used to provide administrative services. This is a good example of an improvement in administrative service level by compiling current information into a database.

Classification	Urban development/regional development-Regional development,
Project name	Community Development Project for Returnees and Receiving Communities in Nangarhar Province
Scheme	Technical cooperation project
Target country	Afghanistan
Present stage	Completed, 2010 - 2013
Objective	To improve the system and environment to implement the basic community-level infrastructure improvement project necessary for the enhancement of the returnees' and receiving communities' living environment. As an activity, the current situation of the target province and development needs are compiled into a database and the information is updated as needed.
Use & application of ICT	Database

(3) Geographic information

Classification	Urban development/regional development-Geographic information, ICT-ICT
Project name	Project for Strengthening Survey of Kenya for GIS Promotion in the Republic of Kenya (一般訳)
Scheme	Technical cooperation project
Target country	Kenya
Present stage	Completed, 2006 - 2008
Objective	To strengthen the Survey Bureau of Kenya for promoting the use of GIS. It is necessary for Kenya to build the national spatial data infrastructure. To do so, the diffusion of GIS is needed. The goal of this project is to promote the use of GIS for building the national spatial data infrastructure (SDI) and to develop resources necessary to diffuse GIS.
Use & application of ICT	GIS, spatial data infrastructure

Geographic information processing is a key point in the use of ICT. GIS has already been used in many projects. JICA conducted an interview survey for this project to identify the problems and important points to keep in mind concerning the use of GIS

and its related tools.

Social infrastructure/peace building section “Project for Strengthening Survey of Kenya for GIS Promotion in the Republic of Kenya”

Gist of the interview survey

i) Background of project

・Digitization of information for the mapping projects proceeded around the latter half of the 1990s. Assistance had been provided to Kenya over a period of 20 years. In those days, it was the longest period of assistance in the history of JICA. By around 2007 when this project was started, vector conversion of the maps into electronic form had been almost completed and the local authority had a high level of competence.

・Meanwhile, the use of GIS needed to be promoted in the developing countries because electronic maps were often not effectively used.

・Under these circumstances, this project was started for the purpose of promoting the use under the concept of adding information necessary for each ministry or agency to GIS and sharing it among the ministries and agencies.

・Assistance provided to this project was of a hybrid type, which was common in a technical cooperation project in those days. A hybrid type of assistance consists of a JICA long-term expert and a consultant.

・The maps are kept in custody not by the military but by the Kenya Lands Ministry, which is equivalent to the Geospatial Information Authority in Japan. Like in Japan, the topographic map is available. Other agencies cooperate in adding information managed by each agency to the topographic map to prepare a thematic map. (For example, the Ministry of Public Health adds information on malaria.)

ii) Opinions, lessons, etc. about the present project seen from the perspective of ICT and the map projects in general

・Introduction of ICT seems to have been easy because it was easier to convert map information into electronic form than preparing a paper map.

・The viewpoint that technology should be applicable to the developing countries is important. However, JICA was keeping a close watch on new technologies because cutting-edge technology was often easier to use.

・The map is universal and can be used in any field. It is necessary to specify what the map is used for. (For example, connecting the map with an advantage of city planning and forest management.)

iii) Procurement of equipment and material

・Basically, JICA purchases software locally. JICA brings software in only when it is not

locally available.

- ArcGIS will cost 2 to 3 million yen to purchase and the annual licensing fee will cost 100,000 yen. As ArcGIS is a very expensive piece of software, it was introduced into the server only and other inexpensive pieces of software including open source software such as QGIS[58] and KML[59] were used for clients. As is usual with the developing countries, they want an expensive piece of software. In those days, JICA had a policy of purchasing software other than ArcGIS from the perspective of not cost reduction but sustainability.
- Which software to use may depend on the counterpart. To avoid this problem, I aimed at unity of software at least in the project which I took charge of, leaving standardization out of the question. Since I took charge of the map project alone at that time, I achieved standardization to some extent, but I had no concern in the GIS project of other sections.
- I left to an expert equipment/material planning such as the selection of a sever or network and there was no problem. It is advisable to ask experts about GIS because it is a field of expertise. The counterpart bears the cost of server and communications environment sizing. I did not need the information communication group's advice.

iv) Transfer to other projects

- From the perspective of applying GIS to other projects and making the most of data, I think data sharing and standardization of technical formats are important. Since how to cooperate differs from issue to issue, it is not easy to apply GIS to other projects without preparation. However, it is important to make GIS available to everyone. (For example, each developing country can freely choose any software, depending on the situation of the country, while the final output should be converted into a specific standardized format.)
- This project (2006 - 2008) has already become outdated from the technological perspective because ICT undergoes rapid changes as a result of technological innovation. A project of those days may be rarely transferred to other countries.

v) Whether to cooperate with other sections or donor organizations of other countries

- There is no cooperation system with other sections concerning GIS. I personally received inquiries and responded to them. The Economic Infrastructure Development Department sometimes holds a seminar.
- International agencies or bilateral aid agencies do not carry out a map project very often. Although in some cases the map prepared by JICA is used and appreciated very much by these agencies, JICA has not worked together with them. The C/P provides the map to them.

[58]: QGIS is a piece of open source GIS software.

[59]: Keyhole Markup Language (KML) is an XML-based file format used to store geographic data and related content and is the official standard of the Open Geospatial Consortium (OGC). Since geographic data can be displayed in many free applications such as Google Earth and ArcGIS Explorer, KML is a general format to share geographic data with non-GIS users.

Classification	Urban development/regional development-Geographic information, Environmental management-Global warming, ICT-ICT
Project name	Study on the Formulation of Geographic Information System
Scheme	Development study
Target country	Montenegro
Present stage	Completed, 2007 - 2009
Objective	To prepare a digital topographic map of about 70% of the whole country on a scale of 1:25,000, improve GIS data infrastructure, and transfer topographic map and GIS data preparation technology in the process.
Use & application of ICT	GIS, database

Classification	Urban development/regional development-Geographic information, ICT-ICT
Project name	Formulation of Geographic Data Base of Nouakchott in the Islamic Republic of Mauritania
Scheme	Development study
Target country	Mauritania
Present stage	Completed, 2007 - 2009
Objective	To prepare a digital topographic map of Nouakchott on a scale of 1:10,000 (1,200 km^2), convert map information into a digital format, and improve it as GIS infrastructure.
Use & application of ICT	GIS, digital topographic map

Classification	Urban development/regional development- Geographic information, Governance-Administrative infrastructure
Project name	Economic Development Planning Capacity Improvement Project by Using Map Information System (一般訳)
Scheme	Technical cooperation project
Target country	Swaziland
Present stage	Completed, 2007 - 2010
Objective	To build the development management information system with geographic information and statistic information integrated and strengthen the capability of using the system. The Swaziland government formulates the development plan effectively and efficiently by operating the development management information system.
Use & application of ICT	Development management information system (with geographic information and statistic information integrated)

Classification	Urban development/regional development - Geographic information, ICT-ICT, Peace building - Public/infrastructure social service support
Project name	Kabul Metropolitan Area Topographic Map Preparation Project (一般訳)
Scheme	Development study
Target country	Afghanistan
Present stage	Completed 2008 - 2011
Objective	To prepare digital topographic map of Kabul and its neighboring area. Technology necessary to prepare a digital topographic map will be transferred through the implementation of the survey.
Use & application of ICT	Digital topographic map

Classification	Urban development/regional development- Geographic information, ICT-ICT, South-South Cooperation - South-South Cooperation
Project name	GIS Application Seminar (一般訳)
Scheme	Individual project (Country-Focused Training)
Target country	Kenya
Present stage	Being implemented, 2008 - 2015
Objective	To make the trainees understand geographical information science and contribute to preparing the map of the Southeast African countries.
Use & application of ICT	GIS

Classification	Urban development/regional development - Geographic information, ICT-ICT
Project name	Project for Capacity Development of Digital Basic State Mapping in Serbia
Scheme	Technical cooperation project
Target country	Serbia
Present stage	Completed, 2009 - 2011
Objective	To improve the sustainable system to properly prepare, update, and provide the digital topographic map (national large-scale base map).
Use & application of ICT	Digital topographic map

Classification	Urban development/regional development - Geographic information, Transportation/traffic - Other transportation/traffic, Urban development/regional development -Other urban development/regional development
Project name	Bangladesh Digital Mapping Assistance Project
Scheme	Technical cooperation project
Target country	Bangladesh
Present stage	Completed, 2009 - 2013

Objective	In the mapping project implemented by the Survey of Bangladesh, to attain a technical level high enough for the staff members to independently carry out their duties in the target area.
Use & application of ICT	Digital map

(4) Common/other urban development

Classification	Urban development/regional development - Other urban development/regional development
Project name	Project for Strengthen the Capacity on Advanced Mapping of SOB for Building Digital Bangladesh
Scheme	Technical cooperation project
Target country	Bangladesh
Present stage	Being implemented, 2013 - 2016
Objective	To improve the digital mapping skills of the staff of the Survey of Bangladesh (SOB) of the Ministry of Defense. As a result, Geo-Portal website of SOB will be opened toward the introduction of National Spatial Data Infrastructure (NSDI), a top-priority project for SOB.
Use & application of ICT	Geospatial information (NSDI), website

Classification	Urban development/regional development - Other urban development/regional development, ICT-ICT
Project name	Project on Capacity Development on Information Security Management of Land Information System for Land Restitution Policy Promotion
Scheme	Technical cooperation project
Target country	Columbia
Present stage	Being implemented, 2013 - 2016
Objective	To strengthen the information security management skills of the counterpart (C/P) organizations (six related organizations) related to land information system.
Use & application of ICT	Information security

In addition, a private-sector technology diffusion and promotion project is described below.

Project name	ICT Project Operation Technology Diffusion and Promotion Project in Binh Duong Province (一般訳)
Scheme	Private-sector technology diffusion and promotion project
Target country	Vietnam
Present stage	Completed, 2014 - 2015
Objective	To strengthen the communications environment of the Binh Duong Province through the provision of expertise in ICT project operation of the broadcasting/communications/data center and at the same time to further promote the new urban development carried forward by the province.
Use & application of ICT	Broadcasting/Communications/Data Center

Appendix1-14 Environmental Management

(1) Air pollution/Acid rain, Water pollution, Soil pollution

Classification	Environmental management-Water contamination
Project name	Enhancing Capacity of Water Environment Monitoring System in the Republic of Kyrgyz
Scheme	Technical cooperation project
Target country	Kyrgyz
Present stage	2005-2007 Completed
Objective	To implement accurate water quality analysis and study of research results on the central analysis office's research elements that meet environmental standards. Also, to acquire methods of analysis/data processing for basic water analysis elements.
Use & application of ICT	Water environment monitoring

Classification	Environmental management-Others: Environmental management, Poverty reduction-Poverty reduction
Project name	Nakuru Environmental Management Project
Scheme	Technical cooperation project
Target country	Kenya
Present stage	2005-2009 Completed

Objective	To improve environmental management capability mainly in Nakuru environmental management. It should result in an adequate water quality monitoring program to be developed and implemented for acquiring practically countable data. A water quality monitoring database will be developed as part of the operation
Use & application of ICT	Water quality monitoring, database
Post-fact evaluation (Internal evaluation 2013)	Generally, this project receives high marks. For the main objective; Environmental management capability improvement in Nakuru city's water related field, environmental tools developed in the project, e.g. water quality monitoring program, guidelines/manuals for plant inspection/guidance, are still adequately used for environmental management of Lake Nakuru's vicinity to make a visibly effective result. Also, a water quality monitoring program for highly reliable data collection/analysis was developed, and environmental tool maintenance, e.g. plant inspection manual/ factory effluent management guidelines, and administration direction were improved. Moreover, a GIS database was developed, and a collaboration system for Lake Nakuru catchment area management was enhanced through discussions on necessary catchment area management strategies among the related staff and seminars.
Research team remarks	There is one concern for sustainability for which no sufficient budgetary steps for supplied equipments have been taken. A measure needed in order to maintain the flow of use & application of ICT that has been cultivated.

Classification	Environmental management-Air pollution・ Acid rain
Project name	Strengthening of Air Monitoring Program
Scheme	Technical cooperation project
Target country	Mexico
Present stage	2005-2008 Completed
Objective	To raise the awareness among Mexican society of the

	importance of air quality monitoring, to improve policy making and evaluation capability through enhancing regional communities providing highly reliable air quality monitoring data. Also, to enhance regional communities' capability of air quality monitoring data management/analysis.
Use & application of ICT	Air quality monitoring
Post-fact evaluation (Internal evaluation 2013)	Generally, the project is evaluated quite highly. Judging from improvement on the provision/application of highly reliable air quality monitoring data by regional network and, for the prioritized objective, promotion of air pollution control/emergency plan by regional government, existence of the expected effect can be acknowledged. In sustainability aspect, there has been a promotion by national policy, secured budget and technical ability, and expansion of the air quality monitoring network. Upon request from regional monitoring network, for air quality monitoring equipment management, DIMACAC (DIRECCIÓN DE INVESTIGACIÓN EN MONITOREO ATMOSFÉRICO Y CARACTERIZACIÓN ANALÍTICA DE CONTAMINANTES) has developed an annual plan for equipment examination air quality monitoring. The air quality monitoring data is linked to other systems that practice air monitoring. Also, central and regional level workshop/training, including the regional monitoring network that is newly integrated into the national air quality information system, is implemented online.
Research team remarks	As shown above, the improved monitoring system has expanded ICT use and application derivatively

Classification	Environmental management-Water contamination
Project name	Water Environment Improvement in Metropolitan Area
Scheme	Technical cooperation project
Target country	Guatemala
Present stage	2006-2009 Completed

Objective	To enhance MARN's (Ministerio de Medio Ambiente y Recursos Naturales) operation capability of effluent regulation for water environment preservation. Water environment information will be collected as part of the operation, including water environment database development/management
Use & application of ICT	Water environment database Post-fact evaluation
Post-fact evaluation	From a comprehensive evaluation, the project needs improvement. For MARN's operation capability enhancement, the increase in the number of the personnel, an attempt at strategy for effluent regulation, which is developed in the project, and promotion of environmental education are all seen. However, the achievement of the regulation goal is only seen in some of the target companies and is not sufficient. Toward sustainability, effluent regulation was made compulsory for all communities in 2015, yet, staff or examination capability is not sufficient for national water quality monitoring, and further, the water quality department's budget is significantly cut to interfere with the operation result.
Research team remarks	The water environment database that was developed on the project can no longer be maintained due to data overloading the server limit, thus, a different system of water resources/ watershed department. Improvement of the operation environment, e.g. increase the server capability, has been proposed to the implementing agency, however, the difficulty in operation due to the database capacity means a lack of basic response to ICT environment O&M, thus, the operation can be problematic.

Classification	Environmental management-Water contamination
Project name	Research and Development for water reuse technology in tropical regions
Scheme	Technical cooperation project−SATREPS
Target country	Thailand

Present stage	2009-2013 Completed
Objective	To conduct a research study on water recycling technology that leads to resolve the issue of water resources vulnerability and sacrament of safe water. A water recycling technology technical information database will be developed. There shall be a polluted mud flow simulation and development of the most appropriate water recycling system as part of the operation in a model location as well.
Use & application of ICT	Technology information database, polluted mud flow simulation, water recycling system

Classification	Environmental management-Air pollution/Acid rain
Project name	The Project for Capacity Development of planning for pollution control of O3 and PM2.5 in Atmosphere
Scheme	Technical cooperation project
Target country	China
Present stage	2013-2016 Being implemented
Objective	To enhance the understanding on the response status and its history, and research methods/pollution control technologies to Japan's tropospheric ozone as well as PM2.5, and for China to utilize the experience for its plan-making. Also, to enhance the understanding of research studies, e.g. monitoring, simulation inventory, on tropospheric ozone and PM2.5
Use & application of ICT	Monitoring, simulation

Classification	Environmental management-Air pollution・ Acid rain
Project name	Capacity Development Project for Air Pollution Control in Ulaanbaatar City
Scheme	Technical cooperation project
Target country	Mongolia

Present stage	2010-2013 Completed
Objective	To enhance Ulaanbaatar city's air pollution control capability emphasizing HRD in the city and other related organizations. Air environment monitoring data will be collected/analyzed in order to evaluate the relevance of the data. A simulation will be run on the base year to confirm the accuracy of the source origin data and simulation model reproducibility as part of the operation. Inventory will be used to run a simulation to evaluate the effect on the air environment. A source origin inventory system including database and manual will be designed/installed. In Phase 2, for air environment monitoring, data management/accuracy improvement including items such as emission source monitoring, air environment monitoring, and source origin inventory/simulation will be in operation.
Use & application of ICT	Simulation, database

Classification	Environmental management-Air pollution/Acid rain
Project name	Capacity Development Project for Air Pollution Control in Ulaanbaatar City Phase 2
Scheme	Technical cooperation project
Target country	Mongolia
Present stage	2013-2017 Being implemented
Objective	Since there are remaining issues in data management/accuracy improvement of some air environment monitoring which were not included in Phase 1 operation, upon the Mongolian government, Phase 2; subsequent from the project is to be implemented. Emission source monitoring, air environment monitoring, and source origin inventory/simulation will be included in the operation.
Use & application of ICT	Database, emission monitoring, air environment monitoring, source origin inventory, simulation

In the two projects above, by consecutive assistance for the total of seven years, highly specialized technology has been transferred, e.g. an air pollution simulation model. For the Mongolian government to become able to recognize the effect on each pollution source referring to its own collected-data, a response proposal is now accepted by Ulaanbaatar city council and is being prepared for implementation. It is a case where a proposal based on specialized ICT produced a significant result.

(2) Mine pollution, general waste, cleaner production, global warming, and others

Classification	Environmental management-Global warming, ICT-ICT, Poverty reduction-Poverty reduction
Project name	Project of Capacity Development for Climate Change Strategies
Scheme	Technical cooperation project
Target country	Argentina
Present stage	2006-2008 Completed
Objective	To enhance adaptability for climate change in Argentina. Adaptability for climate change will be enhanced.
Use & application of ICT	Climate change information management

Classification	Environmental management-General waste
Project name	The Project for Improvement of Solid Waste Management for the Municipality of Panama in the Republic of Panama
Scheme	Technical cooperation project
Target country	Panama
Present stage	2007-2010 Completed
Objective	To improve solid waste management services for the municipality of Panama. A database for regular garbage truck O&M e.g. monitoring of garbage collection/transport improvement status, junction transportation system monitoring, and construction of an information network system for waste management will be part of the operation.
Use & application of ICT	Junction transportation system monitoring, O&M database, waste management information network system

Post-fact evaluation (Internal evaluation 2014)	The mark on this project is relatively low. The important components for the project could not be constructed due to being unable to acquire a site, thus, no improvement was made in waste collection service. The improvement of waste management and its sustainability remains a priority for the central government. However, the inadequacy of both disposal site management and garbage truck maintenance, as well as absence of technical training for AAUD staff, show the existence of systematic and technical issues.
Research team remarks	As mentioned above, the project did not reach the goal of seeing an improvement in waste management service. Therefore, it can be judged that an ICT O&M database as well as a waste management network system are not in operation. There is no mentioning about ICT in post-fact evaluation either.

Classification	Environmental management-Global warming, water resources/Disaster management-Weather
Project name	Prediction of Climate Variations and Its Application in the Southern African Region
Scheme	Technical cooperation project−SATREPS
Target country	the Republic of South Africa
Present stage	2010-2013 Completed
Objective	To improve prediction of seasonal climate variations that are adaptable to environmental issues in the Southern African region. As a result, a model early prediction system that alleviates effects from abnormal climate will be structured and installed. Also, the climate change researchers' network in Southern Africa will be enhanced.
Use & application of ICT	Early prediction system, supercomputer, researcher network

Classification	Environmental management- Global warming, water resources/Disaster management-Weather

Project name	Climate Variability Study and Societal Application through Indonesia-Japan "Maritime Continent COE"-Radar-Buoy Network Optimization for Rainfall Prediction
Scheme	Technical cooperation project−SATREPS
Target country	Indonesia
Present stage	2010-2014 Completed
Objective	To improve prediction accuracy of extreme weather phenomena, and to promote fundamental research/development on rainfall disaster alleviation planning toward achievement to be shared with the world. With an optimized climate radar profiler network, a high-precision observation technology that is sufficient for observation/prediction of short-term climate and rainfall variation will be established in MCCOE.
Use & application of ICT	Early prediction system, supercomputer, researcher network

Appendix2　Aid Programs by International institutions/Bilateral assistance institutions

Appendix2-1 ICT Projects by World Bank
(Loan approved cases of 2005-2015) (1)

プロジェクト名(Project Title)	国 (Country)	Project ID	約束額 Commitment Amount ($mil.)	状態 (Status)	承認日 (Approval Date)
First Competitiveness and Fiscal Management Programmatic DPL	Jamaica	P151448	75.00	Active	2015-03-03
Supporting Burkina Faso Open Data Initiative and addressing drought risks by introducing innovative use of data & Open Data solution	Burkina Faso	P151740	0.00	Active	2014-08-11
Judicial Services and Smart Infrastructure Project	Azerbaijan	P144700	100.00	Active	2014-07-09
MN: SMART Government	Mongolia	P130891	19.40	Active	2014-06-06
2nd DPL to Support Inclusive Green Growth and Sust Devlp in HP	India	P143032	100.00	Closed	2014-05-16
AF for Bhutan 2nd Urban Development Proj	Bhutan	P145392	17.40	Active	2014-05-16
ICT Sector Support in Somalia	Somalia	P148588	2.00	Active	2014-05-15
Ethiopia General Education Quality Improvement Project II	Ethiopia	P129828	130.00	Active	2013-11-12
GH eTransform Ghana	Ghana	P144140	97.00	Active	2013-10-24
Climate Information System and PPCR Coordination	Yemen, Republic of	P132116	19.00	Active	2013-09-05
West Africa Regional Communications Infrastructure Project - APL 2	Africa	P123093	60.00	Active	2013-05-30
Zambia Strengthening Climate Resilience (PPCR Phase II)	Zambia	P127254	36.00	Active	2013-05-09
Additional Finaning of Public Procurement Reform Project II	Bangladesh	P132743	34.50	Active	2013-05-09
Mauritius Second Private Sector Competitiveness DPL	Mauritius	P132510	15.00	Closed	2013-03-27
VU: Telecommunications and ICT TA, Additional Financing	Vanuatu	P143465	2.73	Active	2013-03-20
IN: Development Policy Loan (DPL) to Promote Inclusive Green Growth and Sustainable Development in Himachal Pradesh	India	P124041	100.00	Closed	2012-09-06
Piloting Virtual Incubation Services in East Africa	Eastern Africa	P131488	0.18	Closed	2012-07-12
Kenya - KTCIP/Additional Financing (RCIP 1)	Kenya	P127380	55.10	Active	2012-03-29
Asian regional mobile applications lab (ASP-1)	South Asia	P122176	0.99	Closed	2011-04-20
ASP1 Regional Mobile Applications Lab in EAP	East Asia and Pacific	P126383	0.38	Closed	2011-04-12
Nigeria - Growth & Employment	Nigeria	P103499	160.00	Active	2011-03-17
ECA Mobile Applications Lab - Phase I	Europe and Central Asia	P122187	0.75	Closed	2011-03-07
MDTF-Economic Revitalization of KP and FATA	Pakistan	P124268	20.00	Active	2011-03-02
Yemen Health & Population	Yemen, Republic of	P094755	35.00	Active	2011-02-22
Cambodia Business Incubation (ASP 8 & 9)	Cambodia	P121963	0.87	Closed	2011-01-31
Central African Backbone - APL2	Africa	P117652	14.90	Closed	2011-01-20
Second Development Policy Operation	Armenia	P116451	25.00	Closed	2011-01-11
Extending Mobile Applications in ECA through Social Networking	Azerbaijan	P122236	0.26	Closed	2011-01-10
Mobile Social Networking in Georgia	Georgia	P125782	0.04	Closed	2011-01-10
Extending Mobile Applications in Africa through Social Networking - Kenya (Akirchix)	Kenya	P122163	0.49	Closed	2010-11-17
Extending Mobile Applications in Asia through Social Networking - Vietnam	Vietnam	P122208	0.04	Closed	2010-11-17
Extending Mobile Applications in Africa (Uganda - MoMo Kampala)	Uganda	P124986	0.04	Closed	2010-11-17
Extending Mobile Applications in Asia through Social Networking - Nepal (Young Innovations Pvt. Ltd.)	Nepal	P125010	0.04	Closed	2010-11-17
Mobile Applications Laboratory in Africa II	Eastern Africa	P124081	0.35	Closed	2010-09-08
Tanzania ICT and Services Incubator (AFR 5)	Tanzania	P121961	0.57	Closed	2010-09-03
Armenia - 2011 Census Multi Donor Trust Fund	Armenia	P125411	1.50	Active	2010-07-22
eGhana Additional Financing	Ghana	P120942	44.70	Closed	2010-06-23
DRC Street Children Project	Congo, Democratic Republic of	P115318	10.00	Active	2010-06-01
eBenin Project	Benin	P113370	15.00	Active	2010-03-25
Centre for Enterprise Development (CED) Inc.	Caribbean	P112172	0.10	Closed	2009-05-13
SoftStart Business & Technology Incubator (SBTI)	Africa	P112132	0.13	Closed	2009-05-12
Bahrain Business Incubator Center	Middle East and North Africa	P111995	0.10	Closed	2009-04-22
ANPROTEC - Brazilian Association of Science Parks and Business Incubators	Latin America	P112170	0.05	Closed	2009-03-10
CI - LICUS Support to the Peace Process	Cote d'Ivoire	P114941	0.50	Closed	2009-01-13
Demand for Good Governance Project	Cambodia	P101156	20.00	Closed	2008-12-02
CDIMM Maramures	World	P112725	0.05	Closed	2008-12-01
Congress of Women of the Kyrgyz Republic (CWKR)	World	P112723	0.05	Closed	2008-11-19
Octantis Business Accelerator	World	P112727	0.05	Closed	2008-11-13
PPIAF: SOUTH AFRICA: Capacity Building Support to National Treasury PPP Unit - Municipal Desk	South Africa	P112960	0.36	Closed	2008-10-01
Applied Research and Communications Fund	Europe and Central Asia	P112163	0.10	Closed	2008-09-12
PSG-Science & Technology Entrepreneurial Park (PSG-STEP) - PSG College of Technology	Asia	P112167	0.15	Closed	2008-06-09
AVIAN AND HUMAN INFLUENZA PREVENTION AND CONTROL IN CAMEROON	Cameroon	P105910	1.27	Closed	2008-06-05
Regional Biosafety Communications	Latin America	P110098	0.90	Closed	2008-05-12
Avian Flu Emergency Preparedness Response	Congo, Republic of	P105743	1.00	Closed	2008-02-27
TG-Avian Influenza Control and Human Pandemic Preparedness and Response Project	Togo	P108484	0.56	Closed	2007-12-17

Appendix2-1 ICT Projects by World Bank
(Loan approved cases of 2005-2015) (2)

プロジェクト名(Project Title)	国 (Country)	Project ID	約束額 Commitment Amount ($mil.)	状態 (Status)	承認日 (Approval Date)
Thailand Civil Society and Small Grants Program	Thailand	P110260	0.00	Closed	2007-12-05
Public Procurement Reform Project II	Bangladesh	P098146	23.60	Active	2007-07-05
MW - Avian Influenza prevention and control	Malawi	P103794	1.00	Closed	2007-04-16
Regional Communications Infrastructure Project	Africa	P094103	164.50	Active	2007-03-29
Child Centered Peace and Community Building in the North East	Sri Lanka	P105079	0.00	Active	2007-01-04
The FCE Human Security Program: Providing early warning and implementing rapid response by collecting info on local level conflicts	Sri Lanka	P105081	0.00	Closed	2007-01-04
Effective, Safe and Sustainable Humanitarian Assistance and Dvt Cooperation of Agencies in SL: Mainstreaming Conflict Sensitivity	Sri Lanka	P105082	0.00	Closed	2007-01-04
Enabling Civil Society to Influence the Process of Negotiations in Sri Lanka	Sri Lanka	P105202	0.00	Closed	2007-01-04
COMplus	Latin America	P110469	1.08	Closed	2006-12-18
Avian Influenza Prevention and Control	Zambia	P103625	1.00	Closed	2006-09-26
eRwanda Project	Rwanda	P098926	10.00	Closed	2006-09-07
eGhana	Ghana	P093610	40.00	Closed	2006-08-01
Community-Based Land Management Project	Guinea	P081297	7.00	Closed	2006-06-22
Information and Communications Infrastructure Development Project	Mongolia	P092965	8.00	Closed	2006-06-08
Improving Rural connectivity for sustainable livelihoods	Indonesia	P127240	1.30	Closed	2006-06-08
National Agricultural Innovation Project	India	P092735	200.00	Closed	2006-04-18
Innovation for Competitiveness 1st phase APL	Mexico	P089865	250.00	Closed	2005-05-19
Climate Change Enabling Activity (additional Financing)	St. Vincent and the Grenadines	P088973	0.10	Closed	2005-04-29

Appendix2-2 ICT Projects by ADB(1)

Project Number	Project Name	Country	Type	Status	Approval Year	ADB Financing ($1,000)
48333-001	Applying Space-Based Technology and Information and Communication Technology to Strengthen Disaster	Regional	TA	Approved	2015	
48240-001	Information and Communication Technology for Development Initiative Facility in Asia and the Pacific	Regional	TA	Approved	2014	500
48345-001	Sector and Thematic Analyses in Policy Development	Regional	TA	Approved	2014	800
48355-001	Karnataka MCR Project	India	TA	Approved	2014	500
48238-001	MYA Connectivity Infrastructure Project	Myanmar		Approved	2014	
48242-005	Knowledge for Solutions (Cluster TA)	Regional	TA	Approved	2014	560
48201-001	Key Indicators for Asia and the Pacific 2016	Regional	TA	Approved	2014	750
44367-012	Knowledge Management for Inclusive Growth	India	TA	Approved	2014	2,250
44471-012	Strengthening Infrastructure Planning and Implementation	Micronesia, Federated States	TA	Approved	2014	550
47184-003	Geomapping of ADB's Projects	Regional	TA	Approved	2014	225
46444-001	E-Government for Effective Public Management	Uzbekistan	TA	Approved	2014	1,100
46366-001	Results-Based Strategy and Sector Planning in the Pacific	Regional	TA	Approved	2014	1,285
47142-001	Enhancing Capacities for the KALAHI/CIDSS National Community-Driven Development Project	Philippines	TA	Approved	2013	
46441-001	Climate Resilience and Green Growth in Critical Watersheds	Philippines	TA	Approved	2013	
47201-001	Information and Communication Technology for Better Education Services	Solomon Islands	TA	Approved	2013	
47222-001	Piloting the Design of e-Services Delivery Platform in Health Services	Bhutan	TA	Closed / Terminated	2013	225
47158-001	Design of e-Governance Master Plan and Review of Information and Communication Technology Capacity in Academic Institutions.	Myanmar	TA	Approved	2013	500
46019-001	Promoting Cooperation in Sanitary and Phytosanitary Measures for Central Asia Regional Economic Cooperation	Regional	TA	Approved	2013	
45415-001	Urban Development in Secondary Cities	Armenia	TA	Approved	2013	
46500-001	Establishment of the Pacific Region Infrastructure Facility Coordination Office	Regional	TA	Approved	2013	1,000
46476-001	Improving Public Administration and Services Delivery through e-Solutions	Bangladesh	TA	Approved	2012	700
46478-001	Strengthening Civil Society Participation in ADB-Financed Operations	Myanmar	TA	Approved	2012	225

Appendix2-2 ICT Projects by ADB (2)

Project Number	Project Name	Country	Type	Status	Approval Year	ADB Financing ($1,000)
46397-001	Implementing the e-Procurement System	Kyrgyz Republic	TA	Approved	2012	1,000
44382-022	Broadband for Development Project	Solomon Islands	Grant	Approved	2012	18,000
39542-022	Implementing the Greater Mekong Subregion Core Agriculture Support Program (Phase 2)	Regional	TA	Approved	2012	500
45396-001	South Asia Economic Integration Partnership	Regional	TA	Approved	2012	
44383-012	Strengthening Regulatory Capacity for Information and Communication Technology Development in the Pacific	Regional	TA	Approved	2011	750
45334-001	Developing the Services Sector as an Engine for Inclusive Growth	Regional	TA	Closed / Terminated	2011	
44172-022	Tonga-Fiji Submarine Cable Project	Tonga	Grant	Approved	2011	9,700
41318-012	2011 International Comparison Program for Asia and the Pacific	Regional	TA	Approved	2011	3,200
44937-014	BEMOBILE EXPANSION PROJECT (PAPUA NEW GUINEA AND THE SOLOMON ISLANDS)	Regional		Approved	2011	
44382-012	Broadband for Development Project	Regional	TA	Closed / Terminated	2011	900
44048-012	CAREC Single Window Development	Regional	TA	Closed / Terminated	2011	2,000
40009-043	Infrastructure Reform Sector Development Program	Indonesia	Loan	Closed / Terminated	2010	200,000
41571-012	Supporting Strategic Knowledge Products and Research Networking	Regional	TA	Approved	2010	5,500
44038-012	Capacity Building for ICT-Based Industrial Waste Management	China, People's Republic of	TA	Closed / Terminated	2010	450
43435-012	Establishment of e-Systems in Support of Infrastructure Finance in Asia	Regional	TA	Approved	2010	1,000
44172-012	Tonga-Fiji Submarine Cable Project	Regional	TA	Closed / Terminated	2010	165
43529-012	Public Transport Information and Communication Technology	Mongolia	TA	Closed / Terminated	2010	
44205-012	Preparing Rural ICT Connectivity Project (formerly Assessment of Domestic Fiber Optic Network Capacity)	Bangladesh	TA	Closed / Terminated	2010	225
44151-012	Sharing Knowledge on Community-Driven Development in Asia and the Pacific	Regional	TA	Closed / Terminated	2010	
38356-022	Fiscal Management Reforms	Sri Lanka	TA	Approved	2010	2,000
43191-013	Crisis Related Public Sector Program Loan	Samoa	Loan	Closed / Terminated	2010	16,000
43046-012	Pacific Regional ICT Development	Regional	TA	Closed / Terminated	2009	70
43166-052	Technical Assistance Cluster for Advanced Project Preparedness for Poverty Reduction	India	TA	Closed / Terminated	2009	
42510-012	Mainstreaming Public-Private Partnerships for Providing Urban Amenities in Rural Areas	India	TA	Approved	2009	1,500
41093-012	Rural Information and Communication Technology Policy Advocacy, Knowledge Sharing, and Capacity Building	Regional	TA	Closed / Terminated	2008	
40009-033	Infrastructure Reform Sector Development Program	Indonesia	Loan	Closed / Terminated	2008	280,000
38347-022	Information and Communications Technology for Public Service Delivery	Nepal	Grant	Approved	2008	25,000
40054-013	SASEC Information Highway (formerly Establishment of SASEC ICT Exchange Facilities)	Regional	Grant	Approved	2007	16,973
36513-032	Samoa School Net	Samoa	Grant	Approved	2007	5,900
36008-013	Secondary Education for the Most Disadvantaged Regions	Viet Nam	Loan	Approved	2007	50,000
41596-012	Deploying Innovative Information & Communication Technology (ICT) for Supporting e-Governance in Assam	India	TA	Closed / Terminated	2007	
40054-012	SASEC Information Highway (formerly Establishment of SASEC ICT Exchange Facilities)	Regional	TA	Closed / Terminated	2006	
40552-012	KazPost Financial Strengthening and Modernization Project	Kazakhstan	TA	Closed / Terminated	2006	600
38347-012	Information and Communications Technology for Public Service Delivery	Nepal	TA	Closed / Terminated	2006	600
38055-012	Regional Cooperation in Education (Curriculum and Testing Reform)	Regional	TA	Closed / Terminated	2005	600
37698-013	Science and ICT in Basic Education	Uzbekistan	Loan	Closed / Terminated	2005	30,000
34276-013	Information Technology Development	Maldives	Loan	Closed / Terminated	2001	9,500
48355-002	Karnataka MCR Project	India	Loan	Proposed		30,000
44382-023	Broadband for Development Project	Solomon Islands	Grant	Proposed		9,000
46382-001	North Pacific Regional Connectivity Investment Project	Palau	Loan	Proposed		25,000
47320-001	Samoa Submarine Cable Project	Samoa	Grant	Proposed		18,500
47114-001	Pacific Information and Communication Technology Investment Planning and Capacity Development Facility	Regional	TA	Approved		1,600

Appendix2-3 Projects with Use & Application of ICT by UNDP

Target country	Project name	Classification	Outline	Note
Bulgaria	Bulgarian Libraries-Place for Access to Information and Communication for all	ICT	Provide access to information through accessibility to free internet use and education training	Collaboration with Bill & Melinda Gates Foundation and Bulgarian Ministry of Culture
The Republic of Congo	E-employment	Poverty reduction	Provide employment information and ICT training to unemployed job-seeking youth or students	Collaboration with the Ministry of Labour, Social Security and Employment, the National Office of Employment, the United Nations Economic Commission for Africa (UNECA)
Syria	Strategic ICT Programme for Social and Economic Development	Governance ICT	Policy proposal and capacity building for the government, and provision of an access center and localized contents to the citizens	
Kenya	Huduma Platform	Governance	Provide citizens chance of delivering proposals to administration through web/mobile platform for improvement in public services	Mobile device use Platform provision Collaboration with SODNET and Ushahidi
Kosovo	Kallxo.com	Governance	Provision of platform for corruption report by the citizens. The system allows the information to be mapped online and reported to adequate institutions.	Platform provided Collaboration with Internews Kosovo and Ushahidi (non-governmental organizations in Kosovo) Financial assistance from UNDP
Tonga, Vanuatu, Kiribati	FOI acts and legislations	Governance	Assistance system for developing legislation on information disclosure	
Bolivia, India, Uganda, Zambia	CSO partners on anti-corruption instruments and tools	Governance	Provide civil society organizations anti-corruption/monitoring tools and methods	
Bosnia and Herzegovina	Develop and Implement the National Climate Change Plans	Climate change	Assist national climate change plans, institutional/systematic framework development, or launch of website on climate change	
Kyrgyzstan	Provision of Satellite Communication Equipment for Decision Making in case of emergency	Disaster management	Satellite communication system transmits digital images of disaster for decision-making in emergency	
Kyrgyzstan	Improving Energy Efficiency in Buildings	Environment	Install new regulations, baseline, and monitoring system aiming reduction of energy consumption and CO2 emission	
Nepal	National Climate Change Knowledge Management Platform	Climate change	Develop a climate change knowledge management platform	
Uzbekistan	Management of Water Resource and Monitoring the Climate and	Climate change	Develop water resources and land management plan, and assist with climate change and water resources monitoring through the latest ICT	

	Water Situation		system	
Ethiopia	The Ethiopian Commodity Exchange (ECX)	Poverty reduction	Deliver international market price by market information system to enhance landed/tenant farmers' market accessibility and their income. Provide free mobile communication, SMS, e-bulletin board for remote villages, website, and several means of access	Mobile phone use The Ethiopian government, USAID, Sida, collaboration with EU
India	Lokvani	Governance	Provide public online service available on mobile phones and internet cafes. Enables the complaint admission to government accompanied by platform with issue-solution tracking function	Mobile phone use Platform provided

Appendix2-4 Projects with Use & Application of ICT by DFID

Target country	Project name	DFID financing	Classification	Outline	Note
Not specified	Communication in Governance (CommGAP)	£ 5,392,566	Governance	Establish knowledge and good practice assisting a new policy/practice approach in communication field governance/ accountability	
Low/Middle income countries	InfoDiv Core Contribution	£ 2,460,000	Governance Industrial development	Establish/improve ICT friendly policies and promote ICT-based businesses in low/middle income countries	
Not specified	BBC Media Action Research and Policy Programme: the role of the media and communication in development	£ 2,499,999	Media	Aims for achieving democracy and MDGs, promote media/communication utilization among aid workers	For aid practitioners
Not specified	Macutano Junction	£ 2,151,040	Poverty reduction	Poverty alleviation provide and promote use of research information through educational TV drama	
Asia Africa	Information Communication Technology (ICT) for Development	£ 5,000,000	Poverty reduction	Effective ICT use for poverty alleviation in Asia and Africa	
Africa	Agfax II and New Agriculturist	£ 1,641,120	Agriculture Sustainable development	Assist African development partner countries' decision-making by providing the latest and precise information on agriculture and sustainable development	For aid practitioners
St. Helena	St. Helena Information and Communication Technology Strategy 2011-14	£ 102,293	ICT Governance	Assist St. Helena government with ICT department ICT strategy development to enhance efficiency and effect of public services. Also assist	

				with training and equipment needed for strategy implementation	
Sub-Sahara Africa	EU Africa Infrastructure Irust Fund – DFID 2009 Contribution	£ 27,042,250	Infrastructure	New investment for local infrastructures: energy, transportation, ICT and water in Sub-Saharan Africa	
UK	GLOBAL OPEN KNOWLEDGE HUB (GOKH)	£ 4,593,896	Governance	Enhance accessibility to international development research data and its reapplication as part of British government's Open Data Initiative by digital data hub establishment	Data application (Open data)
Asia Africa	Mobile for Development (M4D) Utilities	£ 10,097,334	Poverty reduction	Aims for availability of low-priced basic public services e.g. electricity, water via mobile phones and an innovative method using the network. Approx. 4 million estimated beneficiaries among the poor in Asia/Africa by 2020.	Mobile phone use

Appendix2-5 Projects with Use & Application of ICT by USAID(1)

Target country	Project name	DFID financing	Years from -to	Classification	Outline	Note
Philippines	IINFORMATION AND COMMUNICATION TECHNOLOGY FOR EDUCATION-AN ASSESMENT PROJECT		2012 -2012	Education	Develop reading assessment instruments in English/Filipino/Ilocano for capacity building in test development by Department of Education	
Egypt	EMPLOYMENT THROUGH TECHNOLOGY AND INNOVATON	$1,398,752	2011 -2013	Industrial development	Enhance recruitment and income among the poor, especially youth, in Egypt by providing training, technical assistance, and building links between employers and job-seekers through ICT	Platform provided
Peru	DIGITAL INCLUSION	$8,500,000	2012 -2015	Social development	Improve people's life, income, and business in Amazon river vicinity to be included socio-economically and to stay away from illegal plant production/sales by building 30 technology centers which offer technology application2009 training.	Business assistance
Lebanon	PERFORMANCE MANAGEMEN	$6,765,366	2010 -2014	Governance	Provide a mechanism that monitors, evaluates, and reports performance/achievement in development2013al programs by	

	T PROGRAM FOR LEBANON (PMPL)				USAID or Lebanon; it enables improvement in sharing results, mutual explanatory responsibility, and transparence between USAID and implementing agencies.	
Armenia	MICROSOFT INNOVATION CENTER, GDA	$849,870	2009 -2012	Industrial development	Establish Microsoft Innovation Center for creation of new products/services, IT company establishment, job creation, producing excellent HR, e-service provision, and promoting information society	Business assistance Public-private collaboration
Afghanistan	AFGAN CLEAN ENERGY PROGRAM		2009 -2012	Infrastructure Industrial development	Aims for building capacity in Afghan government's provision of electricity from renewable energy to its households, schools, and companies. The size and efficiency enhancement of the energy and securing local industry for equipment/service installation are part of the operation. Estimated beneficiaries in over 300 communities.	Smart grid
Afghanistan	TECHNICAL SUPPORT TO AFGHAN ENERGY INFORMATION CENTER		2009 -2012	Infrastructure	Dispatches experts to expand The Afghan Energy Information Center's (AEIC: Established in 2005 by USAID Afghan Energy Assistance Project with a purpose of providing/analyzing accurate and highly reliable data to assist energy infrastructure development/management/recovery in Afghanistan) capacity to be an independent office in Energy/Water Resources Ministry.	
Pakistan	FIRMS PROJECT		2009 -2014	Industrial development Governance	Government assistance (e.g. capacity building, organizational reform) that leads to development in private sector: Promoting revenue increase in Pakistani SMEs with field-emphasis in e.g. agriculture, fishery, garment, tourism, and textiles.	Business assistance
India	BE! AN ENTREPRENEUR	$150,000	2012 -2014	Industrial development	By utilizing a wide communication platform, select and distribute information on low-income entrepreneurs that have solutions to local developmental issues.	Platform provided Business assistance
India	CLOUD BASED LEARNING PLATFORM	$150,000	2013 -2015	Education	Develop a cloud-based platform and provide low-cost educational tablet materials affordable for students. Technical support done by DIV funding. Pilot project will be run in a partnership with public schools.	Platform provided
India	DEVELOPING LOW-CARBON CITIES IN INDIA WITH A FOCUS ON URBAN INFRASTRUCTURES,		2013 -2013	Infrastructure	Promote infrastructure development as response to issues e.g. climate change, renewable/sustainable energy, water resources sustainability, HRD, climate risk, and environmental engineering.	Smart grid

	CLIMATE AND VULNERABLITY					

Appendix2-5 Projects with Use & Application of ICT by USAID (2)

Target country	Project name	USAID financing	Years from -to	Classification	Outline	Note
India	DYNAMIC (AND DECENTRALIZED) EDUCATION INFORMATION SYSTEM FOR PLANNING & IMPROVEMENT (DEISPI) : A SOLUTIN FOR MARGINALIZED SCHOOLS	$286,850	2013 -2014	Education	Using simple data collection tool, establish localized solution for educational issues children face. Systems provided to community, students, teachers, and social activists for educational data monitoring and development. Collected data will be used for local solution planning.	Platform provided Data application
India	FACILITATION READING ACQUISION IN MULTILINGUAL ENVIRONMENTS (FRAME)	$299,892	2013 -2014	Education	Collect data in six low-income locations to prove the relative importance of literacy techniques. Using the data, adequate acquisition of literacy technology will be examined	
India	INCREASING RURAL INCOMES BY EXPANDING ACCESS TO AGRICULTURAL PRICE INFORMATION	$99,940	2013 -2014	Agricultural development	Market price service on Mobile phone: for small-scale farmers, deliver on-demand farm product prices as needed via SMS. It will enable farmers to know adequate harvest/sales time and effective price negotiation and also leads to income improvement.	Mobile phone use
India	INSIGHT: MOBILE ACCOUNTING AND FINANCIAL INCLUSION IN EMERGING MARKETS	$100,000	2012 -2013	Finance	Develop the SMS tool with functions: 1) Small company owners can quickly and easily track financial data 2) Improve management of financial companies' credit capability and loan repayment	Mobile phone use Platform provided Business assistance
India	INVESTIGATING THE IMPACT OF CELL PHONE BASED AGRICULTURAL EXTENTION ("AVAJOTALO")	$160,842	2013 -2014	Agriculture	Research on 'Avaaj Otalo': conversational mechanism that offers agricultural consultation/communication for farmers, e.g. Improvement of system accessibility, quality evaluation of information farmers receive, mechanism of changes brought by the information	
India	LEARN TO READ – READ TO LEARN	$299,738	2012 -2014	Education	Aim for Hindi/English reading skill enhancement using classroom material and very-low-cost tablet. Teachers receive training on instruction for fluency/comprehension improvement, especially for children who have difficulty reading, on a pocket projector	Platform provided

					platform.	
India	MEETING THE DEMAND FOR ELECTRICITY : AN EVALUATION OF METERED PRICING FOR OFF-GRID POWER IN INDIA	$99,839	2013 -2014	Infrastructure	Evaluate technical realization, meter-based charging system, and marginal demand price of in-house generated electricity by Husk Power System	Smart grid
India	MILLENIUM ALLIANCE	$15,400,000	2012 -2017	Industrial development	Promote financial/physical support for social innovations by companies and governmental organizations in India by Millennium Alliance: Partnership between FICCI and non-profit associations which aims for a wide and sustainable platform for promoting innovation	Platform provided Business assistance
India	PREPAID ENERGY – PRICING ELECTRICITY FOR INDIA'S 75 MILLION UNELECTRIFIED HOUSEHOLDS (DEVELOPMENT INNOVATION VENTURES – STAGE 2)	$968,000	2013 -2015	Infrastructure	Formerly, effective distribution of clean energy leading to improvement in access to electricity needed large prior investment. By expanding metered rate solar home system sales, Simpa showed an innovative business model that provides access to clean energy. The project is to prove the model's commercial realization and to lead to the private sector investment promotion	Smart grid Business assistance
India	RENEWABLE POWERED MICRO GRIDS FOR RURAL LIGHTNING	$300,000	2011 -2013	Infrastructure	Study solar powered micro grid developed/run by Mera Gao Power (very-low-cost lighting and mobile phone charging system installed in houses without electricity) to measure its social impact	Smart grid Business assistance
India	RESEARCH GRANT		2013 -2014	Infrastructure	Study climate change issues, especially sustainable management of water resources by examining climate data analysis, historical research, GIS utilization, and user interviews	GIS
India	SAVING LIVES AT BIRTH	$238,658	2011 -2013	Health	A doctor in India redeveloped CPAP, Continuous Positive Airway Pressure, which has been used for treatment of IRDS in developed countries, with locally available equipment in developing countries. The project promotes using the device with an innovative air mixer which does not need electricity/compressed air.	Equipment provided
India	SCALING COMMCARE FOR COMMUNITY HEALTH WORKERS (DEVELOPMENT	$996,424	2012 -2014	Health	Develop open source health care application platform. Provide maternal health education, medical data collection, and status improvement at village level via mobile phone.	Mobile phone use Platform provided Data application

	INNOVATION VENTURES STAGE 2)					

Appendix 2-6 ICT Use & Application Cases in ITU-D

(1)ICT Applications

Area	ICT application
Project name	Telemedicine (Distance medicine)
Target country	Mauritania
Present stage	2011-2013 Completed
Objective	To realize the following by installing distance medicine facilities: ・ Health care expansion to remote locations ・ Improvement of medical training capability ・ Enhancement of medical data communication size
ICT environment for implementation	Local center ⇔ Radio (11M) ⇔ Local center (hospital) → Internet (LS256K) → MAURITEL(communication carrier) → Internet (LS64K) → Local clinic Also proposed: Satellite communication → VSAT → Local center

Area	ICT application, technology and network development
Project name	ICT Applications Against Ebola Disease - Phase I
Target country	Guinea, Liberia, Mali, Sierra Leone
Present stage	2015-2015 Being implemented
Objective	・ Joint-program between ITU and the Japanese government ・ Response to Ebola disease risk using long distance communication/ICT ・ Mobile application development, and provision of an emergency communication means and route by

	purchasing mobile phone (for ETUs, Emergency Tactical Units, and regional offices) ・ The project is Phase 1 of TeleHealth Initiative which was started in ITU
ICT environment for implementation	Mobile phones, mobile applications (No details available)

Area	ICT application
Project name	mHealth for NCDs Joint Programme(NCD: Non-Communicable Disease)
Target country	Mauritania
Present stage	2013-2017 Being implemented
Objective	・ The project is a NCD response joint-program between ITU and WHO, which is based upon their cooperation agreement on development/installation of ‘a Mobile for Health(mHealth)’.
ICT environment for implementation	No details available

Area	ICT application
Project name	Project Be He@lthy Be Mobile - m-Diabetes - Phase 1
Target country	Senegal
Present stage	2014-2015 Being implemented
Objective	・ m-Diabetes project in Senegal is one response means to NCDs, which is part of a global program “Be He@lthy, Be Mobile” jointly established by WHO and ITU・ The project goal is to reduce possible diabetes occurrence in people at risk, to deliver tools for screening known diabetes patients as well as methods to respond to the disease, to reduce the possibility of complications, and to preserve the patients’ quality of life.

	・ The basic principle of m-Diabetes project in Senegal is to assist realizing a policy in response to diabetes and complications and wide use of mobile phones for the control of common risk factors among many NCDs.
ICT environment for implementation	No details available

(2) Technology and network development

Area	Technology and network development, ICT application
Project name	Memory of the Arab World Project
Target country	Mauritania
Present stage	Completed, 2012 - 2013
Objective	"Arab Digital Content" is one of the five initiatives of the Arab world and also one of the projects to achieve "Memory of the Arab World." ・The objective of the project is to document cultural/natural heritage and collect information by using the Internet. ・The following was achieved under the project. ・Developing a website to display the cultural/natural heritage in the Arab States. ・Compiling collected information on cultural/natural heritage into a database. -Recording 118 events in the past -Six historic cities -62 historical events -76 historical features -163 races -2625 rare musical notes and musical heritage -6606 documents
ICT environment for implementation	Website, database

(3) Emergency communications

Area	Emergency communications
Project name	Natural Disaster Early Warning System - Uganda

Target country	Uganda
Present stage	Completed, 2011 - 2014
Objective	・The objective of the project is to build the early warning system in Eastern Uganda. This area is vulnerable to floods and landslides. ・ITU and UCC (Uganda Communications Commission) jointly designed and installed the public warning system to disseminate information to the citizens in the event of a disaster. ・The Butaleja District in Eastern Uganda has been damaged for many years by the Manafwa River floods. ・Not knowing what to do, the residents have seen the floods destroying their farmland and washing away their houses and other assets. ・Under these circumstances, the Ugandan government installed with the support of ITU a solar-powered flood early warning system that warns the residents about an increase in water level. The first flood warning system was installed on the Namulo Bridge in the Butaleja District on September 22, 2014. ・The solar-powered flood early warning system consists of three major components. -Sensor placed in the river -Solar-powered siren by the river -Control center with a backup computer to monitor the sensor and siren system installed in the local headquarters ・When the water level exceeds a threshold, the sensor detects it and the siren automatically sounds. The siren can be heard within a 10-km radius. ・The control center staff announces instructions to evacuate in English, Lunyole, and local language by using the siren system to safely evacuate the residents.
ICT environment for implementation	Water level sensor, automatic siren, control center

Area	Emergency communications

Project name	Feasibility study of restoring connectivity through the use of the Moveable and Deployable ICT Resource Unit (MDRU)
Target country	The Philippines
Present stage	Being implemented, 2014 - 2015
Objective	・Haiyan, the largest typhoon ever recorded, caused devastating damage to the Visayas in the Philippines on November 8, 2013. The communications network remained destroyed for a long time and there was a delay in emergency response of the local and central government agencies. ・The Ministry of Internal Affairs and Communications (MIC) and Department of Science and Technology (DOST) agreed that they would cooperate in installing on Cebu Island movable communications equipment (movable ICT unit) which enables emergency communications restoration in the event of a disaster to study the restorability of communications infrastructure (demonstration experiment). [First project by ITU-D and Ministry of Internal Affairs and Communications in the disaster prevention area] [Movable ICT unit] Call on the Smartphone by using the Wi-Fi network and data communication in a wide area covering the section (about 500m) from the shelter to the disaster response headquarters. An in-car type and attache case type are available.
ICT environment for implementation	Experiment 1: Provision of voice communication between disaster response headquarters and staff Experiment 2: Provision of voice communication between disaster response headquarters and shelter Experiment 3: Provision of voice communication among staff members near the shelter Experiment 4: Disaster-related information file sharing between disaster response headquarters and shelter

Appendix2-7 ICT Utilization examples of the Global Health Project Repository "Remote Health and Medical Care "

Project name	A Telemedicine-enabled Rural Health Social Franchise

Project operators	World Health Partners(WHP) Partner: KMET, a Kenyan NGO
Target country	Kenya
Present stage	Being developed 2014-
Objective	WHP is supporting local health care providers in providing technologies and tools required to enhance the functionality for the health improvement, and in establishing networks. WHP has strengthened the remote medical care support functions for 13 clinics and for the Community Health Volunteers (CHVs) of 81 regions, jointly with KMET, a community based medical provider of Siaya and Kisumu districts. There were 834 remote consultations as the result of the first 6 months. 70% of these consultation were from female patients.
ICT environment for implementation	Providing a remote medical care looking at each other on the PC among remotely-located patients, health care practitioners, and medical professionals in hospitals.

Project name	Wired Mothers
Project operators	University of Copenhagen(Denmark) Partner: Ministry of Health and Social Welfare, Zanzibar, Tanzania; Health Sector Programme Support Zanzibar; Danida Health Sector Programme Support
Target country	Tanzania
Present stage	Completed 2009-2013
Objective	The objective of this project is to study the effectiveness of the use of mobile phones in the prevention of disease and death where the mother and child are concerned. Through "wired mothers", a pregnant woman can link to a primary care facility, and through SMS, receive reminders regarding appointments for medical examinations. Also, this approach seeks for innovative methods where in acute and emergency cases, as well as in non-emergency cases, a pregnant woman could call on a health-care facility. In addition, this study looks at the responsiveness during emergencies by strengthening the communication at various levels through the use of mobile phones.
ICT environment for implementation	Mediator connecting mobile phones and pregnant woman

Project name	Peek Vision
Project operators	Peek Vision (United Kingdom) Partner: London School of Hygiene & Tropical Medicine, University of Strathclyde, NHS Glasgow Centre for Ophthalmic Research Funder: The Queen Elizabeth Diamond Jubilee Trust
Target country	Botswana, Kenya, Mali, United Kingdom
Present stage	Being developed2013-
Objective	"Peek" is a portable ophthalmologic examination kit composed of mobile applications, a smartphone, and an accompanying hardware, enabling prescription of glasses and diagnoses of cataract and retrobulbar diseases. By using this kit, remotely-located health care practitioners can safely store images and patient's information , and specialists of ophthalmology can make diagnoses off-site.

ICT environment for implementation	Fundus examination is also possible by attaching an accessory on the smartphone camera.

Project name	Mobile Early Detection and Prevention of Oral Cancer
Project operators	Biocon Foundation Partner: KLE Institute of Dental Sciences, Bangalore, Axxonet System
Target country	India, Karnataka
Present stage	Completed, being implemented2012-
Objective	Biocon fund has developed a platform for creating Electronic Health Records (EHRs) or screening and monitoring oral cancers based on mobile phone. This m-Health Program is designed to provide a platform to link rural residents and medical specialists, enabling diagnoses and subsequent follows. Examinations are implemented at home or at the workplace. Health care practitioner can examine many residents within a limited time, thus it is a rapid and reliable way of access for residents with oral cancer risk.
ICT environment for implementation	Mobile phone

Project name	BNH Telemedicine Centre
Project operators	Samhita Social Ventures(India) Partner: MNC and Vodafone
Target country	India, Maharashtra
Present stage	Completed, being implemented01/01/2006-
Objective	BNH Remote Medical Care Center has been making efforts to facilitate the access to healthcare by using information technology. This center offers remote consultations and lectures for patients, doctors, and emergency life-saving technicians through the network of surrounding hospitals. The center has also been implementing research activities on the electrocardiogram examination by mobile and remote medical care kit, for the health screening program for villagers. Since it started in 2006, this center has been engaged in these activities and has today become one of the biggest remote medical service providers in Western India. 500 lecture contents of Continuing Medical Education (CME) are distributed, and 6452 doctors, emergency service workers, and nurses took these courses.
ICT environment for implementation	Remote medical care centor, Mobile, Remote medical care kits

Project name	Africa Teledermatology Project
Project operators	Communication for Development Studies, Austrian Academy of Sciences, American Academy of Dermatology
Target country	Burkina Faso, Botswana, Lesotho, Malawi, Swaziland, Uganda
Present stage	Completed, being implemented2007-

Objective	Africa Teledermatology (remote dermatologist) was established to support local physicians, dermatologists, and health care practitioners in hospitals and clinics across Africa. Remote consultation, diagnosis of skin diseases, and management services are operated. Additionally, links to educational resources and access to dermatology curriculum especially made for African regions are provided. The number of dermatologists in African developing countries is limited. Teledermatology may provide means to improve the dermatological cares by providing a remote health counseling channel.
ICT environment for implementation	Remote consultation, diagnosis of skin diseases, and management services

Project name	Cellscope
Project operators	Cellscope Partner: Physicians at University of California, San Francisco
Target country	Viet Nam, Hanoi
Present stage	Completed, being implemented 2013-
Objective	Cellscope is a remote evaluation tool that transmits patient's sample images, and at a low cost, allows a specialist to perform diagnosis using a microscope at a level of quality equal to a clinical practice. This is a remote evaluation tool capable of microscopic diagnosis of Bell. By combining standard optical equipment and a mobile phone, a mobile phone can be used as a portable microscope. It was developed at the University of California, Berkeley in 2007. In this project, investigations were started in 2013 at 15 locations of Hanoi Department in Vietnam to verify the utilization environment of remote medical care technologies and to evaluate their effectiveness in diagnosing tuberculosis.
ICT environment for implementation	Use a mobile phone as a portable microscope by combining standard optical equipment and a mobile phone.

Project name	Amputee Screening via Cellphone Networking
Project operators	University of the Philippines-Philippine General Hospital Partner: Physicians for Peace, SMART Communications and the Ateneo Java Wireless Competency Center (AJWCC).
Target country	Philippines
Present stage	Being implemented 2009-
Objective	ASCENT is a mobile application, where a physician can diagnose the amputated status of a leg remotely and provide advice regarding the use of the prosthetic leg. ASCENTは A health care practitioner enters data into a mobile phone and takes photos with a mobile phone and sent them (as data) to a web-based database. A remotely-located physician then looks at the images through a smart phone and provides assessment and advice to the patient in real time on the use of the prosthetic leg. Using ASCENT has produced some concrete results : patients can receive the prosthetic leg in a month, and the screening time is reduced from 30 minutes to 2 minutes.

ICT environment for implementation	GPRS/3G

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ICT environment for implementation	GPRS/3G

Project name	Telehealth Network of Minas Gerais
Project operators	University Network of Telemedicine - RUTE Project(Brazil) Partner : State Government of Minas Gerais
Target country	Brazil, Minas Gerais
Present stage	Completed in 2005
Objective	The telehealth network of Minas Gerais in Brazil is a public telemedicine initiative, which provides telemedicine services mainly primary cares to small companies and municipalities. The telehealth network consists of low-cost equipment such as computers, printers, digital electrocardiographs, digital cameras, webcams and narrowband internet access in order to be easily accessed from poor villages. In Brazil, teleconsultations between doctors and their patients are not approved therefore they are practiced between medical professionals. This service started as a research project on 82 villages in 2005 and is currently practiced in 710 municipalities. By July 2014, 1,800,000 people underwent electrocardiogram (EKG) and 60,000 teleconsultations were provided.
ICT environment for implementation	Computers, printers, digital electrocardiographs, digital cameras, webcams, narrowband internet access

Project name	Broadband-enabled Indigenous Tele-Eye Care
Project operators	CSIRO(Communication Scientific and Industrial Research Organization)
Target country	Australia
Present stage	Being implemented since 2014
Objective	CSIRO developed Remote-I in order to realize the dispatch of experts who provide eye cares to the communities in remotes places. Local nurses and doctors had trainings to be able to operate Remote-I. They take high resolution images of patients' retinas with a low cost camera and transfer the encrypted images securely to the ophthalmologists in the urban area through broadband. The specialists can examine the condition of the retinas in full 3D. The improvement of the access to ophthalmology medical services using

	Remote-I is important as a health service tool in order to decrease preventable blindness. The technology of Remote-I has the potential to adapt to other health needs therefore its application to urgent external injuries is currently researched.
ICT environment for implementation	Remote-I

Project name	Suwasariya(Healthnet)
Project operators	Health Education Bureau, Ministry of Health, Sri Lanka(Sri Lanka)
Target country	Sri Lanka
Present stage	Completed, being implemented since 2011
Objective	It is an important factor for promotions of health and medical care in local areas to be able to access immediately to medical advice or health information on illnesses and protection against infectious diseases provided by medical professionals or research institutes. Suwasariya (Health Net) has been built to confirm its necessity and improve the health of people in Sri Lanka. It provides health education web site in 3 languages and 24 hour health call center (by hotline, emails and SMS) with the aim of enabling the people to make decisions about their education and health based on the right information.
ICT environment for implementation	Health education web site, 24 hour health call center , emails, SMS

Project name	Zero Mothers Die
Project operators	Zero Mothers Die(Switzerland) Partners : Advanced Development for Africa, Global Digital He@lth Initiative, Millennia2025 Foundation,Airtel,UNAIDS,ITU
Target country	Gabon, Ghana, Mali, Nigeria, Zambia
Present stage	Being implemented since 2014
Objective	Zero Mothers Die is a global partnership initiative for saving the

	lives of pregnant women, new mothers and their babies. It includes not only increasing access to the right medical information from pregnant women through vocal and text messages in local languages and dialects but also empowering females and reducing the gender gap with the use of mobile phones. Tablets and smart phones with preloaded tools which support their work and the latest well-considered training materials are available.
ICT environment for implementation	Mobile phones

Project name	Healing Touch Project for the Tsunami Victims
Project operators	Society for Telemedicine and Healthcare Informatics(SATHI)(India) Partners：SATHI, OXFAM, SCARF and local NGOs like PEDA, ISED, FACE
Target country	India, Nagapattinam(Tamilnadu) and Karaikal(Pondicherry)
Present stage	Completed 2005 - 2006
Objective	The survey at Nagapattinam in Tamilnadu and at Karaikal in Pondicherry discovered that metal problems such as posttraumatic stress disorder, alcoholism and panic disorder remained unsolved after the Tsunami in 2004. The comprehensive project plan includes concept marketing, finding suitable local partners, capacity building and overcoming technical problems and language barriers. Trained personnel visited the houses in the villages and sent high risk patients to the nearest telemedicine centers equipped with teleconference materials to have a mental health diagnosis. The diagnosis were performed by SCARF and the psychiatrists at Chennai.
ICT environment for implementation	Telemedicine centers equipped with teleconference materials

Project name	SMS Printers to Accelerate Return of Test Results for Early Infant Diagnosis of HIV/AIDS
Project operators	Clinton Health Access Initiative (CHAI)(United States of America)

	Partners : Federal Ministry of Health of Nigeria, HIV/AIDS Division; Hewlett-Packard Company; Institute of Human Virology, Nigeria; PEPFAR Implementing Partners ; Global Fund Implementing Partners
Target country	Nigeria
Present stage	Completed, being implemented since 01/01/2011
Objective	The Clinton Health Access Initiative(CHAI), Federal Ministry of Health (FMOH), Nigeria and Hewlett-Packard have collaborated for the project which accelerates the return of test results for early infant diagnosis of HIV/AIDS program (SMART) using SMS printers. In 2003, more than 70,000 early infant diagnostic tests were performed in Nigeria. The program revealed that by using SMS printers, the turn-around-time (TAT) was improved by about 21 days compared to the conventional paper-based method. CHAI and the partners established 200 health care facilities and 8 PCR laboratories continuously and 767 health care professionals and 49 researchers provided trainings in the operation of SMS and SMS printers. This SMART program continues in order to be expanded nationwide.
ICT environment for implementation	SMS printers

Project name	Strengthening Affordable Healthcare using Portable Health Clinic
Project operators	Kyushu University
Target country	Bangladesh, Japan
Present stage	Being implemented from 01/04/2012 to 31/03/2014
Objective	This project focuses on the gasp of incidence rate in community residents with affordable technology and local health care professionals. They bring a briefcase containing a medical sensor for primary medical examination and diagnose the patients' incidence rate with an e-Health application "GramHealth". High risk patients are provided remote consultations by the doctors at the

	project’s call center. This project provides medical services to 20,000 patients in partnership with Grameen Bank in Bangladesh. The business model is to produce thousands of health care professionals as well as continuously support millions of patients.
ICT environment for implementation	Medical sensors, e-Health application "GramHealth"

Project name	Aptus: Classroom Without Walls
Project operators	Commonwealth of Learning
Target country	Canada
Present stage	Being implemented from 01/11/2012 to 01/11/2015
Objective	Strictly speaking, Aptus is not an e-Health solution but it is part of the base of e-learning with targeted contents of health related human resource development. It is a device set designed by COL (Commonwealth of Learning) which enables educators and learners to use the base and the contents of digital learning without accessing neither the electrical grid nor the internet. It is mobile, light and packed in a small box but can contain educational contents up to 32GB. It is a virtual educational environment that can be set up interactively and constructed anywhere such as in a village or a large university campus. It is like a classroom without walls which can be set up within a few minutes and accessible by any learners with a laptop, a tablet or a mobile device.
ICT environment for implementation	Construction on OSS-OS