ANNEX

A) Case Study Summary Information

1. Title of case study:

E-Learning Applications in the Rural Area through Wireless LAN Technology in Bantayan Islands, Cebu, Philippines

2. Details of the person preparing the case study:

Name and title of person preparing the case study: Mr. Yuki Umezawa / Senior Manager, International Cooperation Section

Organization submitting the case study: KDDI CORPORATION

Address: Garden Air Tower, 3-10-10 Iidabashi, Chiyoda-ku, Tokyo, 102-8460 Japan

E-mail: yu-umezawa@kddi.com

Website: www.kddi.com/english/index.html

3. Status of project(s):

☒ Operational

☒ Completed

4. Location and population of the project area

Location (village, district, etc.) Bantayan Island, Cebu, Philippines

Population of the project area 90,000(ninety thousands)

5. Types of projects

☒ Pilots (trials)

☒ Licensed or authorized (Commission on ICT, Philippines)

☐ Projects funded by USF

☒ Others (supported by Asia-Pacific Telecommunity (Extra Budgetary Contribution from MIC, Japan))

6. Type of application / service (check one or more boxes)

☐ Public voice services

☐ Radio or TV broadcasting

☐ E-governance, e-administration

☒ Support for small business, e-business

☐ E-health

☒ Tele-education, e-learning

☒ ICT training

☐ Disaster preparedness / emergency support / disaster mitigation

☐ Environmental monitoring / protection

☐ Others (please specify) _____

7. Type of technology (Check one or more boxes)

☐ Wired local loop: Copper, optical fibre, etc. (customers' loop)

☐ Wireless local loop (customers' loop)

☒ Fixed wireless access (long distance)

☐ Mobile wireless access

☐ Satellite two-way communications: VSAT, etc.

☒ Wireless LANS and IP-based related networks

☐ Terrestrial voice, data, sound or television broadcasting

☐ Satellite voice, data, sound or television broadcasting

☐ Hybrid or combined technologies

☐ Others (please specify) _____

8. Organizations involved in implementing the project:

KDDI CORPORATION / KDDI Research and Development Laboratories, Japan

Waseda University, Global Information and Telecommunication Studies, Japan

The Commission on Information and Communications Technology (CICT), Office of the President, Philippines

University of the Philippines (UP), Cebu, Philippines

Local Government Units, Marine Sanctuary Center and Public Schools in Bantayan Island, Cebu, Philippines

9. -150 word summary of the project indicating its expected social /economic impacts

In this project, broadband Wireless LAN system, "CFO-SS" network, which connects 6 sites (2 Municipal Halls, 2 Elementary Schools, 1 High School and 1 Marine Sanctuary Center in Bantayan Island, Cebu, Philippines), was constructed to provide 10 Mbps broadband links. Over these established links, the local people enjoyed the multimedia Internet applications such as "Internet Access", "E-Mail", "E-Learning", "Video-Conference / Remote Lecture" and "internal VoIP Telephony", and it was confirmed that this project opened a lot of possibilities for the advancement of the community. It would help local people achieve reforms needed in education, business and governance.
As a result, this model can contribute to Bridging Digital Divide and. everybody can access information and take lots of opportunities.

B) Detailed project description and analysis

1. Overview of project's targets, objectives and financing

a. Brief description of the country/region: geography, terrain, climate, demographics, socio-economic situation,

"Bantayan Island" in Cebu, Philippines, particularly the municipalities of Bantayan and Sta. Fe, is the site of the project. The people of Bantayan rely on fishing and poultry raising as major sources of income.

The town of Bantayan is the largest town on the island with the same name. The town is a scenic place with facilities such as among others market place, a sea port, a hospital, and historical sites.

Santa Fe is the third largest community on Bantayan Island. Sta. Fe seaport is the gateway of the Island from Cebu mainland. A small airport is located about 2 km East of Santa Fe.

1) Project Recipient Sites:

Six (6) sites below were identified and selected for the implementation of the project. The six sites were connected through the Wireless LAN System. To extend the network via the Internet three other sites were also identified and selected.

Wireless LAN Network (total length: 31.4Km)

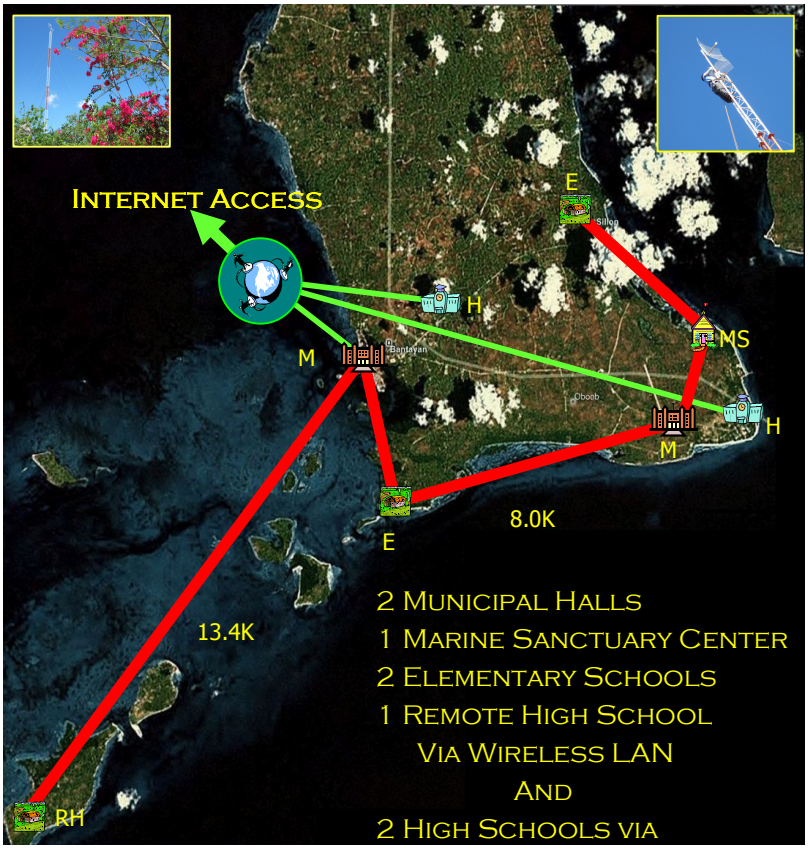

Figure 1-1 Network Configuration in Bantayan Island

2) Wireless LAN System Connection

A. Bantayan Municipal Hall
B. Sta. Fe Municipal Hall
C. Marine Sanctuary Center
D. Sulangan Elementary School
E. Sillon Elementary School
F. Doong High School
(Internet Access Connection)
G. Bantayan National High School
H. Sta. Fe National High School
I. UP Cebu, Visayas

b. Objectives and implementation details of the project applications (basic telephony, e-business, e-administration, e-education, e-health, ICT training etc),

1) Objectives of the Project

Specifically the project aims:

- To establish an ICT infrastructure in Bantayan Island;
- To provide ICT services in Bantayan Island (Wireless LAN and Multimedia Applications);
- To connect the Marine Sanctuary & Learning Center, Public Schools and Municipal Halls using Broadband Wireless LAN, and extend the rural area network to the Internet;
- To promote human resource capability building using IP Technologies by connecting Bantayan and the University of the Philippines (UP) System;
- To obtain the knowledge and skill in developing E-business applications and be a model rural area with broadband infrastructure;
- To have an exchange of ideas between the Philippines and Japan on aquatic farming technologies and E-business via the Internet;
- To examine an application of RFID on Tagging and Remote/Self Instruction for E-learning leading to E-business in Bantayan;
- To strengthen partnerships between developed and developing countries as well as between rural areas and urban areas and
- To promote advances in wireless technologies that would be both beneficial to the Philippines and Japan

2) Background

In order to resolve the Digital Divide, KDDI is of the view that a simple telephony is insufficient even in rural areas from the following reasons:

- Valuable information is available on WWW anytime, anywhere
- Multimedia device helps to get various kinds of opportunity; education, health care, business, commerce, public services, employment, etc.
- Access to the Internet is an effective way to catch up world's movement

Therefore, we need to implement broadband system in rural areas as well.

In order to meet these requirements above, an IP-based broadband Wireless LAN system called **CFO-SS (Carrier Frequency Offset-Spread Spectrum)**, which was developed by KDDI R&D Labs., was used for this project.

3) Implementation details of the project applications

In this project, broadband Wireless LAN system, "CFO-SS", network, which connects six sites, was constructed to provide 10 Mbps broadband links. Over these established links, the local people enjoyed the multimedia Internet applications such as "Internet Access", "E-Mail", "E-Learning", "Video-Conference / Remote Lecture" and "internal VoIP Telephony".

c. Consideration of indigenous communities, isolated and poorly served areas, small islands and their particular needs and situations.

In our network, we selected one High School in a remote island (Doong Island), which is about 13km away from main island of Bantayan. Before the project, ordinary mail was the only measure at this High School for communication from Ministry of Education and it took sometimes few months. However, after our local network was completed, they could instantly obtain any information from homepage of Ministry of Education.

Similarly, telephone service and internet access were not available from Elementary Schools and Marine Sanctuary Center before this project.

d. New technologies deployed for providing reduced cost capital and operating cost solutions.

CFO-SS is a wireless system to be installed very easily. As its maximum transmission length is around 20km, no repeater station was necessary between the sites. That made Initial Investment Cost low.

Operation and Maintenance is also very easy (usually maintenance free).

All we need for CFO-SS as Running Cost is that for power consumption (80W/unit).

e. Financing and partnership aspects of the project, including the estimated total cost of the project and the types of funders (e.g. sponsors' contribution, charitable donations and subsidies from USF).

The project was implemented with collaboration among the Commission on Information and Communications Technology (CICT), Office of the President, Philippines, University of the Philippines, Cebu and KDDI Corporation, Global Information and Telecommunication Studies, Waseda University of Japan.

Asia-Pacific Telecommunity (APT) was the sponsor of this project and total budget of the project was US$ 100,000. Within this budget, cost for purchasing the equipments was around US$ 60,000.

f. Decision-making process to determine the project

This project was carried out under ICT-HRD (Human Resource Development) program in APT. The project was selected by APT in consultation with Japanese Ministry of Internal Affairs and Communications, who actually provided the extra budgetary contribution to APT for this program. Our project was completed within one year from request for proposal to submission of final report to APT.

2. Infrastructure and regulatory environment

a. Infrastructure components: Pre-existing telecommunication facilities, transport access, electricity supply, distance to the nearest local exchange and/or IP network, human resources, security,

Both fixed and mobile telephone services were the most popular way to communicate inside the main island of Bantayan. ADSL service had been introduced at that time but only limited people and organizations, such as Municipal Hall and High Schools, were using it due to its high price.

We didn't see any difficulties over transport access and electricity supply inside the main island of Bantayan but Doong Island where commercial power supply was available only from evening to midnight. However transport access between islands is very difficult at the low tide.

Distance to the nearest local exchange and access point of IP network is about 500m from Bantayan Municipal Hall.

As for the human resources, some teachers in the schools and universities have good knowledge for operation of ICT equipments.

b. Regulatory components: Universal service obligations, licensing conditions, frequency availability (for radio-based projects), other regulatory issues,

CFO-SS uses frequencies of 2.4GHz band, which is called ISM (Industrial, Scientific and Medical) band. And the output power of CFO-SS is less than 60mW. We obtained "demonstration license" from Department of Transportation and Communications for the use of .Wireless LAN system as a pilot project outside.

c. Other factors which influenced the operating environment (manufacturers, standards etc).

Developed by KDDI R&D Labs, the technology of Carrier Frequency Offset-Spread Spectrum has not been standardized unlike IEEE 802.11 or IEEE 802.16 series devices.

CFO-SS10A achieves high-speed data transmission of 10 Mbps by multiplexing five 2 Mbps. By this technology, CFO-SS system shows high resistance to interference and noise, especially against "multi-path", and this makes it possible for CFO-SS to carry the data to distant place without degradation of throughput especially over the see.

Because of its technological originality, it is very difficult to intercept CFO-SS's signal. This fact makes CFO-SS system very secure.

On the other hand, price of CFO-SS is a little bit high due to its small quantity of production.

3. Technical description and services provided

a. Architecture, type of systems, main technical characteristics, frequencies (for radio-based projects), power consumption, performances (capacity, reliability, quality of service), network management, etc.,

1) Architecture

This chart shows basic system architecture.

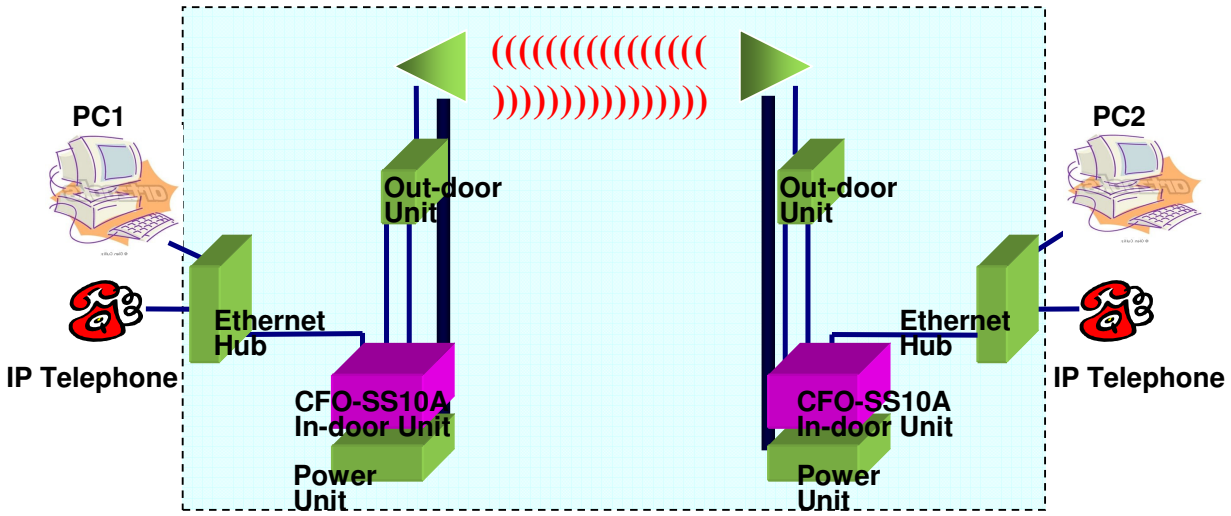

Figure 3-1 Basic System Architecture

2) Basic component of the System

- Wireless LAN system:
  CFO-SS10A (KDDI R&D Labs.)
- IP Telephone System
- Video-Conference System

3) Main technical characteristics of CFO-SS

Main technical characteristics of CFO-SS are as follows:

- Wireless (Frequency: 2.4 GHz ISM band)
- IP availability
- Data speed: 10 Mbps
- Long range (Max. 20 km with directional antennas)
- Resistant to interference and noise

Please refer to the table below for the detailed specification of CFO-SS system.

	CFO-SS10A
Modulation	**CFO-SS** **(Carrier Frequency Offset-Spread Spectrum)**
Frequency	**2,400 – 2,483.5 MHz**
Bandwidth	26 MHz
Number of channels	3 channels (2414, 2442, 2470 MHz)
Data speed	**10 Mbps**
LAN interface	10/100 Base-T
Output power	**0.08 mW/MHz**
Antenna gain	max. 24 dBi
Access control	CSMA/CA (Carrier Sense Multiple Access / Collision Avoidance)
Power	**AC100 V, 0.8 A (80W)**
Temperature	In-door Unit : 0 – 40 ºC Out-door Unit : -10 – 60 ºC
Dimension	In-door Unit : W120 mm×H259 mm×D350 mm Out-door Unit : W140 mm×H210 mm×D63 mm
Weight	In-door Unit : 8.5 kg Out-door Unit : 1.5 kg

CFO-SS18A which has 18 Mbps of data speed with DPST (Dual-Polarization Staggered Transmission) is also available.

Table 3-1 Specifications: CFO-SS10A

4) Performance

Through the project, we have obtained the following results, which prove that this system can be applied in rural areas.

- Small round trip time (few ms)
- Sufficient throughput for IP communication
- Normal operation of IP telephone System
- Normal operation of Video-Conference System

The system based on IP technology enabled us to handle not only voice but also multimedia on the network.

In addition, the followings can be achieved from the results:

- Communications in the rural areas, in the entire community and between neighboring communities, will be easily established by introducing the CFO-SS system.
- Using the Video-Conference System even in international (for example; between the Philippines and Japan), the System contributes to the development of remote education.
- Long-range feature of CFO-SS contributes to reducing the cost and work load of network construction and operation.

b. Installation and deployment: network planning, subscriber management, etc.,

All you need to introduce the CFO-SS system are:

- Initial Investment Cost
- Power Supply (80W)
- Line of Sight

When you can't get clear "Line of Sight", you may need to build an antenna tower high enough to secure LOS.

If you have a place to fix the antenna, it takes only about 30 to 60 minutes to set up the whole CFO-SS system.

c. Interconnection to national networks/backbones,

Though we didn't implement the interconnection to the national telephone network in this project, a technology to interconnect the CFO-SS network to national telephone network using equipment, such as VoIP Gateway, Gate Keeper, Network Manager, PSTN Gateway and Billing System, is well established and it is not difficult.

It is also very easy to interconnect the CFO-SS network to national IP backbone with its IP interface.

d. For each service delivered (POTS, "IP telephony", etc.): mode (data type and bit rate) and quality (voice quality and bit error rate).

1) General

The throughput within the constructed CFO-SS network was 2 to 5 Mbps. ADSL portion, which maximum speed was 256 kbps, was the bottleneck to access into the Internet from any sites in the network.

Very little bit errors were observed in the case of tandem connection of CFO-SS.

2) IP Telephone

SIP IP Telephone was installed at each site for internal communication in the closed network. Voice quality was very good over broadband network

3) Video-Conference

"Net Meeting" worked properly inside the constructed network.

"Skype" and "Yahoo Messenger" were also used, and its quality was quite good even in the international connection (between the Philippines and Japan).

4. Cost aspects

a. Cost of the equipment, cost per line and cost of the operation of the system,

1) Cost of the equipment

Price for one pair of CFO-SS (including In-door Unit, Out-door Unit, Power Unit, Hub, Antenna and Cables) is around US$8,000.

2) Cost per line

Provided that 40 telephone terminals are installed at each end of CFO-SS pair, cost per line is US$100.00 (US$8,000 / 80 terminals). Here it's not including the cost for equipment to interconnect to national networks and construction.

3) Cost of the operation of the system

Cost of the system operation is basically just for the power consumption (80W/unit).

b. Cost of each terminal and cost of the service for the user.

1) Cost of terminal

- IP Telephone System:
  DPH-100 IP Telephone (D-Link) US$180 / terminal

- Video-Conference Application:
  We used "Skype" and "Yahoo Messenger" for trial. Free
  (PC is not included in the price)

2) Cost of the service for the user

As the services are provided on non-commercial basis in a private network, it is free of charge for the users to use the system except power consumption.

Regarding the Internet access from the constructed network, as we used existing ADSL (fixed rate) at Bantayan Municipal Hall, no additional charge was necessary.

5. Effectiveness and sustainability of the project

a. Effectiveness and benefits of the project for the targeted user groups,

Followings things became possible for targeted user groups by this project.

- IP Telephone:
  Local people enjoy communications between sites within the constructed network without warring about charge.

- Video-Conference:
  Video-Conference application worked very successfully between main island of Bantayan and Doong Island over the sea. It brought a new concept to the people in the High Schools on tele-education. Video-Conference was introduced regularly to the class lessons between Bantayan High School and its remote school in Doong Island.

- Web Browsing:
  People can access the Internet and obtain huge amount of valuable information instantly.

- E-learning:
  Local people can promote human resource capability building by accessing to E-learning contents in the University of the Philippines (UP) System.
- They obtain the knowledge and skill in developing E-business applications and can be a model rural area with broadband infrastructure.
- They can exchange ideas between the Philippines and Japan on aquatic farming technologies and E-business via the Internet.
- It was said that this project opened a lot of possibilities for the advancement of the community. It would help local people achieve reforms needed in education, business and governance.
  As a result, this model can contribute to Bridging Digital Divide and. everybody can access information and take lots of opportunities

b. Profitability of the project and/or its contribution to local entrepreneurial activities,

This project is not aiming at profitability but improvement of quality in their daily life. However it is possible for the local people to obtain the knowledge and skill in developing E-business applications.

c. Specific strategies to respond to the needs of women, youth, handicapped, indigenous people and other marginalized or socially disadvantaged groups

Women, youth, handicapped and other marginalized or socially disadvantaged groups tend to live in rural and remote areas. As CFO-SS is a good measure to expand the cover areas of broadband service into rural and remote areas, it responds to the needs of such people in this sense.

d. Aspects of the project, which could be strengthened to enhance its effectiveness or sustainability maximizing the benefits of telecommunication infrastructure in rural and remote areas.

Prior to the projects in Bantayan, we invited the Philippine partners to Japan to promote better understanding of the Wireless LAN system (CFO-SS) and how to use applications with the system. A practice and a survey carried out in Japan made it easier and smooth to execute the collaborative construction of CFO-SS network in Bantayan, and also to operate the system after the project.

It is also said that this project is sustainable once the CFO-SS system is installed, because the system requires only costs for power supply and very little maintenance. If we charge for the usage of IP telephony and other services, it will be possible to recover the initial investment cost.

6. Social and human development impacts

a. Overview of key social and human development needs of the population in the project area,

Both fixed and mobile telephone services are the most popular way to communicate inside the main island of Bantayan. The Internet access services (dial-up and ADSL) had been introduced at that time but only limited people and organizations, such as Municipal Hall and High Schools, were using it due to its high price. Local people, especially school students and teacher, were willing to have facilities to access the Internet.

b. Role and commitment of the project to addressing these needs,

Newly constructed network by this project made it possible for High School and Elementary School students and teachers to access the Internet and enjoy "Web Browsing", "E-mail", "Video-Conference" and so on.

As all the systems used in this project have been left in Bantayan for their own use, it is expected that they will find new ways of utilising the systems in their daily activities.

c. Socio-economic benefits for, and impacts on the community(ies) and/or at a wider level, including support for gender equity, promotion of community participation and the needs of marginalized and disadvantaged populations

CFO-SS can provide chances to the marginalized and disadvantaged populations in rural and remote areas to come in contact with ICT, expanding the cover areas of broadband service.

The system left in Bantayan will be used as sample to demonstrate the capability of broadband Wireless LAN system to the people coming from region, neighbouring communities, inside the country and neighbouring countries.

d. Means foreseen to enhance the project's future contributions to human and social development.

As the University of the Philippines (UP) System already has a lot of contents for E-learning, it is expected that local people access these materials over Internet and use them effectively for their study of ICT training and others. It will promote the usage of ICT technology and contribute to human and social development by themselves.

7. Other observations

a. Unexpected results and lessons learned,

It was very lucky for us to be able to complete this challenging project successfully. Using high antenna tower (about 20m high from the ground level) and avoiding high trees and hill, keeping "Line Of Sight" is very important to design the good network.

We sometimes experienced "blackout" of commercial power supply and had to stop the construction work until it was recovered. Also some electronic devices were broken, possibly due to the fluctuations of voltage.

b. Anticipated near/long-term project challenges and reorientation.

The following items are considered to be our near/long-term project challenges.

As such system is in placed; the following actions are therefore recommended.

1) E-Learning Applications

a. Further training on computer and online services such as browsing and e-mail.

b. Training on finding information on the Internet through search engines.

c. Web page creation and web programming training.
- Potential vocational occupation

d. Remote lectures with other schools all over the world.

2) e-Governance Applications

a. Access by the local government officials to other government websites such as the Commission on Audit to acquire data.

b. Forums and dialogue between local government officials. For example, the officials from the barangays in Doong Island can talk to the mayor of Bantayan through Video-Conferencing.

c. A website to contribute information to researchers about Bantayan Island.

d. Geographical Information System (GIS) Integration.

e. Online Monitoring of Environmental Protection Efforts
- Environmental Compliance Audit (ECA)

f. Remote Lectures

3) e-Business Applications

a. Explore possibility of hosting services for local businesses in Bantayan through the server in the Bantayan Municipal Hall.

b. Development of software for local business by students and faculty members of UP Cebu College for a minimal fee to support project sustainability.

4) Offline Computer Applications and Computer Familiarization

a. Provide computer familiarization through training on basic computer operations and use of Office applications (Proprietary and Open Source).

b. Provide training on basic computer maintenance e.g. on proper use and identification of viruses distributed as e-mail attachments and through malicious websites.

5) Operation and Maintenance/ Sustainability Requirements
that needs to be established.

This includes among others the spare parts, office supplies and training of ICT personnel and of the O&M technicians.

1. Make every internet access points as Community Access Centres (CACs)
   - CACs for internet surfing, educational games, software applications development, website development, content development, E-business and ICT Training
   - ICT Training for both hardware and software, management of CACs etc.

2. ICT Training
   - Basic and Advance Course in Computer Education
   - Computer Networking
   - Specialized application software courses
   - Specialized Group Training (Housewives, Elderly, Physically challenged, Farmers, Fishermen, Students, Government Employees, Businessmen, Out-of-School Youth, etc.)

3. Coordinate, collaborate, cooperate and manage all these ICT activities through:
   - A small group of concerned individuals to lead
   - Public consultations and Activity promotion
   - Continue ICT development of the Bantayan Islands

4. Establish or create a Small Group
   - Bantayan Island ICT Management Team

- Chaired and co-chaired by 1 Local Government Unit (LGU) Official and 1 Official from Local Business Organization
- Members from other LGUs, Business Organizations, Schools PTAs, Cooperatives, Marine Sanctuary, People Organizations
- UP Visayas, and CICT Region 7 as technical advisors/consultants
- Main objective is to oversee the development of ICT in Bantayan

5. Recommendations for a Sustainability Plan
   - Organizational set-up: ICT O&M Management Team
   - Funding Options:
     - Contribution from Municipal LGUs
     - Funding Support from Congressional Representative
     - Funding Support from Provincial Government
     - Contribution from Local Business organizations
     - All of the above
   - Training: In-house and/or out-sourced
   - Revenue Generation: Operationalize CACs
   - Operation and Maintenance: In-house and/or outsourced
   - Goal: Revenue should be enough to sustain the operation and replace defective parts of the system

c. Additional information considered useful

1) Completed Projects using CFO-SS and its Reference

We have tested CFO-SS system in several sites.
(in Amami Islands / Japan, Malaysia, Peru and Vietnam)

- Amami Islands / Japan (Medical Application)
  http://www.kddilabs.jp/s-cross/ (Japanese only)

- Kuching, Bario / Malaysia (Operability of CFO-SS in rural area)
  "IP–based WLL for Bridging Digital Divide in Rural Area"
  http://www.aptsec.org/Program/ICT/WebHRDICT/Batch-2/2-1Experiment-WLANin%20RR.doc

- Hatinh / Vietnam (Medical / Educational Application)
  http://www.kddivietnam.com/AT%20Project.htm

- **KDDI CORPORATION**
  http://www.kddi.com/english/index.html

THANK YOU FOR YOUR COOPERATION

_____