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Global warming countermeasures clean development mechanism business research

Low income community mangrove reforestation project in Fiji

＜final report digest version＞

Taishi design office co. ltd

1. Basic factors concerning project implementation

1. 1. Summary of the proposed project and background to planning

1. 1. 1. ＜Project summary＞

This project is based on subject participation of low income class at South Pacific Ocean island state Fiji, involving the operation of small scale absorption source CDM(SS AR-CDM) through mangrove environmental plantation. Moreover, a park accessible for ecotourism will be built at the aforementioned site which will ensure economic incentive to the host country and local communities, and also aim to maintain continual activity.

This project scheme is expected to provide a number of benefits to the environment, society, and economy. However, being a joint ownership body, yet focusing on the ownership of a community of low income class, the basic concept of Mangrove environmental plantation will be what had been unfeasible in the past: to measure the synergetic effect by fulfilling both "countermeasures against global warming" and "adaptation" at the same time. In other words, answering socioeconomic issues and conducting environmental conservation will mutually repeat the positive growth cycle, and the continuance of project activity will contribute to the sustainable development of the host country and local communities.

1. 1. 2. ＜Project background＞

①Environmental issues/ Although the South Pacific Island states belongs to a group with few GHG outputs, it is an area very much affected by global warming. 90% of the total population resides in the coastal area, and as there are lots of areas in Fiji that are highly vulnerable to sea level rise, coastal erosion and loss of mangrove forests are at the fore of environmental issues. The need for mangrove plantation is high due to loss in habitation area and decrease in the amount of fish caught especially at areas where erosion is progressing.

②Sociological issues/ the ethnic composition of Fiji's inhabitants: 49% are Fijian citizens and 49% are Indian citizens. Fijian citizens are land owners, however, it is highly necessary to use their land effectively for, there are lots of self-sufficient poverty groups practicing small-scale agriculture.

1. 2. Summary of host country (Fiji)

1. 2. 1. <Geography> Fiji is positioned longtitude 177 degrees east to longtitude 175 degrees west, latitude 12 degrees south to 21 degrees, and is an island state made up of around 330 small islands that are interspersed in the South Pacific Ocean (Melanesia area). The total area of land is 18,333 ㎢.

1. 2. 2. <Climate> Belongs to the tropical rainforest climate and there are no extreme differences in temperatures. It is divided into wet season (Nov-April) and Dry season (May-Oct), and although the

temperature becomes considerably low in the dry season when affected by trade winds, it is surrounded by the ocean, therefore the daily and annual range of air temperature is minimal. Moreover, the temperature in the west is slightly higher compared to the east area, however, the minimum average air temperature is lower in the west.

1．2．3．<Economy>Fiji's sugar industry is famous globally, and the majority of the sugar produced is exported, contributing greatly to acquisition of foreign currency. Nevertheless, sugar production is easily influenced by external factors such as international prices and natural disasters, and therefore it is difficult to state that it is makes a stable economic infrastructure. The coup d'etat case that occurred in May 2005 brought undesirable effect to Fiji's overall economy, and caused damage to the tourism industry in particular. However, after the general election in 2001, the stability of the political condition raised the growth rate to 4.3% in 2001, and to 4.4% in 2002.

The tourism industry showed significant recovery and in the future the tourism industry is expected to be the initiating agent for economic development in Fiji. The architectural business is in buoyant condition due to the launch of large scale projects including hotels.

1．2．4．<Investment environment> Due to the formation of foreign investment law (FIA1998) in 1998, the government proposed activity and development of investment environment centering on "Clarification of the regulation or inhibited field, and investment incentive field" and "Improving the transparency of the investment procedure and cutback of period required for approval".

1．2．5．<Historical background and political situation> It is a multiethnic state composed of indigenous population of Fijian citizens (51%), and Indian immigrants (44%). Indian immigrants (that is Indians) first came as a work force for sugar cane cultivation as a part of the British plantation measure when India was still a British colony in 1879. After Fiji became independent in 1970, Indian immigrants remained in Fiji and formed the Indian community.

1．3．Environmental administration and conservation measures

1．3．1．<Forest conditions> According to "environment information maintenance research/report (Fiji) by country"（JICA、1998.11）, Fiji's forest annual decrease rate in the last 30 years has been lower than 1%. The four causes responsible for forest decrease are large scale agriculture, exurban development business, expansion of farm land, development of urban areas, and forest fire and the biggest concern is unsustainable deforestation by small scale farmers.

1．3．2．<Presrevation district of sea area> Mangrove conservation is not the immediate goal, however Fiji Locally Managed Marine Area（FLMMA）Network operate as conservation activity of seashore coastal area. In order to effectuate sustainable use of aquatic resources, the community becomes an entity, establishing a protection area in the ocean, engaging in various activities. This project is SS AR-CDM, where local communities are able to participate as subjects, however, it is assumed that there are enough basic material to formulate the project.

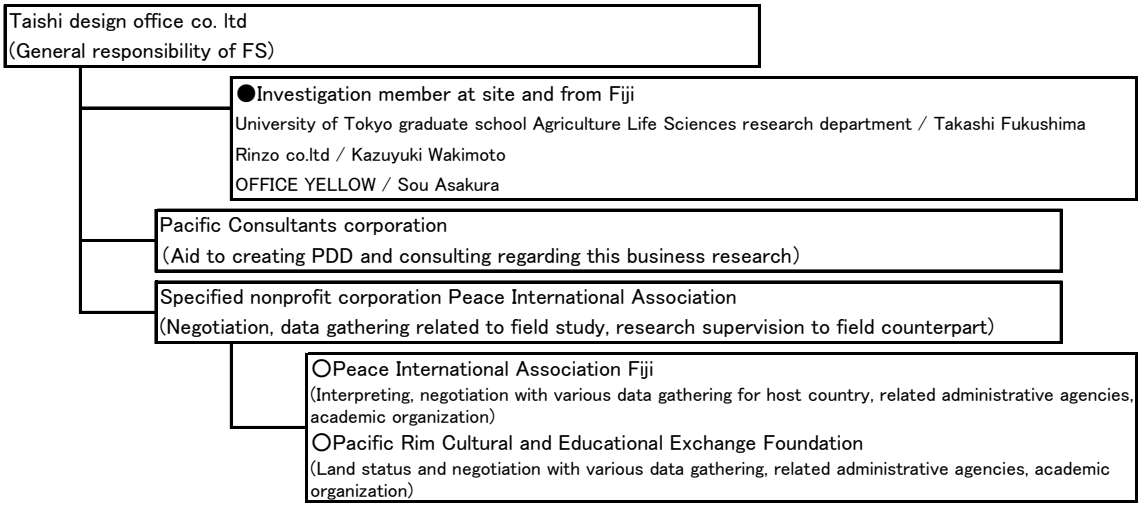
1．3．3．<Environmental conservation of international collaboration> Out of the "Okinawa initiative" adopted at Third Japan/South Pacific Ocean island forum (PIF) heads of state summit in Okinawa held by Japanese prime minister Koizumi and the Fijian prime minister Garese's co-chairmanship in 2003, PIF engages in effectuating sustainable use and protection of resource and ecosystem in order to pursue "safe and sustainable environment". Moreover, in regard to global warming issues, the authentication of

Kyoto protocol was encouraged and will attempt to formulate a common rule allowing every country to participate. Concerning the conservation of mangroves, the importance of Ramsar Convention is growing. The government of Fiji has not gained membership as of Feb 2006, however, is considering its accession.

1．4. Host country's CDM/JI's acceptance criteria, DNA's installation conditions, policy/situation associated with CDM/JI

Fiji has been the fastest in the world to be signed for Kyoto protocol and to conclude agreement on the same day, Sept 17th 1998. This shows that the government of Fiji is highly concerned with climate change issues (has made 14th in the accession to the climate change scheme treaty). The Ministry of Local Government, Housing, Squatter Settlement and Environment is responsible for DNA, and has already accepted the small-scale hydraulic power generation project (Vaturu and Wainikasou Hydro Projects" This project has also been registered at CDM administrative board.

1．5. Implementation system of research(domestic/host country/others)



1．6. Technology transfer/main contributions that this proposed project will make to the sustainable development of host country.

The project objective is to effectuate "adaptation" as a detailed valid scheme has never been executed (although the necessity of it has been recognized) and at the same time effectuate "CDM" that grant benefits to the local community, and the contribution to sustainable development is expected to be enormous.

The main contributions to sustainable development of the host country and local communities, is as follows.

A．＜Contribution by CDM＞

①Increase revenue by returning CDM Credit ②Building capacity (acquiring knowledge that is CDM related)

B.＜Contributions through Mangrove environmental plantation＞

①Improving acquisition rate of fisheries resource(fish, prawn, crabs etc) involved in formation of

Mangrove forests, ②Creation of employment from plantation and management, ③Increase revenue (land lease costs) when in need for land lease, ④Adaptation to global warming (dissolve the vulnerability caused by coastal erosion due to sea level rise), ⑤Breakwater against threats from opens seas including Tsunamis (demonstrated by Sumatra earthquake), ⑥Protection and improvement of biodiversity, ⑦Building capacity (acquiring knowledge and skills necessary for plantation and management), ⑧effective use as tourism resource

C.＜Contribution through ecotourism＞

①Creation of employment from ecotourism, continual cash earnings, ②passing down of traditional culture through implementing ecotourism, ③Building capacity (Acquiring knowledge and skill concerning tourist industry)

Contributions for sustainable development for Fiji and its local communities from three different perspectives have been enumerated in the above, however, in practical terms we hope for multiple synergetic effect. Two powerful materials "CDM" and "Mangrove environmental plantation" are equipped for disclosure in case it is surveyed from the aspect - scheme for ecotourism (sustainable development of tourism plan). When attracting regular tourists, the business enterprise will focus on developing optional products. This project aims mainly at SS AR-CDM, but at the same time retains the element that "CDM from Mangrove environmental Plantation" is material disclosure, and can anticipate a profound effect.

2. Project planning

2. 1. Concrete contents of project

This project will be conducted at the coastal region near Lomawai village, south west of Vitilevu island, Fiji's main island where erosion is progressing. Its objective is to conserve the environment by replanting mangroves. The expected area subject to plantation is 250 ha, and estimated fixed amount of CO2 during the 30 years period for this project is 112,608.

Moreover, there will be a park built accessible for ecotourism in the area in which Mangrove plantation will be conducted, and low income class communities in host countries will become subjects for management. The targeted site for project will allow the scheme to develop which will contribute socioeconomically, such as creation of employment and stimulating the economy, and aim at increasing incentive towards continual preservation.

①Mangrove environmental plantation

South west area of Vitilevu island is where sugar cane cultivation is active, but is also known for its formation of numerous mangrove forests. Compared to areas within Fiji, terms and conditions, such as the flux and reflux of the tidal level, climate and fertile land make it suitable for mangrove forest formation. Moreover, there are large leaves along the coastline which enables plantation conducted extensively.

②Appropriate area for implementing ecotourism

At north and south of Vitilevu island, is an international resort facility complex that accommodates lots of tourist from abroad. It also has publicity, such as from the linkage with various travel agencies, and therefore is favorable for ecotourism. Moreover, it is placed about 1 hour by car (via main road) from

Nadi International airport, the largest transport base of the South Pacific. It is also about 2 hours (via main road) from the capital Suva, the center of South Pacific government, culture and education.

2．2．Project boundary, Baseline scenario and additionality

2．2．1．＜Project boundary＞

Although the sites where mangrove reforestation is possible are intertidal zones and atolls which belongs to government, these sites have influence from communal use rights.

The project boundary of the project activity consists of following three types of areas: Communal Land, intertidal zones of coastal area in Lomawai village, and atolls.

2．2．2．＜Baseline scenario and additionality＞

In this project activity, since net anthropogenic GHG removals by sinks are less than 8,000 t CO_2/year, project design document will be developed in line with small-scale AR CDM project.

If significant changes in the carbon stocks, in particular the living biomass of woody perennials (above- and belowground biomass) and below-ground biomass in wetlands, are not expected to occur in the absence of the project activity, the changes in carbon stocks can be assumed to be zero.

In the project activity, baseline net GHG removals by sinks are assumed to be zero. The project sites for the project activity have no vegetation and there would be no significant change of carbon pools as they had been constant over the decades.

The reforestation of mangroves would not occur in the absence of the proposed small-scale A/R CDM project activity because of the following reasons:

1) In the project area, there is no custom to plant mangroves. There would be customary barrier in terms of planting mangroves which no body in the area has done. At the same time, local people do not have knowledge for regeneration of mangrove forest.

2) There would be financial barrier to start the project activity. Planting mangroves would cost labor, time and money to the local people who live off subsistence economy. The local people would not have difficulty in obtaining loans for project activity which would not give them enough return to pay back the interest rates.

3) In addition, the Lomawai village is not connected to the grid system and most people engage in fishery and agriculture and would not be able to afford spending time and labor to planting mangroves which would not give them direct benefits in the short term.

For the small-scale A/R CDM project activity, project participants need to demonstrate that the project activity faces one barrier out of barriers listed in the Attachment B. Above barriers would satisfy the demonstration of additionality.

Without incentives to gain income from sales of lCERs, it would be impossible to implement project activity.

2. 2. 3. ＜Estimating the baseline net GHG removals by sinks＞

Baseline net GHG removals by sinks will be determined by the equation:

$B_{(t)} = \Sigma_i (B_{A(t),t} + B_{B(t),i}) * A$ (1)

where:

$B_{(t)}$ = Carbon stock in the living biomass pools within the project boundary at time "t" that would have occurred in the absence of the project activity (t C)

$B_{A(t)\,i}$ = Carbon stocks in aboveground biomass at time "t" of stratum i that would have occurred in the absence of the project activity (t C/ha)

$B_{B\,(t)\,i}$ = Carbon stocks in belowground biomass at time "t" of stratum i that would have occurred in the absence of the project activity (t C/ha)

A_i = Project activity area of stratum i (ha)

2. 2. 4. ＜Actual net greenhouse gas removals by sinks＞

"Actual net GHG removals by sinks" only considers the changes in carbon pools for the project scenario (please refer to paragraph 8 above). The stocks of carbon for the project scenario at the starting date of the project activity[1] (i.e. t=0) shall be the same as for the projection of the baseline net greenhouse gas removals by sinks at t=0. For all other years, the carbon stocks within the project boundary at time "t" ($N_{(t)}$) shall be calculated as follows:

$N_{(t)} = \Sigma((N_{A(t)\,i} + N_{B\,(t)\,i}) * A_i)$ (5)

where:

$N_{A(t)\,i}$ = Carbon stocks in aboveground biomass at time "t" of stratum i under the project scenario (t C/ha)

$N_{B(t)\,i}$ = Carbon stocks in belowground biomass at time "t" of stratum i under the project scenario (t C/ha)

A_i = Project activity area of stratum i (ha)

2. 2. 5. ＜Net anthropogenic GHG removals＞

Net anthropogenic GHG removals can be derived from the from the formula below.

Net anthropogenic GHG removals = actual net GHG removals by sinks– baseline net GHG removals - leakage

= 132,480 － (132,480*0.15)

= **112,608 t CO_2 (30 years)**

The annual net anthropogenic GHG removals 3,754 t CO_2/year.

[1] The starting date of the project activity should be considered to be the point in time when the land is prepared for the initiation of the afforestation or reforestation project activity. In accordance with paragraph 23 of the modalities and procedures for afforestation and reforestation project activities under the CDM, the crediting period shall begin at the start of the afforestation or reforestation project activity under the CDM.

2. 2. 6. ＜Leakage＞

leakage is estimated using FOD method or multi-phase decay model which are both applied already in emission reduction projects especially for landfill gas recovery and organic composting. The following instructions, if amount of leakage falls within the defined range below, it can use the default value.

If project activities cause any leakage that may result from litter falling into ocean, and if tidal wave carries it outside the project boundary, possible emissions of CH_4 shall be considered as leakage.
The estimation of CH_4 emissions arising from litter shall be assumed 15% of the total actual net GHG removals by sinks, or if the data is available, the project participants can also apply the following procedure to estimate its leakage:

Step 1: Estimation of fallen litter into water body
Porject participants shall establish randam sampling plots in each stratum to collect fallen litter (e.g. through 1m square nets) for appropriate representation for appropriate time period. The collected litter then shall be converted to tones of organic matter per ha per annum.

Step 2: Estimation of potential CH_4 emission
The amount of CH_4 that would be emitted from organic matter shall be estimated using FOD method or multi-phase decay model approved in AM0025 (organic composting).

Step 3: Conversion of CH_4 to CO_2
The tons of CH_4 shall be converted to tons of CO_2 through multiplying GWP of 21.

If the derived amount of CO_2 is greater than 10% and less than 50% of actual net GHG removals by sinks, then leakage shall be equal to 15% of the actual net GHG removals by sinks

2. 3. Monitoring

＜Ex post estimation of the baseline net GHG removals by sinks＞
In accordance with paragraph 6 of appendix B to decision 14/CP.10, no monitoring of the baseline is requested. Baseline net greenhouse gas removals by sinks for the monitoring methodology will be the same as the projection of this element using the simplified baseline methodology above.

＜Ex post estimation of the actual net GHG removals by sinks＞
Before performing the sampling to determine any changes in carbon stocks, project participants need to measure and monitor the area that has been planted. This can be performed through, for example, on-site visits, analysis of cadastral information, aerial photographs or satellite imagery of adequate resolution.

Once project participants have selected the method to monitor the area that has been planted, this method should be used to monitor the performance of the planted areas throughout the project activity. If significant underperformance is detected, changes in carbon stock from such areas shall be assessed as a

separate stratum.

Carbon stocks shall be estimated through stratified random sampling procedures and the following equations:

$P(t) = \Sigma((PA(t)\ i + PB(t)\ i) * Ai)$ (15)

where:
P(t) = Carbon stocks within the project boundary at time "t" achieved by the project activity (ton C)
PA(t) i = Carbon stocks in aboveground biomass at time "t" of stratum i achieved by the project activity during the monitoring interval (ton C/ha)
PB(t) i = Carbon stocks in belowground biomass at time "t" of stratum i achieved by the project activity during the monitoring interval (ton C/ha)
Ai = Project activity area of stratum i (ha)

＜Data variables for monitoring＞

- Location of the areas where the project activity has been implemented
- Ai - Size of the areas where the project activity has been implemented for each type of strata
- Location of the permanent sample plots
- Diameter at breast height (1.30 m)
- Height
- Basic wood density
- Total CO_2

2．4．Environmental impact/other indirect impact

Results of this research (collection of data and/or information analysis, specialist hearings etc.), including the socioeconomic and environmental effects as a result of implementing the project, is expected as follows. In conclusion, there are lots of beneficial effects to the host country and/or local community, and believe that it will lead to sustainable development.

2．4．1．＜Socioeconomic impact＞①cultivation of fisheries industry resource (crabs, prawn, fish and others), ②improvements in forestry value (ecotourism, others)

2．4．2．＜Environmental impact＞①Preservation of coastal ecosystem (suitable supply of organic carbon), ② The facilitatory effect of suspended particle subsidence in water due to mangrove root system (coral reef conservation effect), ③purification of water quality and/or conservation effect due to removal of nutrient salts(phosphorous/nitrogen), ④ coastal conservation effect to erosion by waves, ⑤ prevention of soil erosion due to sea level rise (sediment deposition effect and/or breakwater effect)

2．5．Stakeholders' comments

①Sept, 2005/Dr. Randy Thaman:University of the South Pacific (USP)

・Mangroves can be used for various purposes including environment and ecological preservation in areas that are under development.

・It is also effective as a breakwater towards tsunamis.
・The most important role of mangrove is to protect animals and plants.
・Preservation of the mangrove forest (important in a sense that it will protect the forest) will lead to reduction of CO2.
②Sept, 2005/Adi Vale Bakewa (Lomawai Village, Salt Committee Leader)
・We are thinking of guiding ecotourists and planting mangroves.
・It will be possible to attract tourists to ecotourism from nearby first-class hotels through the formation of Mangrove forests.

3. Shaping the business

3．1．Financial analysis

Taishi design office co. ltd will conduct the project as an investment liable corporate.

＜Profitability(IRR)＞

	Revenue source (Credit)	Revenue source (Credit and Eco-tourism)
1US$/t-$CO_2$	—	15.3%
3US$/t-$CO_2$	—	18.6%
5US$/t-$CO_2$	4.2%	21.6%
7US$/t-$CO_2$	8.8%	24.4%
10US$/t-$CO_2$	14.4%	28.2%
15US$/ t-$CO_2$	22.0%	33.9%

＜Assessment of profitability＞

Basis of investment judgment:①IRR is 10% or more.②IRR is more than "Ten year averages of the London Inter-Bank Offered Rate +2 %".(source/Business assessment by Sink-CDM investment model(JIFPRO 2005)

	Revenue source(Credit)	Revenue source(Credit and Eco-tourism)
①IRR10%	7．6 US$/t-$CO_2$	2．8 US$/t-$CO_2$
②IRR6.7%	6．0 US$/t-$CO_2$	1．6 US$/t-$CO_2$

＜Cost-effectiveness＞cost of CO_2 1t reduction

SS AR-CDM	3．7 US$/t-$CO_2$
SS AR-CDM with Eco - tourism as supplementation plan	25．5 US$/t-CO2

3．2．Prospects and assignments towards shaping the business more concrete

A Mangrove environmental plantation (survival rate-under 50%) of 100,000 (dense planting/approx. 7 ha.) was conducted near Lomawai village between August and December 2004 as a CDM experimental plantation. The work consignment was made possible experimentally, after having gained

understanding from local residents (low income class). Upon conducting this project, prospects look promising for consignment of practice and for clearing the "participation of low income class" requirement.

3．3．Implementation structure of project (domestic/host country/others)