

**Data Collection Survey on Reverse Logistics  
in the Pacific Islands  
Final Report**

January, 2013

**Japan International Cooperation Agency (JICA)**  
The Overseas Coastal Area Development Institute of JAPAN  
Yachiyo Engineering Co., Ltd.

EI
JR
13-025



### Currency exchange rate

27-May-2012

	USA (US\$)	Japan (JPY)	Fiji (FJ\$)	Samoa (WST)	Tonga (TOP)	Tuvalu (AU\$)	Vanuatu (VUV)	NewZealand (NZ\$)	Australia (AU\$)
US\$	1.00	79.6385	1.8591	2.3781	1.7809	1.0248	97.7250	1.3263	1.0308
JPY	0.0125	1.00	0.0233	0.0298	0.0224	0.0129	1.2264	0.0166	0.0129

( Source: <http://www.bloomberg.co.jp/tools/calculators/currency.html#results> )



## Abbreviations

AC set	Air Condition set
ADB	Asian Development Bank
AI	Australian Industry Group
AU\$	Australian Dollar
AusAID	Australian Agency for International Development
BAF	Bunker Adjustment Factor
BIR	Bureau of International Recycling
Bln.	Billion
C&D	Construction and Demolition (waste)
CDL	Container Deposit Legislation
CRT TV	Cathode Ray Tube television
CW	Commercial Waste
DVD	Digital Versatile/Video Disc
EIA	Environment Impact Assessment
EMC	Environment Management and Conservation Act (Vanuatu)
EPR	Extended Producer Responsibility
EU	European Union
E-waste	Electronic waste
FSC	Fiji Sugar Corporation
ft.	feet
GDP	Gross Domestic Products
GNI	Gross National Income
GRT	Gross Register Tonnage
GSS	Government Shipping Service(Fiji)
GT	Gross Tonnage
H/RW	Hotel/ Restaurant Waste
ha	Hectare
HH	Household
HIES	Household Income and Expenditure Survey
HS	(International) Harmonized System
HW	Household Waste
IRM	Inorganic Risk Materials
ISPM	International Standards for Phytosanitary Measures
JICA	Japan International Cooperation Agency
J-PRISM	Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries
JPY	Japanese Yen

kg	kilogram
km	kilometer
Mln.	million
MOE	<u>Ministry</u> of Labor, Industrial Relations, Tourism and <u>Environment</u> (Fiji)
MSW	Municipal Solid Waste
MV	Motor Vessel
MW	Market Waste
ND\$	New Zealand Dollar
NZ	New Zealand
PAA	Priorities and Action Agenda, 2011 – 2016 (Vanuatu)
PCs	Personal Computers
PET	Polyethylene Terephthalate
PHD	Public Health Department (Vanuatu)
PIB	Prices and Incomes Board(Fiji)
PICs	Pacific Island Countries
POFA	Port Of First Arrival
PR	Public Relations
QW	Quarantine Waste
RORO	ROll-on/ROll-off ship
RSW	Road Sweeping Waste
RWG	Recyclable Waste Goods
RWM	Recycled Waste Materials
SPREP	Secretariat of the Pacific Regional Environment Program
SS	Sewage Sludge
SWAT	Solid Waste Agency of Tuvalu
SWM	Solid Waste Management
TF	Transitional Facilities
T\$	Tonga Dollar
TEU	Twenty-foot Equivalent Unit (container)
UGR	Unit Generation Rate
UK	United Kingdom
UN	United Nations
USA	United States of America
US\$	United States Dollar
USEC	US East Coast
USWC	US West Coast
VAT	Value Added Tax

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## Abstract

### 1. Background of the Study

#### 1.1 Purpose of the study

The purpose of this survey is to collect necessary data to consider a project on circulation of recycling materials by utilizing "reverse logistics". The project will be in coordination with recycling-society programmes which JICA has conducted in the Pacific Region, as represented by J-PRISM (Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries).

More precisely, basic data of material flows from import to export or disposal in the Pacific Islands will be collected, and then the feasibility of a reverse logistics network with port development in view of promotion of the recycling business in the Pacific Islands will be determined. Furthermore, the survey is going to identify problems with creating a recycling oriented society in the Pacific Islands. These outcomes will also be reflected in the coming waste regional strategy (targeted years from 2015 to 2025) established by SPREP: The Pacific Regional Environment Programme.

#### 1.2 Survey Area

This study is conducted in the Pacific Island Countries (PICs) and covers the five countries of Fiji, Samoa, Tonga, Tuvalu and Vanuatu. These countries are members of SPREP. J-PRISM has been active in improving the Solid Waste Management (SWM) sector in these countries as well. The PICs are shown in the following figure.



**Figure Map of the Pacific Island Countries**

Next table shows the present social and economic status in each country.

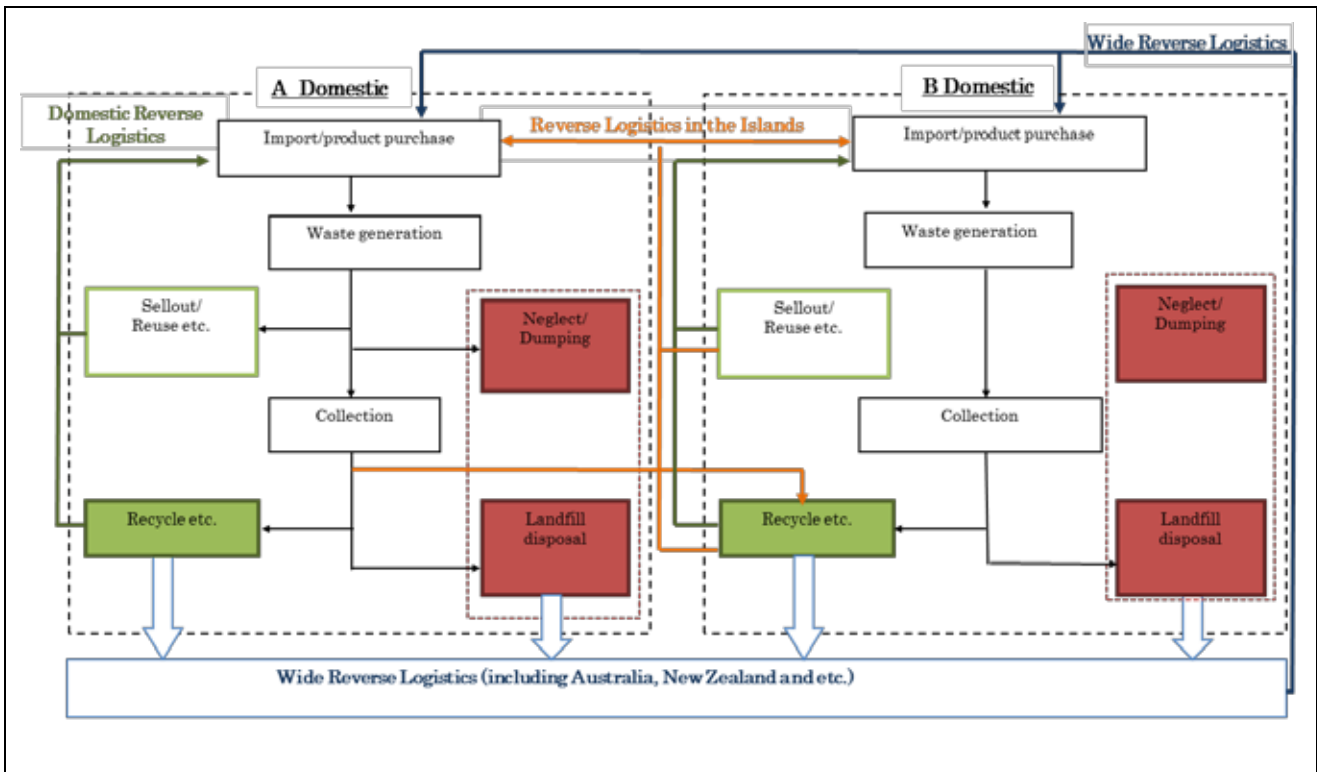
**Table Socio-economic indicator of each country**

Item	Fiji	Samoa	Tonga	Tuvalu	Vanuatu
Population	860,623 <sup>(1)</sup>	180,000 <sup>(6)</sup>	103,967 <sup>(6)</sup>	12,000 <sup>(4)</sup>	240,000 <sup>(4)</sup>
Capital city (population)	Suva (85,691) <sup>(2)</sup>	Apia (37,708) <sup>(7)</sup>	Nuku'alofa (34,111) <sup>(9)</sup>	Funafuti (4,492) <sup>(8)</sup>	Port Vila (35,901) <sup>(11)</sup>
Land area (km <sup>2</sup> )	18,333	2,840	720	26	12,190
Islands number (inhabited)	332 (110) <sup>(3)</sup>	10(6) <sup>(3)</sup>	176(52) <sup>(3)</sup>	9(9) <sup>(3)</sup>	82(65) <sup>(3)</sup>
Economic Indicators					
GNI	USD3 billion	USD 510 million	USD 340 million	USD 27 million	USD 660 million
GNI/ capita	USD 3,610 <sup>(4)</sup>	USD 2,840 <sup>(6)</sup>	USD 3,260 <sup>(6)</sup>	USD 2,749 <sup>(10)</sup>	USD 2,760 <sup>(4)</sup>
Main Industries <sup>(5)</sup>	Sugar cane, garment, tourism	Agricultural, coastal fishery	Agriculture copra, palm oil, pumpkin), fishery	Agriculture, fishery.	Agriculture, tourism
Sources: (1) World Bank., 2010, (2) National Census, 2007, (3) Pacific Islands Centre, PIC, (4) World Bank, 2010, (5) Ministry of Foreign Affairs, Japan, (6) World Bank, 2009), (7) National Census, 2006, (8) National Census, 2002, (9) National Census, 2006 (10) UN Data, 2009, (11) 2009 data					

### 1.3 Concept of “Reverse Logistics” and “Recycling port”

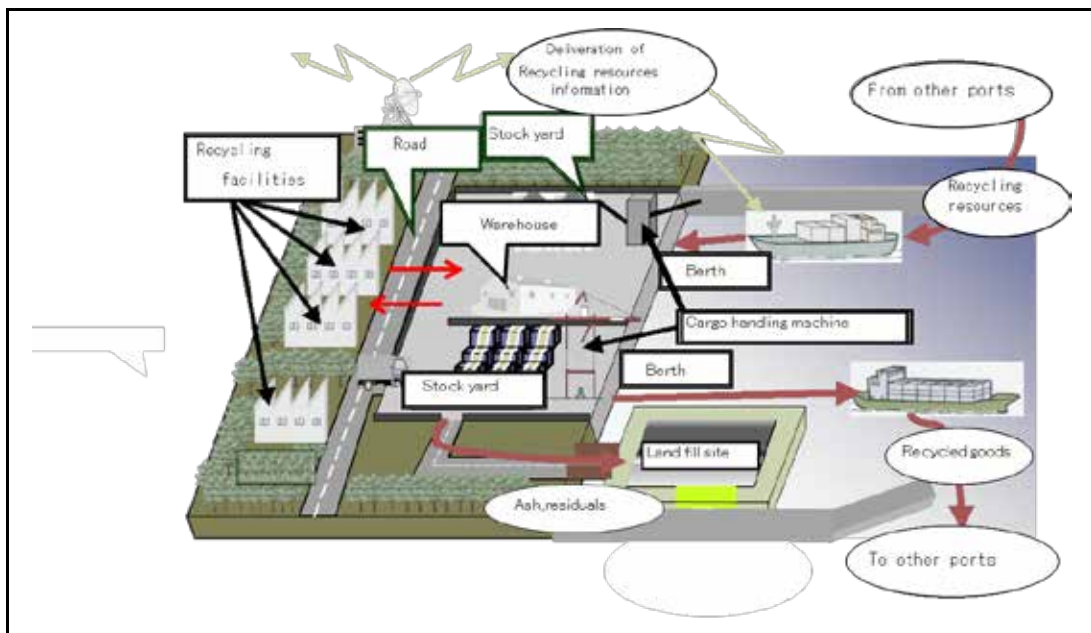
#### (1) What is “Reverse Logistics” ?

“Reverse logistics” stands for all operations related to the reuse of products and materials. In other words, reverse logistics is a transportation system for collecting used products and materials, and moving those products and materials to remanufacturing points for recycling and/or reuse purposes. Introduction of reverse logistics across a vast area is essential because a material could have value in one place even though it does not in another place.



**Figure Image of recycling materials flow, reverse logistics in islands and wide ones beyond islands**

“Recycling-Port” complements the function of the reverse logistics. Recycling-Port is a terminal for processing and stocking recycling materials that require environmentally oriented treatment. In Japan, 22 ports are designated as “recycling-port”, where remanufactured resources are processed and stocked. Recycle ports formulate a network of reverse logistics.



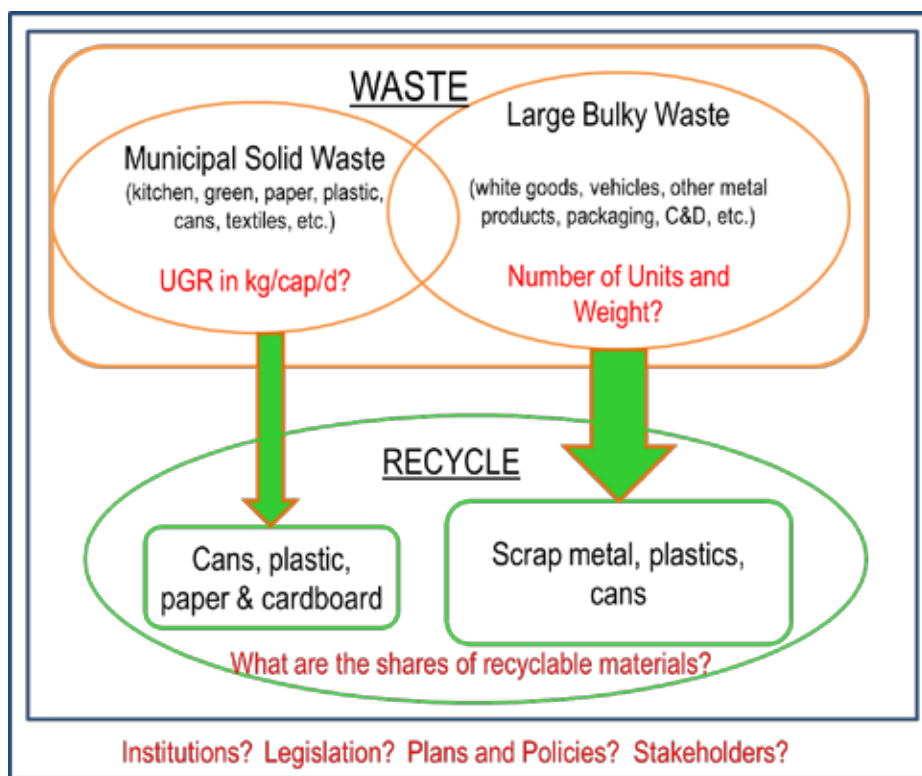
**Figure-3 Image of “Recycling Port”**

In the Pacific Islands, used materials are abandoned in the islands because of the relatively small volume, lack of remanufacturing technology and improper waste-material collecting system. Accordingly, the survey is going to examine the feasibility of recycling-ports and reverse logistics in the Pacific Islands by extending the water transport network among these islands and/or beyond the Islands.

## 2. Present Conditions of Recycling of Bulky Waste

### 2.1 Types of Solid Wastes and Shares of Recyclable Wastes suitable for Reverse Logistics

There are two main types of solid wastes; Municipal Solid Wastes and Large Bulky Wastes. The following figure shows the composition of each of these two types as well as the potential recyclable materials from these wastes. This chapter describes the current situation pertaining to organization, laws, plans, stakeholders, waste generation and recycling activities regarding the potential recyclable materials from Municipal Solid Wastes and Large Bulky Wastes.



**Figure Generated Waste Types and Recyclable Materials**

Two terms are adopted for this purpose; **Recyclable Waste Goods** and **Recycled Waste Materials**. Recyclable waste goods (RWG) refer to the goods that have been discarded more or less in the form that they were produced in, such as vehicles, white goods, furniture, etc.. The second term; Recycled waste materials (RWM) refers to the materials that are actually processed from the recyclable waste goods to be recycled.

Recyclable Waste Good collected in the targeted survey areas are plastics, papers and metal products such as abandoned cars, white goods, heavy equipment and ships. These recyclable waste goods are dismantled, loaded into containers and transported to foreign countries by the recyclers.



**Figure Recyclable Waste Goods**

## 2.2 Current situation on generation and recycling of solid waste and RWG

The current situation on generation and recycling of solid waste and RWG is shown in the following Table. Even though some local governments in the Pacific Island countries studied under this Project practice recycling through source separation and collection of RWG, the recycling activity is mainly done by the recycling companies.

The permission system from the responsible ministry to permit recycling companies to work in this field is only established in Fiji, while the remaining four Pacific Island Countries (PICs) have a registration system in place for recycling companies for the purpose of taxation. Comparing Fiji with the other PICs, Fiji has more recycling companies, more amount of recycled RWG and more variety of collected RWG. As for waste paper, there is a recovery factory in Fiji that produces toilet paper from the waste paper. On the other hand, the amount and variety of collected RWG by recyclers are limited in the other countries.

**Table Current situation on generation and recycling of solid waste and RWG**

Countries	Fiji	Samoa	Tonga	Tuvalu	Vanuatu
Population (2012)	854,120	184,864	103,036	9,531	251,500
National plan for solid waste management	Existing	Under formulation	No	Under formulation	Existing
Unit generation rate of municipal solid waste in urban area (g/cap/day)	403 Year 2007	380 Year 2010	470 Year 2008	430 Year 2000	427 Year 2008
Registration system for	Existing	No	No	No	Under

recycling companies					preparation
Number of recycling companies	Around 15	Around 3	1	1(one man operation)	Around 5
Volume of recycling in 2011(ton)	38,218	4,133	584	113	4,601
Recycling activity	35,895	4,116	584	113	4,601
Ø Vehicles, white goods, heavy equipment and cans	Existing	Existing	Existing	Existing	Existing
Ø Papers	Existing	No	No	No	No
Ø Plastic including PET bottle	Existing	No (disappeared)	No	No	No
Recycled items for domestic use	Paper, lead battery, used oil	—	—	—	—

### (1) Current situation of targeted RWGs in Fiji

A total of 2,000 vehicles have been annually newly registered, and the total number of registered vehicles in 2011 was over 81,000. With regard to white goods, although most families have TVs and refrigerators, ownership rates of computers and air conditioners are low. Ownership rates of TVs, refrigerators and washing machines have increased in recent years. Pilot projects for source separation of PET bottles, papers and cans with support from JICA and other donors have been implemented. For example, under a JICA project, completed in early 2012, a pilot project was started for collecting PET bottles, glass bottles and cans in some areas in Lautoka. Even though there is no pilot project for recycling in Suva, the local government has prepared the pilot project plan. For the recycling of beverage containers, DOE is promoting the Container Deposit Legislation and Refund System for Fiji (CDL). Under this proposal, manufactures of beverages, under the Extended Producer Responsibility (EPR) would be obliged to cover a portion of the burden incurred from the recycling of the containers.

Scrap metals collected and processed by recyclers are exported mainly to South Korea, New Zealand, Australia and Indonesia. Pet bottles and papers are exported to Hong Kong and Australia, respectively. The destination of RWM are decided by recyclers depending on many factors, such as transportation cost, demand, relationships with middle men, etc.

### (2) Current situation of targeted RWGs in Samoa

With regard to vehicles, in September 2009 driving on the left-hand side of the road was introduced in Samoa in place of right-hand traffic. The reason behind this change was to satisfy the desire of the citizens of the country to purchase second-hand Japanese vehicles from nearby countries employing the left-hand traffic system as Australia, New Zealand and Japan itself. As a result, the total number of registered vehicles temporarily dropped in 2008 and the number was about 16,000 in 2011. Recyclers collected abandoned vehicles, extracted the scrap metals and exported them. Processing by recyclers is conducted in the main island, and there are still many abandoned vehicles in the second most inhabited island of Savaii, as well as the other islands.



With regard to white goods, ownership ratios of TVs and refrigerators is over 60%. There is no source separation system for PET bottles, papers and cans by the public sector. Recyclers collect, compress and export these waste items in containers. New Zealand and Indonesia have been the main destinations of RWM for the last three years.

(3) Current situation of targeted RWGs in Tonga

The number of registered vehicles has drastically increased since 2009 and reached 20,081 in 2011. With regard to white goods, ownership rate of TVs, refrigerators and computers has increased in recent years. Ownership rate of TVs, refrigerators and washing machines is high, however similar rate for microwaves, air conditioners and computers is less than 50%.

Deposit boxes are available for cans and glass bottles in the cities. At first the boxes had been managed by a AusAID project, and after the project ended the boxes are now managed by GIO Recycling Ltd. The company collects recyclables deposited in the boxes. In addition, the company regularly collects steel cans, aluminum cans, PET bottles and white goods from deposit boxes placed in the landfill site. However the boxes in the landfill site cannot accommodate all RWGs due to insufficient capacity.

GIO Recycling Lt is the only recycling company in Tonga and the company exports all collected RWM to New Zealand. Amount of export was 629 tons in 2011.

(4) Current situation of targeted RWGs in Tuvalu

The number of registered vehicles in 2011 was around 1,600. Comparing with the other four PICs, most of the vehicles are motorbikes and there are 150 abandoned vehicles in Funafuti. With regard to white goods, there is TV transmission and radio is the main mass media. Therefore there are far fewer TVs than the other PICs. TVs are used to watch DVDs. Although some of the abandoned white goods are placed at the compost plant which was constructed by AusAID, most are disposed at the landfill site.

Although a private recycler collects aluminum cans, the other recyclables, PET bottle and papers are disposed of at the landfill site. There is no plan for the public sector to start source separation and collection. There is only one individual who is recycling at the private level. In 2010, this recycler exported around 100 tons of scrap metals to New Zealand.

(5) Current situation of targeted RWGs in Vanuatu

Newly registered vehicles and total registered vehicles in 2011 were estimated to be around 5,000 and 14,000 units, respectively. Ownership rates for TVs and refrigerators are less than 50% and lower than corresponding rates of the other PICs.

With regard to PET bottles, papers and cans, Recycle Corp has continuously collected cans and exported as scrap metals. The company started collection of papers and cardboard, however the company has not been able to export the paper yet. Main destination of the RWMs is South Korea followed by other Asian and Middle East countries. The company decides the destination depending

on transportation cost and demand in each case. The president of the company is Australian; however the company had not exported to Australia due to the strict quarantine regulations there.

### 2.3 Market Demand for Scrap Metal

Most collected recyclables are exported to foreign countries due to the lack of recovery systems in the targeted survey countries. Main destinations of the exported recyclables are nearby New Zealand, Australia, South Korea, Singapore as well as occasionally to the Middle East. The recyclables collected in the survey countries are distributed into the global market. The following table shows the main importers and exporters of scrap metal in the years 2006 to 2010.

**Table Exports and Imports of Scrap Metal**

Exports and Imports in Mln. Tons						
Year	2006	2007	2008	2009	2010	2010
Main Importers						share (%)
Turkey	15.1	17.1	17.4	15.7	19.2	34%
South Korea	5.6	6.9	7.3	7.8	8.1	14%
China	5.4	3.4	3.6	13.7	5.8	10%
India	3.4	3.0	4.6	5.3	3.2	6%
Taiwan	4.5	5.4	5.5	3.9	5.4	9%
EU	7.3	5.1	4.8	3.3	3.6	6%
USA	4.8	3.7	3.6	3.0	3.8	7%
Canada	1.5	1.4	1.7	1.4	2.2	4%
Malaysia	2.9	3.7	2.3	1.7	2.3	4%
Indonesia	1.1	1.3	2.9	1.5	1.6	3%
Thailand	1.4	1.8	3.1	1.3	1.3	2%
<b>Total Main Importers</b>	<b>52.9</b>	<b>52.9</b>	<b>56.8</b>	<b>58.6</b>	<b>56.6</b>	
Main Exporters						
USA	14.0	16.6	21.7	22.4	20.6	36%
EU	10.1	10.6	12.8	15.8	19.0	34%
Japan	7.7	6.4	5.3	9.4	6.5	11%
Canada	4.0	4.1	4.1	4.8	5.2	9%
Russia	9.8	7.9	5.1	1.2	2.4	4%
Australia	1.3	1.5	1.7	1.9	1.6	3%
South Africa	0.6	0.8	1.3	1.1	1.2	2%
<b>Total Main Exporters</b>	<b>47.4</b>	<b>47.9</b>	<b>52.0</b>	<b>56.7</b>	<b>56.4</b>	
Source: Australian Industry Group, 2011						

It is expected that the global demand for scrap metal will continue in the future because of the importance of steel in the sectors of industry and construction. However the market is subject to fluctuations as evidenced by the sharp increase in the imports of scrap metal by China in 2008, and decline thereafter. Turkey and South Korea have steadily increased their imported amounts of scrap metal.

### 3. Current situation of reverse logistic and future projections of generation, collection and export amounts

The amounts of RWG and RWM in 2011 are estimated based on the available statistics and interviews as shown in the following Table. A share of 57% of generated RWG (recycling ratio) are collected and recycled in Fiji. Recycling ratio in the other countries is less than 40%, which means that most of RWG are not recycled and are directly disposed in disposal sites or open areas.

**Table Recyclable Waste Goods Amounts in 2011**

Items	Fiji	Samoa	Tonga	Tuvalu	Vanuatu
1 Recyclable Waste Goods (t/yr)	66,788 (100%)	13,308 (100%)	5,969 (100%)	685 (100%)	12,591 (100%)
- Vehicles share of total RWG	11,614	2,752	2,400	58	2,751
- White Goods	2,146	256	194	17	215
- Other Metal Products	33,649	6,645	1,639	377	5,847
- Steel Cans	1,875	582	373	49	412
- Aluminum Cans	1,405	366	327	8	412
- Pet bottles	2,345	1,313	336	17	916
- Paper & Cardboard	13,754	1,394	700	159	2,038
2 Recycled Waste Materials (t/yr)	38,081 (57%)	4,741 (36%)	598 (10%)	103 (15%)	4,642 (37%)
- Scrap Metal share of total RWM	36,002	4,728	598	103	4,642
- Pet Bottles	704	13	0	0	0
- Paper & Cardboard	1,375	0	0	0	0
3 Recycled Material Market	38,081	4,741	598	103	4,642
- Export share of total Market	37,531	4,741	598	103	4,642
- Domestic share of total Market	550	0	0	0	0
4 RWG to Landfill or Abandoned	28,707 (43%)	8,567 (64%)	5,371 (90%)	582 (85%)	7,949 (63%)

Projections of RWG and RWM in 2020 are shown in the following Table. The projections are estimated on the assumption that the recycling business will become more active and the recycling rates will be enhanced.

**Table Recyclable Waste Goods Amounts in 2020**

Items	Fiji	Samoa	Tonga	Tuvalu	Vanuatu
1 Recyclable Waste Goods (t/yr)	79,899 (100%)	16,238 (100%)	6,997 (100%)	748 (100%)	21,170 (100%)
- Vehicles share of total RWG	12,435	3,234	2,599	69	5,973
- White Goods	2,598	310	240	18	530
- Other Metal Products	38,106	8,392	1,708	384	8,189
- Steel Cans	2,724	621	522	59	720
- Aluminum Cans	1,603	381	482	12	858
- Pet bottles	3,846	1,537	482	21	1,605
- Paper & Cardboard	18,587	1,763	964	185	3,295

2	Recycled Waste Materials (t/yr)	51,407 (64%)	7,813 (48%)	1,470 (21%)	135 (18%)	10,526 (50%)
	- Scrap Metal share of total RWM	44,293	7,483	1,422	135	10,035
	- Pet Bottles	1,538	154	48	0	161
	- Paper & Cardboard	5,576	176	0	0	330
3	Recycled Material Market	50,407	7,813	1,470	135	10,526
	- Export share of total Market	50,138	7,747	1,470	135	10,526
	- Domestic share of total Market	1,269	66	0	0	0
4	RWG to Disposal sites or Abandoned	28,492 (36%)	8,425 (52%)	5,527 (79%)	613 (82%)	10,644 (50%)

The numbers of 20 FT containers of exported RWM based on the estimate in 2011 and projection in 2020 are shown in the following Table. An increase of around 1,100 TEU, corresponding to 47% of total in 2011 is projected in the targeted five PICs.

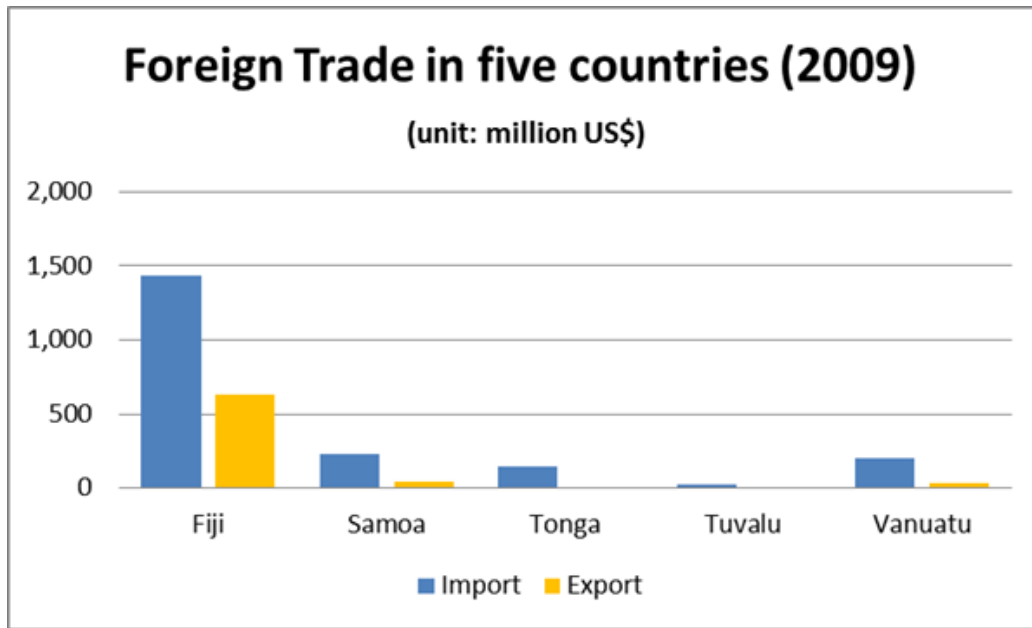
Table Export amount of RWM (TEU)

	Export amount in 2011 ( A )	Projected exported amount in 2020 ( B )	Increasing amount of the export ( C ) =(B)-easi
Fiji	1,880	2,510	630
Samoa	240	390	150
Tonga	30	70	40
Tuvalu	5	7	2
Vanuatu	230	530	300
Total	2,385	3,507	1,122

#### 4. Survey of Water Transport and Ports

##### 4.1 International Maritime Network

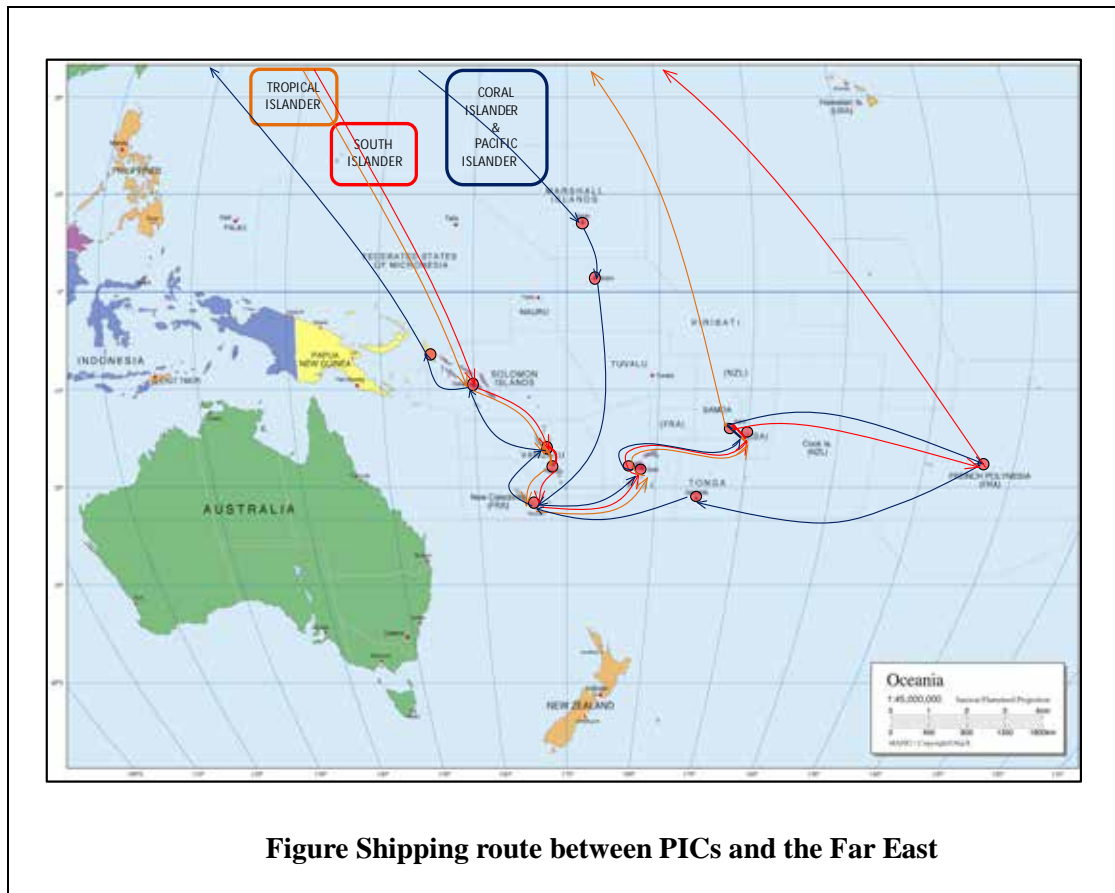
There is heavy dependency on the import of consumer goods in the PICs. Various commodities, food, machines, clothes and transportation vehicles are imported but few cargoes, only first industry production, sugar, fish and copra are export commodities. Fiji, the largest exporter of PICs, exports one-fourth of the import value. The ratios of the other countries are less than that of Fiji. It was also found that recycling materials are new export commodities in PICs. Recycling consumers exist in the Pacific region such as Korea, China, Vietnam and Indonesia. Japan still imports scrap metal even though it is major scrap metal export country.



Source: International Trade Statistics 2010, UN

**Figure Foreign trade in five countries (2009)**

PICs are connected to the developed countries where final recycling consumers are found. There are four major shipping routes. One is from PICs to NZ and Australia. There is a heavy traffic between PICs and NZ, Australia. Second is to the Far East. Kyowa and its partners operate services 21 times per year. They deploy multi-purpose vessels tailored for ports in PICs with shallow water, poor port facilities and a few but various cargoes. The third is to Singapore. SWIRE operated the only direct line to Jurong, Singapore 24 times per year. Deployed vessels are container ship with 1,200 to 1,700 TEU capacities. The fourth is for US. Hamburg Sud and Hapag-Lloyd operate direct connection to the US west coast by container vessels with 1,200 to 2,700 TEU capacities.



**Figure Shipping route between PICs and the Far East**

Freight rate in PICs is higher than that in the major world route. Shipping companies provide a lower price for export than that for import to encourage export in PICs as they do in the major world routes. After conducting a case study of recycling cost, the team assumes that share of water transportation cost was at most 31% of producing and shipping scrap steel from PICs to the Far East. In addition, selling price of base metal and precious metal are much higher than that of scrap metal. These metals would be more viable.

**Table Case study of fee (tentative)**

Vanuatu - Far East		Work Fee	Value(US\$/TEU)	Share	
Cost	Collection and Sort	scrap collecting fee	N/A	} 31%	
		sort scrap and pack in container	N/A		
Transportation cost		Inland freight	N/A		
		water freight(Pacific Islands - Far East)	1,600		
Terminal handling charge		Port in Pacific Islands (Port Vila)	506		
		Port in Far East (Busan)	74		
		Total	2,180+α		
					US\$ per ton
Income	Scrap metal				
		Scrap metal	7,000	100%	350

Note: Selling price of Scrap metal is US\$350 per ton.

Recycling materials are subjected to quarantine inspection in importing ports. A consignor has to meet quarantine requirements at a destination port. Many recyclable materials tend to be exposed to the elements and thus it will be necessary to remove biosecurity contaminants in the processing stage. Precise information on quarantine regulations is necessary for exporters of recycling materials in PICs.

#### 4.2 Ships and routes for domestic transport

Reviewing maritime transport in PICs, several characteristics are identified. First is ownership of marine transport. The domestic network is covered by local shipping companies in PICs. However, ownership of the domestic shipping company depends on the country's policy. Nine private shipping companies and one government owned company are serving routes in Fiji. Private ships are serving the domestic network in Vanuatu. On the other hand, a shipping corporation in Samoa and a shipping agency supported by the government of Tonga are serving the domestic route. A government owned general cargo ship is operating in Tuvalu. This means that privatization in maritime business has been introduced in populated countries, but government assistance is essential in less populated countries.

Second, transportation system is tailored and developed to meet PICs conditions. Even though RORO/Ferry ships are deployed in each country except Tuvalu, many of the RORO ships are equipped with surf boats and cranes. A surf boat is essential to carry commodities to small islands where a mother ship cannot enter. Another finding is that 6-ton capacity containers have been introduced to transport small cargoes in Tonga where port facilities cannot accommodate larger containers.

##### (1) Freight rate

Freight rates in each country are sampled in the following table. These amounts of freight rate are to be added to international freight rate when a recycling company plans to export abroad recyclable materials collected in local islands via the mainland. International freight rate between PICs and the Far East is said to be US\$1,500 to US\$2,000 per TEU. Compared the international the freight rate and the domestic rates, the domestic rates are relatively low.

**Table Domestic freight rate in PICs**

Country	Route	Freight (per 20ft container)	Remarks
Fiji	Suva – Lambasa	US\$947	Including land transportation cost
Samoa	Manifanua – Salelologa	US\$300	Heavy truck (US\$15 per ton)
Tonga	Nuku'alfa – Vava'u	US\$546	
Tuvalu	Funafuti – Nanumea	US\$1,600	
Vanuatu	-	N/A	

## (2) Port facilities

To facilitate circulation of recyclable material collection throughout the region, RORO system is essential. RORO ships that enable container transport have been introduced in PICs but they cannot enter all ports. The following table shows provincial population distribution in each country. Distribution of population is quite uneven in PICs. For instance, seventy-nine percent of Fijian total population is found in the province of Viti Levu where the capital city is located. On the other hand thirty-four percent of Vanuatu's population is found in Shefa, where the mainland is located, while the share of other provinces ranging from 13 to 20 percent (with exception of Torba). This means that Vanuatu has a more dispersed population distribution than Fiji does. Tuvalu, the least populated country, has the most dispersed population distribution among the five. When examining the development of new RORO facilities, features of the population distribution should be considered.

**Table Provincial population and RORO port in PICs**

Country	Province	Population	Population Share	International Port	Domestic Port		Source
					RoRo	Non-RoRo	
Fiji	VITILEVU	661,997	79%	Suva, Lautoka	Suva, Lautoka, Natovi	Natovi, Elimgton, Denarau and Ysawa i Rara	2007 Population Census of Fiji
	VANUALEVU	135,961	16%	Malau, Galoa, Wairiki and Savusavu	Nabouwalu, Malau, Savusavu, Taveuni	Natuvu	
	LOMAIVITI	16,461	2%		Levuka, Koro, Muanivanua, Buresala, Gau (Nawaikama & Qarani)	Rakiraki, Naviti, Tovulalai	
	LAU	10,683	1%		N/A	Moala, Toyota, Matuku, Lakeba, Naitauba, Nayau, Vanua Balavu, Cicia, Vanua Vatu, Nasaqalau	
	KADAVU	10,167	1%		Vunisea	Vunisea, Mano	
	ROTUMA	2,002	0%		Oinafa		
	<b>TOTAL</b>	<b>837,271</b>	<b>100%</b>				
Vanuatu	TORBA	9,359	4%		N/A	Torba Province	2009 National Population and Housing Census
	SANMA	45,855	20%	Santo	Santo		
	PENAMA	30,819	13%		N/A	Ambae, Maewo, Pentecost	
	MALAMPA	36,727	16%		N/A	Ambrym, Malekula, Paama	
	SHEFA	78,723	34%	Port Vila	Port Vila	Epi	
	TAFEA	32,540	14%			Tanna, Tafea Province	
	<b>TOTAL</b>	<b>234,023</b>	<b>100%</b>				
Samoa	UPOLU	137,599	76%	Apia	Apia, Mulifanua		Population and Housing Census 2006
	SAVAII	43,142	24%		Salologa		
	<b>TOTAL</b>	<b>180,741</b>	<b>100%</b>				
Tonga	TONGATAPU	72,045	71%	Nuku'alofa	Nuku'alofa, Lifuka		Tonga 2006 Census of Population and Housing
	VAVA'U	15,505	15%	Vava'u	Vava'u	Neiafu	
	HA'APAI	7,570	7%			Pangal, Ha'afeva, Is, Nomuka, Tungua, Pangai	
	EUA	5,206	5%			Eua	
	NIUA	1,665	2%			Niuaotupapu, Niuafo'ou	
	<b>TOTAL</b>	<b>101,991</b>	<b>100%</b>				
Tuvalu	FUNAFUTI	4,492	47%	Funafuti	Funafuti		Tuvalu 2002 Population and Housing Census
	NANUMEA	664	7%			Nanumea	
	NANUMAGA	589	6%			Nanumanga	
	NIUTA	663	7%			Niutao	
	NUI	548	6%			Nui	
	VAITUPU	1,591	17%			Vaitupu	
	NUKUFETAU	586	6%			Nukufetau	
	NUKULAELAE	393	4%			Nukulaelae	
	NIULAKITA	35	0%			Niulakita	
	<b>TOTAL</b>	<b>9,561</b>	<b>100%</b>				

## (3) Recycling material transport

Recycling business has been operating in the main land of each PIC. The volumes of export per year are varying from 8,663 tons in Fiji to five containers (approx. 100 tons) in Tuvalu. Furthermore,



businesses have also started in local islands in Fiji, Vanuatu and Tonga. Container transport or truck transport is used in each case. No regulation is applied for domestic recycling materials transport as long as these are neither hazardous nor explosive. Precise data on recycling material domestic transport cannot be collected in each country at present. In order to formulate a policy and a plan related to recycling business, comprehensive data collection system is required.

## **5. Review Issues in Transport and Storage of Recycled Waste Materials under Reverse Logistics**

### **5.1 Issues on Bulky Waste Recycling**

As described in the earlier chapters of this report private recycling companies have emerged in each of the 5 countries, in varying capability (manpower, amounts of RWMs, equipment used, etc.) levels.

#### **(1) Collection coverage of RWG**

In Fiji, many recycling companies reported that many of the collection contractors do not keep their commitments and sell the RWG to the highest bidders. While in three of the PICs, the populations are very largely concentrated in the main cities and islands, in Vanuatu and Tuvalu the population is more evenly disbursed over a larger number of islands and more efforts are needed to improve domestic shipping to extend collection over a wider region of the country.

Public awareness is required to gradually introduce source separation. In addition the need for a format to enhance more coordination between the collection contractors and recycling companies may be considered.

#### **(2) Requirement to improve working standards and conditions at Recycling Companies**

The comparatively large number of private recycling companies that emerged in Fiji during the last few years is very welcome, but it is clear that there are issues related to their operations which need to be improved. Better separation of the scrap metals by category is expected to lead to increased foreign demand. In addition balanced monitoring by the concerned government authorities and government policies would encourage recycling companies to invest more in equipment and improved working conditions.

#### **(3) Concentration of demand on exports of RWM**

The Study estimated that about 60% of the RWGs are salvaged and processed into RWMs in Fiji and the rates are far less in the other four PICs studied. The domestic demand for waste paper and vehicle batteries was observed only in Fiji. There is a need to seriously study the feasibility to manufacture the cans and pet bottles in the PICs to increase domestic demand, and develop regional

and domestic markets for such waste items as paper that are not in demand in the international market.

(4) Identification of Government responsibility

With the private sector taking the initiative in the bulky waste recycling sector, the extent that the government should intervene in this sector should be carefully considered. Will more government intervention increase the recycling amounts or will it create obstacles and hinder the business? Governments should be encouraged to develop policies, strategies and action plans for bulky wastes recycling to encourage wider participation by the private sector. And the permitting systems provided to recycling companies need to provide for monitoring of the companies' activities in order to improve the working conditions and ensure that the companies are upgrading their processing skills.

## **5.2 Issues on water Transport and ports for handling RWGs and RWM**

Our survey revealed that recycling material exports will reach 2,800 TEUs in Fiji, 380 TEUs in Samoa, 90 TEUs in Tonga, 10 TEUs in Tuvalu and 400 TEUs in Vanuatu in 2020 respectively. Total volume in 2020 is 40 percent larger than that in 2011. First, to achieve this, the participation of government and private sectors for recycling activity in each country will be required. Second, improving transport should only be done when it is justified by the generated volume of recycling materials.

(1) Collection system over a wide area is not formed in PICs

Present collection system does not serve outer and sparsely inhabited islands. 1.4 million people are spread across an area of 3.69 million square kilometres. Since recyclable materials are dispersed, it would be hard to aggregate and process materials without effective transportation. International container routes for developed countries from PICs are multi-port-calling networks, though major trunk lines form hub-and-spoke networks. The multi-port-calling networks are preferable for collecting recycling materials in dispersed regions. Even though further study of generation of recycling materials, allocation of processing points and capacity of recycling agents is required, linkage between international network and domestic network in each country should be explored to achieve effective collection of recycling materials.

(2) Difficulty of domestic recycling materials transport

RORO system is essential to facilitate collection of recyclable material throughout PICs. RORO ships that enable container transport have been introduced in PICs but they cannot enter all ports. It is not feasible to construct a RORO terminal in each island and atoll. The relationship between population distribution and RORO terminal needs to be examined further as it will indicate where priority on port improvement should be placed.

(3) Ocean freight rate is added on recycling cost

The extent of the burden of freight rates on transport of recyclable waste materials should be considered. For instance, major scrap material exporters are US, JAPAN and other European developed countries that are located in densely populated areas. They generate a huge volume of recycling materials and this can take advantage of economy of scale. PICs cannot expect this advantage. Scrap metal market including selling prices is dominated by these large generators and consumers.

A case study of recycling cost showed that share of water transportation cost was at most 31% of the cost of producing and shipping scrap steel from PICs to the Far East, Furthermore, domestic freight rates are to be added to the international freight rate when a recycling agent plans to export abroad recyclable materials collected in local islands via the mainland. The export of scrap metal is viable under present market conditions, but future prospect are not known. In order to alleviate impact of freight cost on exporting recycling materials, various kind of efforts will be expected.

(4) Recycling companies' lack of information on quarantine regulation at destination port

Many of the recyclable materials tend to be exposed to the elements and thus, it will be necessary to clean biosecurity contaminants in processing stage. Precise information on quarantine regulation is necessary for exporter of recycling materials in PICs

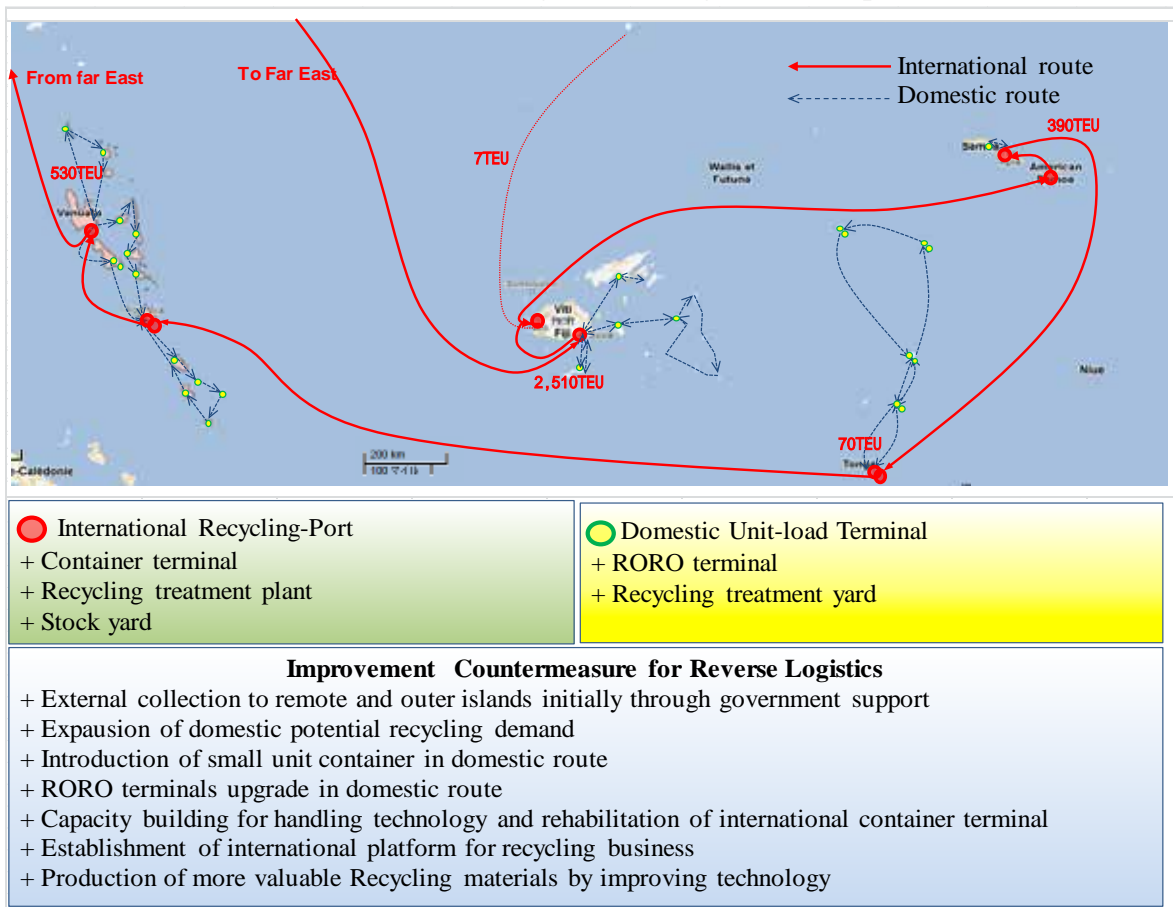
## **6. Forming reverse logistics in the pacific islands**

### **6.1 A regional framework of reverse logistics in the pacific islands**

(1) Concept of reverse logistic system

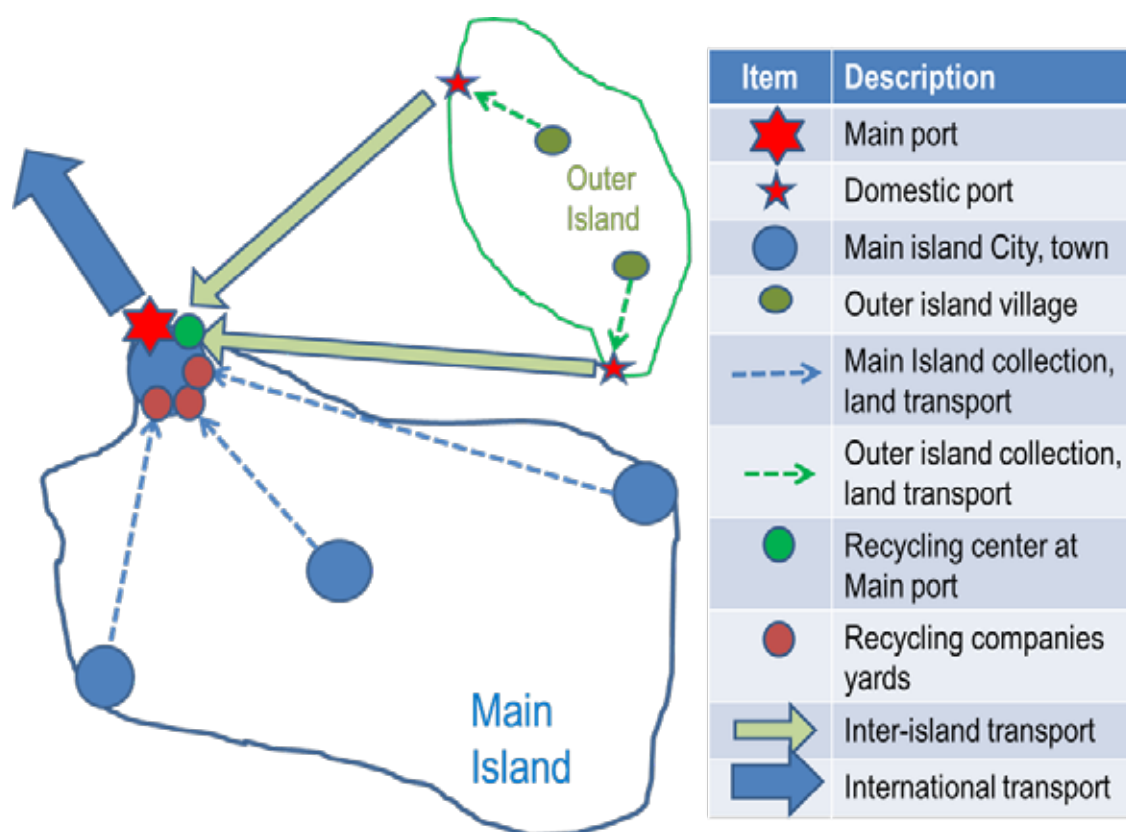
A regional framework of reverse logistics system in the pacific islands is shown below. RWGs generated in local islands are expected to be collected and transported to an international port in the main island by domestic shipping. The accumulated RWGs are cleaned, selected, and sorted as commercial commodities and then, stocked in the international port or its vicinity until finally being exported by international shipping.

**A framework for forming e reverse logistics in the pacific islands**



**Figure Regional framework of reverse logistics in the pacific islands**

The following figure shows the example of such domestic reverse logistic network. In order to materialize formation of the reverse logistics network and to promote recycling business in the pacific islands, RWG collecting system that is being now conducted in cities in main islands should be expanded to whole the main island as well as local islands. At present in main islands, a recycling company collects RWGs generated in the island, processes them in its factory, and then exports them to foreign markets from an international port. On the other hand, public sector support may be needed if RWGs in local islands will be collected and stocked in a recycling agent’s premises or port. Since the volume of RWGs in local islands is relatively lower than that in the main island.



**Figure Domestic reverse logistic network between a main island and local islands.**

(2) Categorization and future prospects in five countries

Based on the review of recycling activity and RWG's transport in PICs, the team categorized Fiji as category I, Samoa, Tonga and Vanuatu as category II, and Tuvalu as category III respectively.

a) Category I: Private recycling companies maximize the items and volume of RWG and improve the collection ratio of RWG to further develop reverse logistics system. Public sector supports their businesses, if necessary.

b) Category II: Public sector leads and works together with private recycling companies to improve reverse logistics system. The focus will initially be on economically feasible RWGs including scrap metal. Support should be made available to private companies until a stable business environment is created.

c) Category III: Public sector should play a main role and involve private sector to establish reverse logistics system in a country.

(3) Targeted Recycling Rate of Recyclable Waste Goods

Measures to be taken by each Category to improve recycling by type of RWG are as described below.

Category I, as it has on-going recycling activities for all the RWGs, targets to increase the

collection amount shall be set. It shall also enhance the recycling of paper within its country.

Category II shall enhance the existing recycling activities of scrap metals from vehicles and white goods, as well as improve the recycling activities of other RWG items such as paper and PET bottles. In addition, paper recycling in Fiji shall also be determined.

Category III shall first establish a recycling system centering on the scrap metals from cans and white goods. The possibility of recycling other RWG items shall also be explored.

**Table Targeted RWG Items and Measures to be taken by Category**

<b>Items</b>	<b>Category I Fiji</b>	<b>Category II Samoa, Vanuatu, Tonga</b>	<b>Category III Tuvalu</b>
Vehicles, White Goods, Heavy Equipment, Cans (Scrap Metals)	ž Maximization of international export	ž Maximization of international export	ž Establishment of intra-regional and international export of RWG
PET Bottles	ž Improvement of export, ž Examination of domestic recycling business	ž Establishment of a collection and export system	ž Determination of recycling
Paper, Cardboard	ž Maximization of domestic recycling business, ž Improvement of international export	ž Establishment of a collection system, ž Establishment of intra-regional and international export	ž Determination of recycling

Based on the considerations described so far the recycling targets for each of the three categories were set.

In countries of Category I the recycling activities are already progressing, and therefore a modest increase rate of 5% to 10% has been set. Countries of Category II have low recycling rates at present, and the rates are actually very low when compared to that of Fiji. Therefore there is significant room for improvement and accordingly more ambitious improvement rates for recycling in 2020 of more than 10% of the present rates have been set. In the case of Category III countries, it is first necessary to develop the basic infrastructure to support the reverse logistics, and therefore a low improvement rate of only a few percentage points in 2020 has been targeted.

Accordingly the following table shows the target improved recycling rates set by category (country) in this Project.

**Table Target Recycling Rate by Category (Country)**

<b>Recycling Rate</b>	<b>Category I Fiji</b>	<b>Category II</b>			<b>Category III Tuvalu</b>
		<b>Samoa</b>	<b>Vanuatu</b>	<b>Tonga</b>	
Recycling Rate as of 2011	57%	36%	37%	10%	15%

Recycling Rate	Category I Fiji	Category II			Category III Tuvalu
		Samoa	Vanuatu	Tonga	
Target value for 2020 (Targeted rate)	+ 5% ~ 10% ( 64% )	+ 10% or more			+ a few percent (18% )
		( 48% )	( 50% )	( 21% )	

The effects of achieving the targeted recycling rates described are shown in the following table. If we consider the case of Fiji the amount of RWMs in 2020 when compared to the figure of 2011 would grow by about 13,000 tons. This growth would in turn increase the number of containers to be imported by 630 units, create increased employment of 121 persons in the recycling sector, and decrease the costs of collection and disposal of waste by JPY 66 million. In similar terms for Samoa, Vanuatu and Tonga the growth in recycled waste amount would increase by 3,000 tons, 6,000 tons and 1,000 tons respectively, raising number of container units for export to 150, 300 and 40 units and increasing the number of employees in the recycling countries in these countries to 28 persons, 53 persons and 8 persons. On the other hand reductions in collection and disposal costs of JPY 15 million, JPY 29 million and JPY 4 million may be expected in Samoa, Vanuatu and Tonga respectively. For Tuvalu the recycling amount is expected to grow by 30 tons.

**Table Effects of Achieving the Target Recycling Rates**

Item	Category I Fiji	Category II			Category III Tuvalu
		Samoa	Vanuatu	Tonga	
Recycled amount in 2011, tons	38,081	4,741	4,642	598	103
Recycled amount in 2020, tons	51,407	7,813	10,526	1,470	135
Growth amount (tons)	13,326	3,072	5,884	872	32
Container units increase (units/year)	630	150	300	40	2
Recycling companies increased employment <sup>(1)</sup> (person)	121	28	53	8	0
Reduction in costs of collection and disposal <sup>(2)</sup> (FJ\$/year)	1,532,000	353,000	677,000	100,000	4,000
Reduction in costs of collection and disposal <sup>(2)</sup> (JPY/year)	66,000,000	15,000,000	29,000,000	4,000,000	200,000
(1) : Our survey result shows that the production rate of one recycling company employee is 110 t/year					

Item	Category I	Category II			Category III
	Fiji	Samoa	Vanuatu	Tonga	Tuvalu
(2) : National Solid Waste Management Strategy 2011-2014, Fiji indicates that cost for collection and disposal is FJ\$ 115/ year					
Source: JICA Study Team					

## 6.2 Policies and Strategies to promote Reverse Logistics

Detailed policies and strategies shall be described in the report for each of the three categories in order to improve reverse logistics at the different phases of the system and towards the public and private sectors respectively.

In summary, detailed policies and strategies of Category I (Fiji) will be shown.



**Table List of the detailed policies and strategies in the category I (Fiji)**

Stage	Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
				Public sector	Private sector
Collection stage	International Port City	Collection of RWGs	Expansion of collection of RWGs	<ul style="list-style-type: none"> <li>• Establish RWGs recycling strategy (recycling targets, identify target RWGs, etc.)</li> <li>• Prepare the related legal framework (determine responsibilities of importer, dealers and consumers; introduce economic incentives)</li> <li>• Implement separate collection (can, paper, pet bottles)</li> <li>• Increase public awareness</li> </ul>	<ul style="list-style-type: none"> <li>• Recycling companies will collect waste vehicles, heavy equipment and white goods</li> <li>• Recycling companies will process RWGs collected by public authorities</li> <li>• Dealers of vehicles and white goods will arrange drop off points for waste vehicles and white goods</li> </ul>
	Inland cities in islands with international port		Establish a RWG collection system	As above	As above
	Outer Islands		Introduce collection system (include within solid waste collection)	<ul style="list-style-type: none"> <li>• Develop related legislation</li> <li>• Develop capacities of related government authorities</li> <li>• Introduce waste collection</li> <li>• Implement RWG collection pilot project</li> <li>• Increase public awareness</li> </ul>	<ul style="list-style-type: none"> <li>• Obtain community cooperation through increased public awareness</li> </ul>

Transport Preparation Stage	Inland cities in islands with international port	Pretransport processing and storage	Construction of preprocessing and storage facility	Provide preferential treatment e.g., tax incentives	Develop facility
			Operation of facility	Provide preferential treatment e.g., tax incentives	Operate facility
	Outer Islands	Pretransport processing and storage	Construction of preprocessing and storage facility	Develop facility	-
			Operation of facility	Provide preferential treatment e.g., tax incentives	Operate facility
Domestic transportation stage	Inland cities in islands with international port	Land transportation	Improvement of land transportation	+Road construction, and Improvement of road condition for RORO transportation +Facilitation for introduction of trailers, i.e. tax exemption when purchasing trailers	+Land transport operator purchases trailers and transports RWGs
	Outer island	Land transportation	Improvement of land transportation	+ Road construction and improvement of road condition for RORO transportation. + Facilitation for introduction of trailers, i.e. tax exemption when purchasing trailers	+Land transport operator purchases trailers and transports RWGs

		Marine transportation	Improvement of marine transportation	+Trial demonstration of RWG transportation with an existing ship and its route + Freight rate alleviation measures +Operational subsidy and s purchasing of ship by public sector in remote island route +facilitation for replacement to a RORO Ship in main island routes	+Trial demonstration of RWG transportation +Deployment RORO ship +Freight adjustment for RWG cargo
			Improvement of port facility	+Construction of port facility and navigation aid for RORO ship	None
			Introduction of handy container	+Installment of cargo handling facilities for a handy container (set for handy container spec, yard pavement, fork-lift and other handling machines )	+Introduction of handy container and handling equipment
Treatment Stage	International Port City	Enhancement of value added to products, Storage	Improvement of treatment and storage facilities	Provide assistance in obtaining and upgrading of techniques	<ul style="list-style-type: none"> <li>• Introduce appropriate facilities after identifying customer needs and quarantine regulation</li> <li>• Acquire and introduce new technology</li> <li>• Examine and introduce recycling technology</li> </ul>
			Strengthening of environmental	Thoroughly implement monitoring	Implementation of environmental protection measures

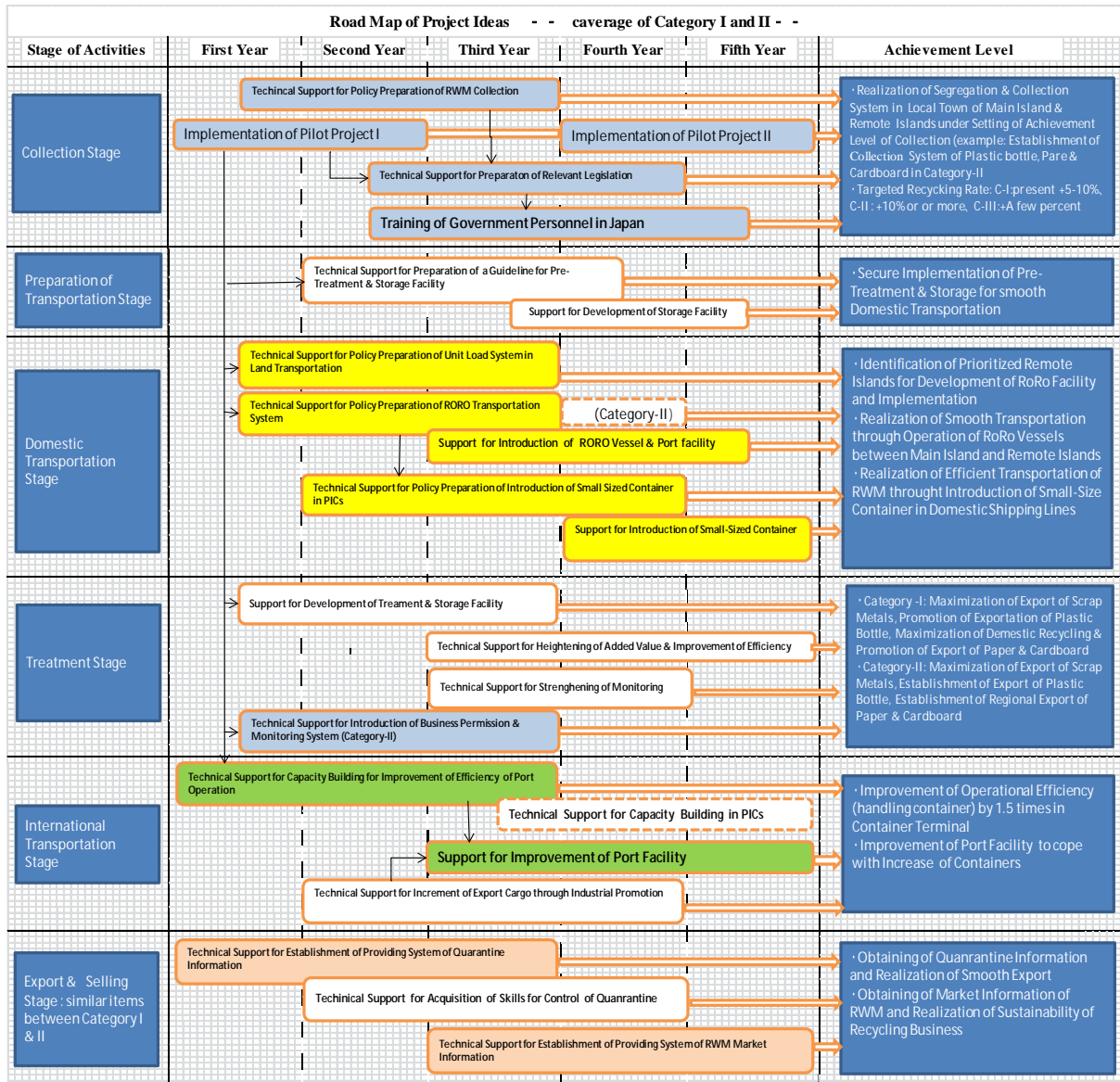
			protection measures		
International transportation	International port city	International Marine transportation	Improvement of port operation	+Capacity development for cargo handling efficiency + Introduction of IT system for port operation	+Capacity development of cargo handling skill +Introduction of IT system for port operation
			Improvement and modernization of port facility and handling equipment	+Improvement of port facilities (berth, yard, stock house, and etc) for enhancing port efficiency	+Improvement of equipment for enhancing handling efficiency
			Improvement of transport efficiency through export cargo	+Promotion of export cargoes by stimulating industry	+Promotion of export cargo including RWM
Exporting and selling RWM stage	International port city	Quarantine and selling	Learning regulation on destination countries	+Formulation of platform for providing quarantine and customs information in destination countries +Providing quarantine and customs information to recycling company	+Collecting quarantine and other regulation information of RWM export +Enhancement of skill for packing and exporting RWM
				+Collecting information of the	

					market.
			Accessing global market information	+Providing market information to recycling agent	+Collecting information of the market.

### 6.3 Road map for establishing reverse logistic system in PICs

The team proposed five year plans to implement measures mentioned in the previous sections.

**Table Road map for establishing reverse logistic system**



Note of the Priority Projects		Introduction of RWG Collection in New Areas and Policy Making Support
		Development of Unit-Load System in Domestic Shipping
		Improvement of International Container Terminal Operation
		Technical Cooperation Project for Development of Information Platform on Reverse Logistic

The reverse logistic system is organized when a recycling flow is fully accomplished. The flow contains following recycling activities such as collecting RWGs, preparing transportation, domestic transportation, processing, international transportation, export and selling. At present, each activity needs improvement. Thus public and private sectors should work together to deal the recycling activities simultaneously.

#### **6.4 Proposal for priority projects**

There are many measures to be taken to establish a reverse logistics, which can be classified into three main points: ensuring adequate quantity of RWG, reducing transport cost, and selling products at high price. As a solution, the report suggests to establish the reverse logistics system described in 6.1, in which RWG are collected from outer islands where there is no existing waste collection. This system also aims to encourage a multinational collaboration to secure the quantity of RWM and achieve economies of scale. In this context, the report suggests to prioritize the following project: 1) collection of RWGs in new areas (e.g., outer islands); 2) reduction of transport cost by improving cargo handling efficiency and domestic shipping; and 3) establishment of a system to offer information about quarantine and market.

##### **a) Solid Waste Management Sector**

This Study proposes to establish a reverse logistics system that combines domestic transportation with international transportation. Domestic transportation is used to collect RWG from outer islands, such as discarded vehicles and heavy equipment observed in outer islands during the site survey. However, recyclers are reluctant to run a business in outer islands due to the limited generation amount of RWG and inadequate transport infrastructure. Therefore, it is suggested to conduct a RWG collection pilot project in order to establish a reverse logistics for RWM in outer islands. The project also includes development of pre-transport processing facility. The project examines the feasibility of, and difficulties in developing reverse logistics from outer islands through the pilot project. The team will also make a policy proposal based on the lessons learnt.

##### **b) Maritime and Ports Sector**

Reduction of freight rate in marine transportation through improvement of port operation and modernization of domestic transportation is considered to be one of the support tools for forming a reverse logistics system. Initially, the support tools focus on RWG/RWM, not on general cargoes. In addition, the share of RWG/RWM is not large among the trade. However the improvement of RWG/RWM transport will eventually have a positive effect on conventional cargo transportation.

Therefore, it is worth exploring the feasibility of improving the transport of not only RWG/RWM but also general cargo. There are two approaches in reducing the marine transportation cost; one is to save time and reduce cost of cargo handling by improving cargo handling operation in ports. Public sector is expected to play an important role in its effort. In particular, our team is

proposing that international container terminals be improved, especially in Suva port and other international ports which handled a large number of containers in PICs.

And the other is to improve the domestic transportation system. Truck and container transportation have not spread in PICs. It is essential for bulky cargoes like the RWG/RWM to introduce the unit load transportation system and to realize efficient transportation between a main island and local islands. The RWG/RWM is too large and heavy for laborers to handle by themselves. It is highly required to introduce machinery and pursue efficiency of transportation.

c) Intra-sector projects for forming information platform

By forming information platform for collecting data on reverse logistics business, the present problems associated with reverse logistics business can be eased. A recycling company will be able to communicate with government authorities and private companies through the platform on reverse logistics. The platform will make it easier to develop new businesses on reverse logistics. For these reasons, our team proposes that an information platform be formed on reverse logistics that will cover both waste recycling field and transportation field. It will promote communication between relevant private companies and PICs and increase the possibility of introducing reverse logistics business.





## **Chapter 1. Outline of Study**

### **1.1 Purpose of the study**

The purpose of this survey is to collect necessary data to consider a project on circulation of recycling materials by utilizing "reverse logistics". The project will be in coordination with recycling-society programmes which JICA has conducted in the Pacific Region, as represented by J-PRISM (Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries).

More precisely, basic data of material flows from import to export or disposal in the Pacific Islands will be collected, and then the feasibility of a reverse logistics network with port development in view of promotion of the recycling business in the Pacific Islands will be determined. Furthermore, the survey is going to identify problems with creating a recycling oriented society in the Pacific Islands. These outcomes will also be reflected in the coming waste regional strategy (targeted years from 2015 to 2025) established by SPREP: The Pacific Regional Environment Programme.

### **1.2 Survey Area**

This study is conducted in the Pacific Island Countries (PICs) and covers the five countries of Fiji, Samoa, Tonga, Tuvalu and Vanuatu. These countries are members of SPREP . J-PRISM has been active in improving the Solid Waste Management (SWM) sector in these countries as well. The PICs are shown in Figure 1-1

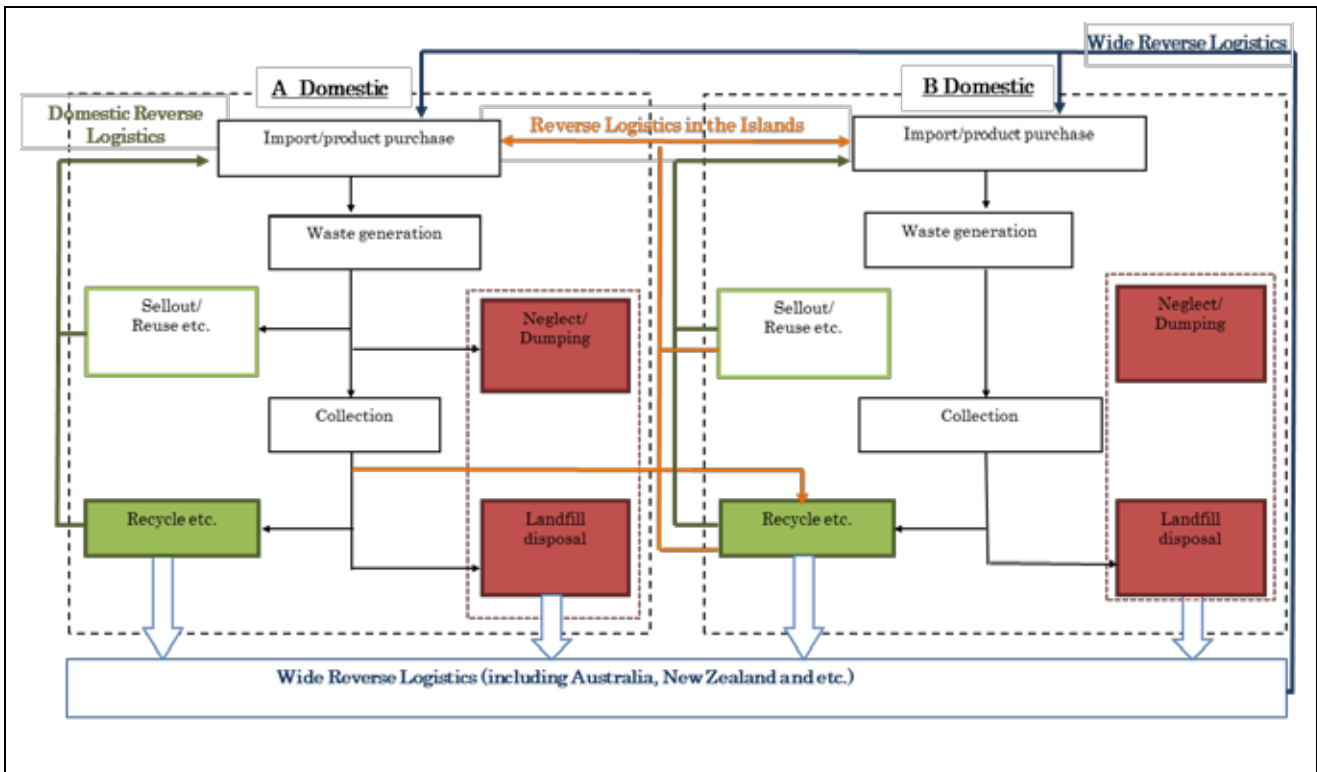


Figure 1-1 Map of the Pacific Island Countries

### 1.3 Concept of “Reverse Logistics” and “Recycling port”

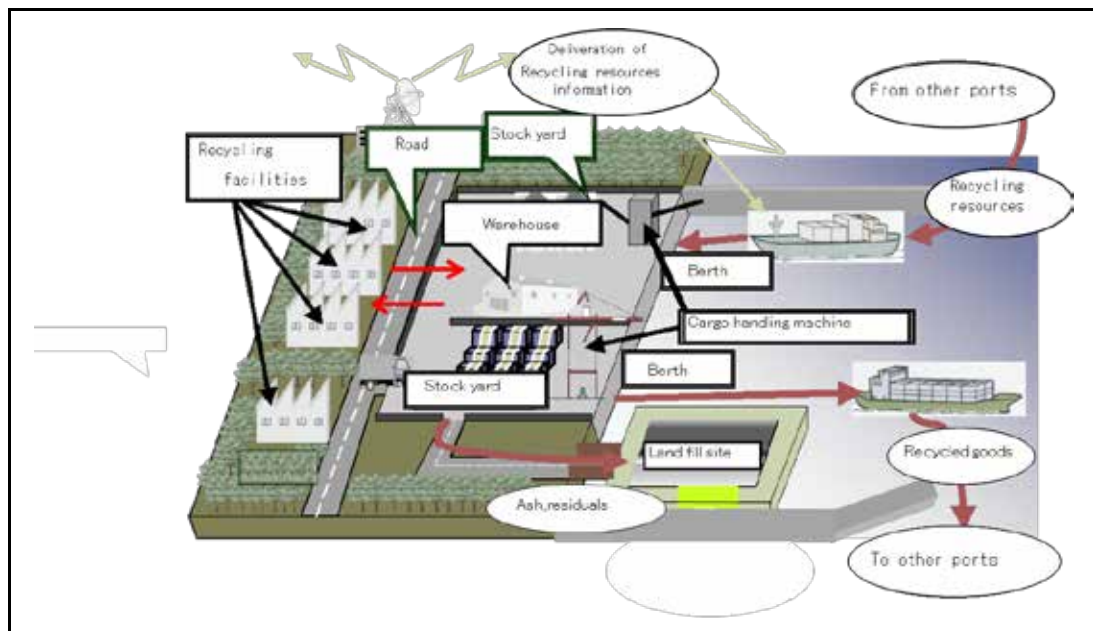
#### (1) What is “Reverse Logistics” ?

“Reverse logistics” stands for all operations related to the reuse of products and materials. In other words, reverse logistics is a transportation system for collecting used products and materials, and moving those products and materials to remanufacturing points for recycling and/or reuse purposes. Introduction of reverse logistics across a vast area is essential because a material could have value in one place even though it does not in another place.



**Figure 1-2 Image of recycling materials flow, reverse logistics in islands and wide ones beyond islands**

“Recycling-Port” complements the function of the reverse logistics. Recycling-Port is a terminal for processing and stocking recycling materials that require environmentally oriented treatment. In Japan, 22 ports are designated as “recycling-port”, where remanufactured resources are processed and stocked. Recycle ports formulate a network of reverse logistics.



**Figure 1-3 Image of “Recycling Port”**

In the Pacific Islands, used materials are abandoned in the islands because of the relatively small volume, lack of remanufacturing technology and improper waste-material collecting system. Accordingly, the survey is going to examine the feasibility of recycling-ports and reverse logistics in the Pacific Islands by extending the water transport network among these islands and/or beyond the Islands.

#### 1.4 Relevant authorities

The survey team is going to explain the inception report including purpose, content, methodology and schedule to the targeted countries and related organizations and request their cooperation in the survey. SPREP and J-PRISM members are also requested to join the meeting. Counterparts of the survey are listed below;

**Table 1-1 Relevant authorities**

Countries	Waste regulation administration and concerned body	Port and maritime administration and concerned body
Fiji	Department of Environment, Ministry of Local Government, Urban Development, Housing and Environment Suva city Council Lautoka City Council	Department of Transport Planning Unit, Ministry of Works, Transport & Public Utilities Fiji Ports Corporation Limited
Samoa	Ministry of Natural Resources and Environment	Ministry of Works, Transport and Infrastructure (MWTI) Samoa Ports Authority Samoa Shipping Corporation
Tonga	Ministry of Environment & Climate Change Tonga Waste Authority	Department of Marine & Ports, Ministry of Transport Ports Authority of Tonga(PAT )
Tuvalu	Waste Management Unit, Ministry of Home Affairs Funafuti Kaupule	Department of marine & port services, Ministry of Communications & Transport
Vanuatu	Department of Environment Protection and Conservation, Ministry of Land and Natural Resources Port-Vila Municipality Council Luganville Municipality Council	Department of Port and Marine Ifra Port Development Service
SPREP: The Pacific Regional Environment Programme		
J-PRISM: Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries		

#### 1.5 Survey Team Members

Survey team members' assignments are listed below. Each member is going to conduct data collection, interview related authorities and bodies and exchange information.

**Table 1-2 List of survey team members**

Name	company	Specialty
Akira Koyama	OCDI	Team leader, Reverse logistics
Takatoshi Arai	YEC	Reverse logistics, waste material, recycle technology
Ichio Motono	OCDI	Maritime network, port plan & management
Takayuki Iijima	OCDI	Maritime network, port plan & management
Kentoku Funaki	YEC	Waste material, recycling technology
Mahmoud Riad	YEC	Waste material, recycling technology



OCDI: The overseas coastal development institute of Japan

YEC: Yachiyo Engineering Co., Ltd.

### 1.6 Procedure of the Survey

The work will be ten months study and team will work in Japan and in the pacific islands vice versa.

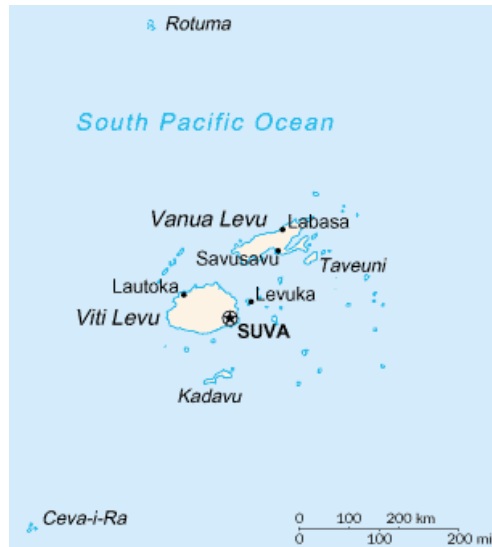
**Table 1-3 Study schedule**

	March	April	May	June	July	August	September	October	November	December
Work in Japan		<input type="checkbox"/>			<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
Work in the Pacific Islands										
Report		Inception Report			Interim Report					Final Report

## 1.7 Outline of the five countries

### (1) Fiji

With Suva as its capital city, Fiji has a land area of 18,333 km<sup>2</sup>, which is almost equal to the land area of the other four PICs covered under this Study. The country's territorial waters cover an area of 1,290,000 km<sup>2</sup>. The population of Fiji is mainly composed of the larger ethnic Fijians and Fijian Indians brought to Fiji during the British colonial rule to work in the sugar cane plantations. The relationship of these two communities dominates the politics and land ownership issues in Fiji and the country has yet to stabilize politically as it has endured a number of coup d'états after it gained its independence in 1970. Elections are presently set for 2014.



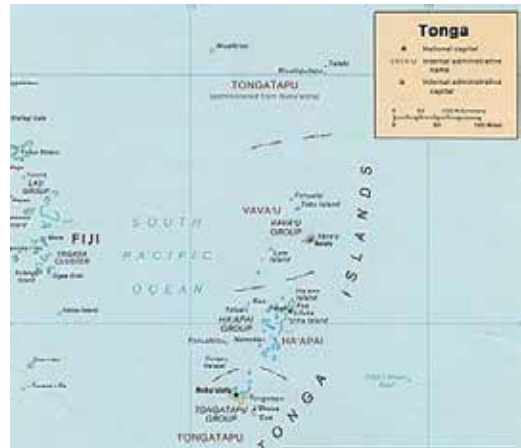
### (2) Samoa

Samoa has a land area of 2,840 km<sup>2</sup> and its capital city is Apia. The area of its territorial waters is 120,000 km<sup>2</sup>. In September 2009, Samoa experienced a major earthquake and tsunami which brought about much damage and a sharp decline in tourism, and resulted in difficult economic conditions for this island country. And typical to smaller island countries, Samoa suffers from sharp imbalance in the covering consumer demand through imports and lack of any significant domestic production.



**(3) Tonga**

Tonga has a land area of 720 km<sup>2</sup> and its capital city is Nuku'alofa. The area of Tonga's territorial waters is 700,000 km<sup>2</sup>. The country's economy is based on international aid and foreign remittances from its nationals working abroad. The government is keen to develop products for export and has already succeeded to export pumpkins and is now actively in developing and exporting related products.



**(4) Tuvalu**

Tuvalu is the smallest of the five PICs of this Study, with a land area of 25.9 km<sup>2</sup>. Tuvalu's territorial waters area is 900,000 km<sup>2</sup>. The capital city is Funafuti. The country's resources are very meager, and its economy is supported by revenues from foreign ships fishing in its territorial waters, and its nationals working on international fishing ships. In 1987 the Tuvalu Trust Fund was established by the governments of Tuvalu, United Kingdom, Australia and New Zealand to address the deficit in the budget and since then its profits have been used to fill up the deficit.





**(5) Vanuatu**

Vanuatu has a land area of 12,190 km<sup>2</sup> and its capital city is Port Vila. The country’s territorial waters cover an area of 680,000 km<sup>2</sup>. Vanuatu is a member of the Commonwealth of Nations and has a republican form of government. Historically it was colonized by both the British and the French and this inheritance is reflected in its present political fabric, with the ruling party constantly shifting between pro French and pro-British political parties, under a continuing unstable political situation.

The country’s self-sufficiency depends on its copra production; however there is a large gap in livelihood between urban areas and rural areas. The country’s deficit is filled by international aid, and in recent years the government has made efforts to diversify its agriculture activity and promote tourism.



(Map sources; Wikipedia)

A summary of the conditions in each of the five PICs covered under this study is shown in Table 1-4.

**Table 1-4 Socioeconomic Conditions in the Covered PICs**

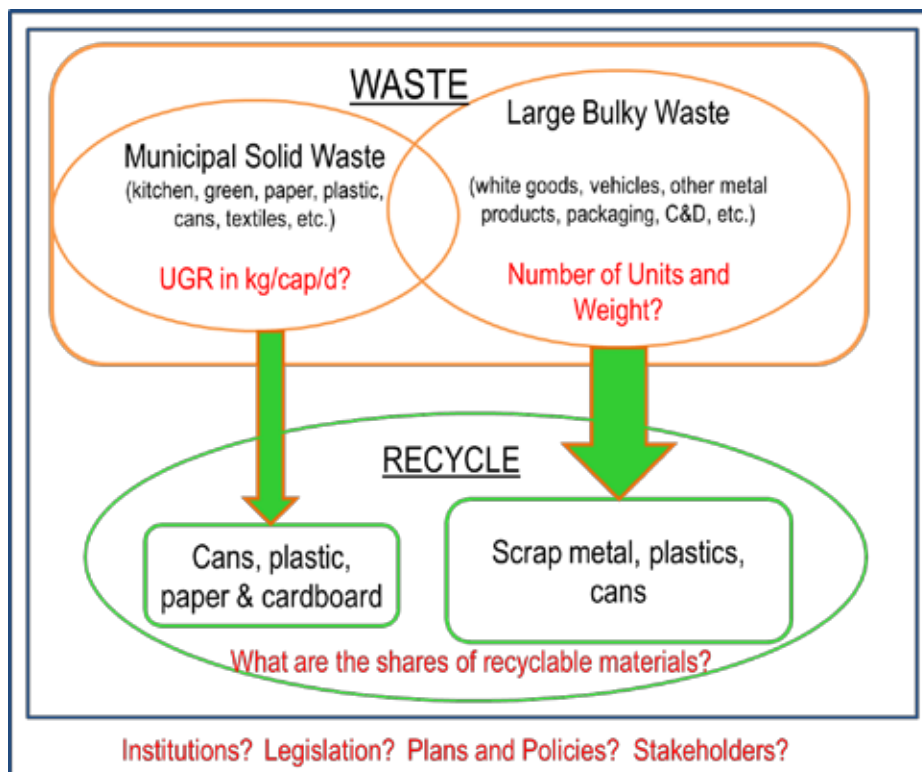
Item	Fiji	Samoa	Tonga	Tuvalu	Vanuatu
Population	860,623 <sup>(1)</sup>	180,000 <sup>(6)</sup>	103,967 <sup>(6)</sup>	12,000 <sup>(4)</sup>	240,000 <sup>(4)</sup>
Capital city (population)	Suva (85,691) <sup>(2)</sup>	Apia (37,708) <sup>(7)</sup>	Nuku'alofa (34,111) <sup>(9)</sup>	Funafuti (4,492) <sup>(8)</sup>	Port Vila (35,901) <sup>(11)</sup>
Land area (km <sup>2</sup> )	18,333	2,840	720	26	12,190
Islands number (inhabited)	332 (110) <sup>(3)</sup>	10(6) <sup>(3)</sup>	176(52) <sup>(3)</sup>	9(9) <sup>(3)</sup>	82(65) <sup>(3)</sup>
Economic Indicators					
GNI	USD3 billion	USD 510 million	USD 340 million	USD 27 million	USD 660 million
GNI/ capita	USD 3,610 <sup>(4)</sup>	USD 2,840 <sup>(6)</sup>	USD 3,260 <sup>(6)</sup>	USD 2,749 <sup>(10)</sup>	USD 2,760 <sup>(4)</sup>
Main Industries <sup>(5)</sup>	Sugar cane, garment, tourism	Agricultural, coastal fishery	Agriculture copra, palm oil, pumpkin, fishery	Agriculture, fishery.	Agriculture, tourism
Sources: (1) World Bank., 2010, (2) National Census, 2007, (3) Pacific Islands Centre, PIC, (4) World Bank, 2010, (5) Ministry of Foreign Affairs, Japan, (6) World Bank, 2009, (7) National Census, 2006, (8) National Census, 2002, (9) National Census, 2006 (10) UN Data, 2009, (11) 2009 data					

## Chapter 2. Present Conditions of Recycling of Bulky Waste

### 2.1 Introduction

#### 2.1.1 Types of Solid Wastes and Shares of Recyclable Wastes suitable for Reverse Logistics

As outlined in Chapter 1, our Study area covers five Pacific Island Countries (PICs) where there are 242 inhabited islands. Solid wastes are generated by the inhabitants of these islands. There are two main types of solid wastes; Municipal Solid Wastes and Large Bulky Wastes. Figure 2-1 shows the composition of each of these two types as well as the potential recyclable materials from these wastes that can be targeted for removal from the islands, either through export to international destinations or treatment in other islands of the same country. The figure also shows the information that is required and will be provided in this chapter.



**Figure 2-1 Generated Waste Types and Recyclable Materials**

In this chapter the **amounts of the generated wastes** will be described. In the case of the Municipal Solid Waste the unit generation rate (UGR) per capita surveyed in past studies shall be identified for each country. For the Large Bulky Wastes, the trade data and relevant statistical data has

been collected for each of the five PICs in order to determine the discarded large bulky wastes in terms of number of units and weight as applicable.

The **composition of both waste types** will be analyzed in order to determine the shares of the recyclable waste materials (the amounts of the recycled materials will be estimated in Chapter 3). This chapter will further identify the **institutional aspects and activities of stakeholders** related to the recycling sector. The findings in this Chapter will be summarized in the last section of this Chapter.

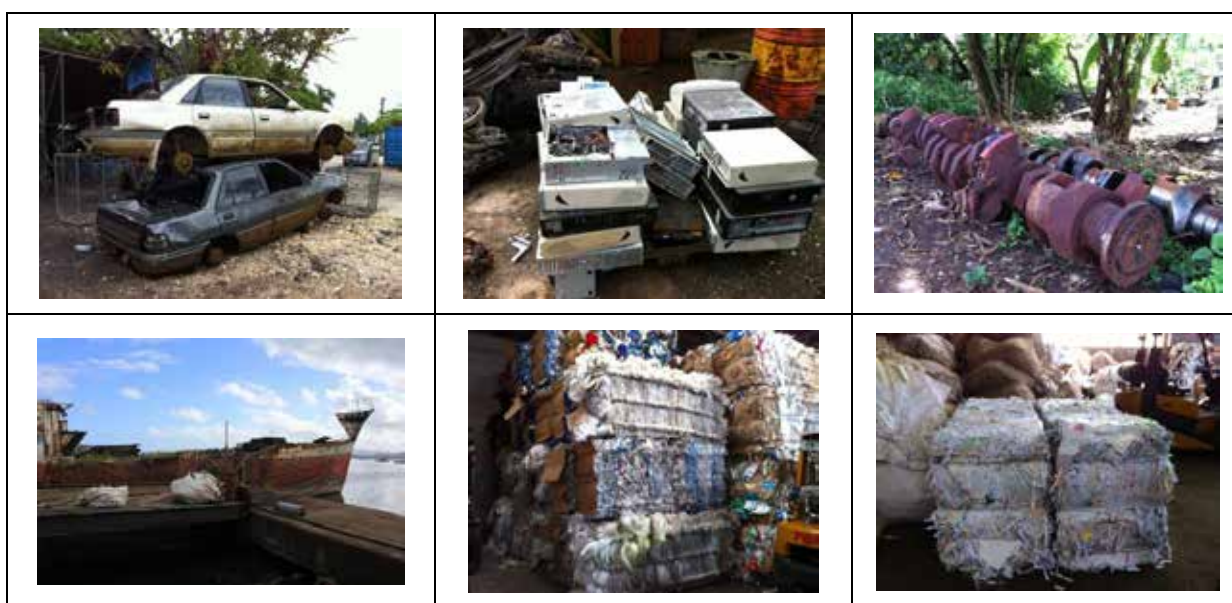
### 2.1.2 Recyclable Waste Goods and Recycled Waste Materials

Ports are the lifelines for all of these islands. The same may be said about the importance of ports for the proper management of solid wastes. Goods come through these ports and once consumed or abandoned become waste. With the exception of kitchen and green wastes, most of the types of generated waste cannot be recycled in the islands.

The alternative is for these waste types to be disposed of on the islands, or illegally in the surrounding waters. Land disposal would require development of sanitary landfill sites with enough capacities to accept these wastes and to be engineered and operated in a manner required to protect the environment. Most of these islands are small in size and have poor financial resources to operate sanitary landfills sustainably. It is therefore very important to consider the diversion of the bulky wastes from the landfill through the transport of waste from these islands for recycling elsewhere.

The present situations of the wastes that can be recycled outside the islands are studied in this chapter. Two terms are adopted for this purpose; **Recyclable Waste Goods** and **Recycled Waste Materials**. Recyclable waste goods (RWG) refer to the goods that have been discarded more or less in the form that they were produced in, such as vehicles, white goods, furniture, etc.. All these waste goods are produced by materials which have the *potential* to be recycled (i.e. *recyclable*). The second term; Recycled waste materials (RWM) refers to the materials that are actually processed from the recyclable waste goods to be *recycled*. These materials include scrap metals made of ferrous and non-ferrous metals, aluminum and metal cans; plastic bottles; and paper and cardboard.

The survey results will be explained for each of the five countries separately. First the general conditions of Solid Waste Management (SWM) in each country will be described to the extent relevant to the targeted recyclable waste goods (for example, this study did not cover the efforts made to deal with kitchen wastes and green wastes as these waste types are managed locally). Secondly the conditions surveyed concerning the recyclable waste goods in each country will be described. These include vehicles, white goods, cans, pet bottles, paper and cardboard, and other products used in construction and demolition, heavy equipment, furniture, gas cylinders, and etc. (RWG examples are shown in Figure 2-2). The quantification of the recyclable waste goods is based on the statistical data review and analysis, interview surveys, and HS data.



**Figure 2-2 Recyclable Waste Goods**

### **2.1.3 Sources of the Information**

The information provided for UGR and composition of the Municipal Solid Waste is based on past surveys. There are unavoidable discrepancies in the years of these surveys as well as the survey coverage areas and components of the waste composition analyzed.

The information provided for Recyclable Waste Goods (RWG) and Recycled Waste Materials (RWM) was obtained from interviews with recycling companies, statistics and trade data. The items covered in the interviews were fixed by the Study Team and therefore the information was relatively uniform for all the companies in the five countries. On the other hand the Study Team found differences in the quality and comprehensiveness of the statistical and trade data from one country to the other. Accordingly there are some imbalances in the reporting for each country. This also applied to the plans and policies on SWM described by officials of each country; some were detailed while others were in the conceptual stages.

## **2.2 Conditions in Individual PICs**

### **2.2.1 Fiji**

#### **(1) Existing Solid Waste Management conditions**

- 1) UGR and Composition of Municipal Solid Waste

The waste composition survey implemented in 2007 in Lautoka and Nadi determined that the average solid waste unit generation rate (UGR) was 0.403 kg/capita/day. Based on the Fijian population in 2007 of 837,271, and adopting the average UGR for the whole country, the total solid waste generated was 123,158 tons in 2007, as shown in Table 2-1.

**Table 2-1 Total Municipal Solid Waste Amount (Fiji, 2007)**

Population (year 2007) <sup>(1)</sup>	Unit generation amount <sup>(2)</sup> (g/capita/day)	Generation amount (ton/year)
837,271	403	123,158
Sources: (1) Census, (2) Waste Amount and Composition Survey in Lautoka City Council and Nadi City Council, average UGR		

The waste composition is mostly composed of kitchen wastes (59%), while paper and cardboard account for 11% of the total waste by weight. Table 2-2 shows the solid waste composition.

**Table 2-2 Solid Waste Composition (2007)**

Items	Composition	Graphical Presentation
Kitchen wastes	59.0%	
Paper	11.2%	
Plastics (Films)	10.1%	
Metals <sup>(2)</sup>	4.4%	
Steel can	1.4%	
Aluminum can	0.9%	
Textiles	2.6%	
Bottles and glass	2.3%	
Pet bottles	1.7%	
Glass and wood	1.5%	
Rubber and leather	0.4%	
Others	7.0%	
TOTAL	100.0%	

Source: (1) Waste Amount and Composition Survey in Lautoka City Council and Nadi City Council  
 (2) To obtain the breakdown of steel and aluminum cans with in the metals component, the results of waste composition survey, Tokyo, 2005 (breakdown of “metals” into steel cans at 32%, and aluminum cans, 20%) were considered.

## 2) Relevant Institutional System

The solid waste management rests with the Department of Environment (DOE) which belongs to the Ministry for Local Government, Urban Development, Housing and Environment.

Environmental management which aims at pollution prevention is administrated in accordance with the Environment Management Act of 2005. Other relevant laws and regulations include;

- Fiji Affairs Act (Cap 120)
- Public Health Act (Cap 111)

- Environment Management (EIA Process Regulation, 2007)
- Environment Management (Waste Disposal and Recycling Regulation, 2007)
- Litter Promulgation, 2010
- Biosecurity Promulgation, 2008

### 3) Related Policies and Plans

The National Solid Waste Management Strategy, 2011 – 2014 outlines the policies adopted by Fiji for managing solid waste. The strategy explains that *“The vision of this strategy is for informed and responsible communities committed to sustainable solid waste management. The proposed goal is to increase the proportion of solid waste that is managed in a cost-effective, financially-sustainable, legally-compliant, and environmentally-sound manner.”*

For the management of industrial solid waste, DOE works in coordination with Water and Sewage Department of Fiji and Trade Waste Policy for Fiji.

For the recycling of beverages containers, DOE is promoting the Container Deposit Legislation and Refund System for Fiji (CDL). Under this proposal, manufactures of beverages, under the Extended Producer Responsibility (EPR) would be obliged to cover a portion of the burden incurred from the recycling of the containers.

### 4) Relevant Recyclers and Stakeholders

In Fiji, recycling companies must have a permit from DOE to engage in recycling activities. The following sixteen (16) companies, shown in Table 2-3 have received permits from DOE. The activities of some of these companies are shown in Figure 2-3.

**Table 2-3 Recycling Companies issued DOE Permits**

Company Name	Recycling Category
J.P.T. Enterprise (Suva Office)	Scrap metal, White Goods, PET Bottles, Alminum Cans, Office papers, etc
Ace Recycling Ltd (Lautoka Office)	Scrap metal
South Pacific Metal Limited (Suva Office)	Scrap metal
Waste Recyclers (Lautoka & Suva Office)	Scrap metal, PET Bottles, Alminum Cans, Waste Office papers, etc
Pacific Scrap Metal Buyers (Suva Office)	Scrap Metal
Fletcher Pacific Steel (Fiji) Ltd. (Suva Office)	Waste Oil
Pacific Batteries Ltd (Suva Office)	Lead Acid Batteries
Coca Cola Amatil	Recycle own product (PET Bottles & Aluminum Cans)
Recycling & Composting ( Ba Office)	Waste from sugar cane industry (FSC) & poultry farmers

Company Name	Recycling Category
Sun & Bright (Suva Office)	Scrap Metal
Sun & Moon Company Ltd	Scrap Metal
City Worldwide Ltd ( Nadi Office)	Scrap Metal
South Pacific Metal Ltd	Scrap Metal
Pacific Batteries Ltd	Lead Acid Battery
South Pacific Waste Recyclers	Waste office papers
Asia Pacific Engineering	
Source: Department of Environment, Fiji	



**Figure 2-3 Recycling Companies in Fiji**

### 5) SWM Services

In Suva city about 35 ton/day of domestic waste is generated, collection coverage is close to 100%, and the collected waste is disposed of at Naboro sanitary landfill.

The solid waste management costs incurred by Suva city and Nadi city are shown in Table 2-4.

**Table 2-4 SWM Costs and Rates**

City	Households general rates included in waste charge	Separate annual garbage collection rate charged
Suva	\$50.30/ high income household from general rates	\$28.13 high income/households
Nadi	\$41.25/ household	\$24/ household
Source: National solid waste management strategy 2011-2014		

### 6) Existing SWM Services and Recycling in Vanua Levu

Vanua Levu is the second largest island of Fiji in land area and population. Lambasa City, the largest city in Vanua Levu, is the second largest center of Fiji's sugar industry. Savusavu, the second largest city of Vanua Levu, is a resort area.

#### a Existing SWM Services in Lambasa City



Waste collection has been entrusted to a private company, which collects general waste (incl. food waste) three times a week and garden waste once a week. There is no regular collection for bulky waste, and hence bulky waste is highly likely to be disposed of together with garden waste. The waste collection covers the whole city area.

The landfill site of Lambasa City was built in the 1970's and has remained in the same place since then. It has an area of nine acres, of which half has already been filled up. This landfill site has been operated by the private company that collects waste. There are some waste pickers in the landfill site, who burn wastes to collect recyclables such as cans.

b Generation Status of Scrap/Recyclable Materials in Vanua Levu

J.P.T Enterprise is the only company which conducts recycling business in Vanua Levu. There used to be two more recycling companies but both have already terminated their businesses. The recycling companies, including the closed one, mainly target the scrap metal from vehicles and heavy machines. J.P.T. Enterprise transfers scrap metals to their head plant in Suva after roughly shredding metals for easy transport. At the Suva plant, scrap metals are shredded into small pieces, classified by material and packed in containers for shipping. Since Lambasa port has no sufficient facilities for scrap metal shipping, the metal scraps are first transported by road to the Savusavu port, and then shipped to Suva by sea. For the scrap shipping to Suva, large-sized trucks are used instead of containers. After driving from the plant to Savusavu port, the metal-loaded truck drives onto a ship and is transferred to Suva. A truck has the maximum loading capacity of 15 tons. All the scrap metals processed in Suva are exported to Pusan, Korea.

A sugar factory in Lambasa City generates a few thousand tons of scrap metals, but only when it upgrades its facility which is carried out once in a decade. Moreover, the buyer of the scraps is decided through bidding conducted by the head office..

**(2) Targeted Recyclable Waste Goods generation amounts and recycling conditions**

1) Collection and Recycling of Discarded Vehicles and White Goods

The number of registered vehicles and newly registered vehicles are shown on an annual base from 2002 to the present in Table 2-5. Recently, every year about 2,000 vehicles are newly registered and the total registered vehicles have exceeded 81,000 vehicles.

**Table 2-5 Total Registered Vehicles and Annual Registrations – Fiji**

Year	Registered vehicles (vehicle)	New registered vehicles (vehicle)
2002	67,737	5,248
2003	69,059	2,097

Year	Registered vehicles (vehicle)	New registered vehicles (vehicle)
2004	74,622	2,229
2005	77,546	2,530
2006	81,463	2,628
2007	81,534	2,090
2008	81,909	2,486
2009	79,882	1,800
2010	81,344	1,718
2011	81,787	2,284

Source: Land Transport Agency

In the case of white goods, the numbers of units owned by the type of white goods are surveyed within the census surveys. The results show that more than half of the total households own a television set and a refrigerator, while the ownership rates for personal computers and air conditioning units is low. Table 2-6 shows the numbers of white goods owned by Fijian households in 1996 and 2007, as produced in the census reports. Comparing the data of both years the ownership rates of televisions, refrigerators and washing machines showed increases. The estimates for 2011, also shown in the table were made by the JICA Study Team based on the interview survey and the trend of the household ownership.

**Table 2-6 Total White Goods Units Owned by Fijian Households**

Year	1996 <sup>(1)</sup>		2007 <sup>(1)</sup>		2011 <sup>(2)</sup>		
No. of Households	144,239		174,423		177,933		
Items	Household Ownership rate	Owned units	Household Ownership rate	Owned units	Household Ownership rate	Units owned by businesses and offices	Owned units
Televisions	46.1%	66,431	70.1%	122,353	80.0%	+5%	151,985
Refrigerator, Freezers	46.6%	67,144	61.1%	106,619	70.0%	+5%	132,987
Washing machines	20.6%	29,688	47.0%	82,027	60.0%	+5%	113,989
Microwaves	--	--	--	--	40.0%	+5%	75,993
Air conditioners	--	--	3.7%	6,536	40.0%	+5%	75,993
Computers	--	--	17.0%	29,682	30.0%	+50,714 unit <sup>(3)</sup>	105,025

Source: (1) Census 1996 and 2007, (2) JICA Study Team estimates, (3) Based on estimates of total numbers of professionals, officials, technical staffs and clerks using PCs

## 2) Collection and Recycling conditions of pet bottles, waste paper and metal cans

With the assistance of JICA and other donor agencies, Fiji is implementing a number of pilot projects to introduce source separation and separate collection of recyclable waste goods. In Suva city,

while pilot projects have yet to be implemented, it is understood that the relevant officials are moving in the direction of introducing separate collection there. A number of recycling companies have set up processing yards where the recyclable waste goods are brought to be processed for recycling. In Lautoka city, under a JICA project concluded earlier this year, separate collection of pet bottles, glass bottles and cans was introduced in parts of the city. It is expected that the separate collection service will gradually be expanded in the city.

The generation amounts of pet bottles, paper, steel cans and aluminum cans in 2007 are shown in Table 2-7

**Table 2-7 Generated Amounts of Pet Bottles, Paper and Cans (Fiji, 2007)**

Recyclable Waste Goods	unit	Pet bottle	Paper	Steel cans	Aluminum cans
Generation amount	ton/year	2,139	13,752	1,834	1,222
Unit generation amount	g/cap/d	7	45	6	4
Source: JICA Study Team					

### 3) Existing Recycling Activities within Fiji

Within Fiji recycling activities are limited to the recycling of waste paper to produce toilet paper, utilizing waste vehicle batteries to produce new batteries and using waste shipping oil as energy source to produce reinforcement steel for construction purposes. Re-use of discarded vehicle parts in the maintenance and repair of operating vehicles is also practiced.

One recycler company, located in Suva city, reportedly collects waste paper which is used to manufacture toilet paper. Daily the company collects 2.5 tons of waste paper and manufactures 2 tons of toilet paper. The collected waste paper types are newspapers, magazines, books and printed materials, office paper, etc. The company does not use waste cardboard. The company employs four trucks to directly purchase the waste paper from the generation sources, at 5 Fijian cents per kilogram. Some generators bring their waste papers directly to the company's plant. The toilet paper produced by the company is under the brand name of Nambawan and 1 set of 6 rolls costs Fijian dollar 1.09. Activities of this company are shown in Figure 2-4.

One company produces vehicle batteries in Fiji. The lead used in the manufacturing process is all recycled from old batteries. About 100 tons of waste batteries are purchased by the company, and 70% of that amount is used to produce new batteries. The remaining portion is slag, which is transported to the landfill. The waste batteries are both imported and obtained locally. As this waste type is considered hazardous waste the company reportedly complies with the Waigani convention in the transport of these products.



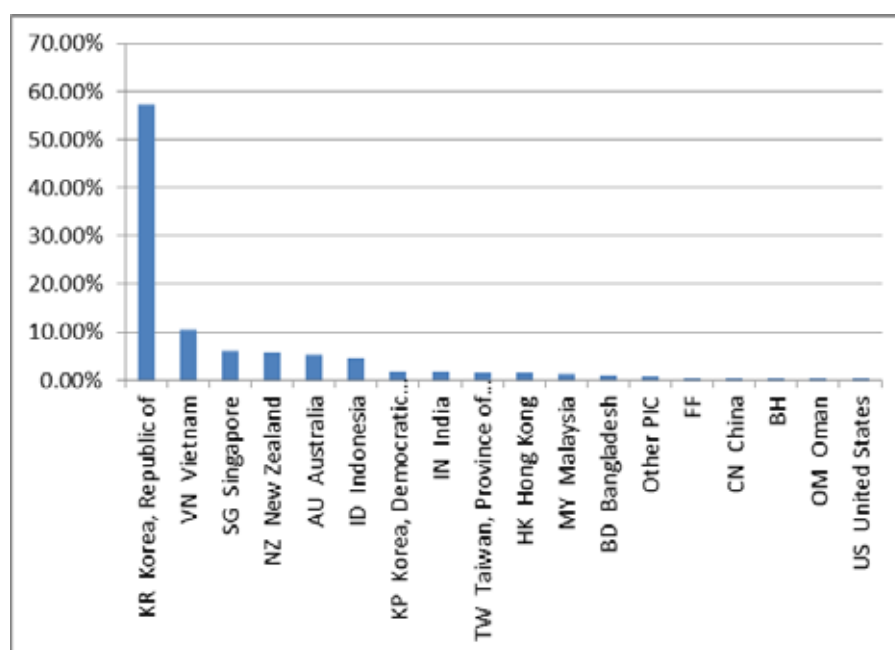
**Figure 2-4 Recycler Company of Waste Paper**

4) Export Destination Countries of the Recycled Waste Materials exported from Fiji

The HS export data for 2010 shows that an amount of 44.1 thousand tons of scrap metals (96% of total RWM export), plastics (2%) and waste paper and cardboard (3%) were exported from Fiji in that year. While there are a number of recycler companies that collect waste paper, only one company actually recycles the waste paper in Fiji. For the other companies, they reported that it is more profitable for them to export the collected waste paper for recycling abroad than to invest in recycling facilities at home.

According to the interview survey with recycling companies, the scrap metal is mainly exported to Korea, New Zealand, Australia, Indonesia, etc. Pet bottles are exported to Hong Kong and waste paper to Australia. The destination of the recyclable waste materials is decided based on many factors such as cost of transport, market demand, business arrangements with agents and middlemen, etc. The analysis of the destinations of exported waste materials in 2010 showed that about 57% of the amount was transported to Korea, followed by 10% to Vietnam. The analysis results tally with the information obtained from the interviews with the recycler companies that in the last 2-3 years the number of recycling companies with Korean partners had increased in Fiji.

Figure 2-5 shows a graphical presentation of the countries where the RWM are being exported to.



**Figure 2-5 Destinations of Recyclable Waste Materials exported from Fiji in 2010**

5) Regulations on movement of hazardous wastes

In Fiji, hazardous substances and hazardous wastes are regulated by the Environment Management Act 2005, as follows;

"hazardous substance" means a substance which, due to its nature, condition and quantity is toxic and capable of posing an immediate or long term risk to human health or the environment;  
 "hazardous waste" means toxic, inflammable, corrosive, reactive, infective or explosive waste, and includes waste which is potentially hazardous to human health or the environment<sup>1</sup>;

Of relevance to this Study, only waste batteries need to be considered and the movement of waste batteries is regulated by the provisions of the Basel and/or Waigani hazardous waste movement regulations.

**2.2.2 Samoa**

**(1) Existing Solid Waste Management conditions**

1) UGR and Composition of Municipal Solid Waste

In October 2010, the Ministry of Natural Resources and Environment implemented a waste

<sup>1</sup> The Waigani Convention covers toxic, poisonous, explosive, corrosive, flammable, ecotoxic, infectious and radioactive waste. The Basel Convention adopts the same characteristics with the exception of radioactive characteristic.

composition survey in Apia. The following composition of domestic waste was identified as a result of this survey, and the unit generation rate (UGR) was determined to be 0.38 kg/capita/day. Table 2-8 shows the Municipal Solid Waste composition for Apia.

**Table 2-8 Solid Waste Composition (Apia, 2010)**

Categories	Composition <sup>(1)</sup>	Graphical Presentation
Green	38.70%	<p>The pie chart displays the following data points: Green waste (39%), Diapers (15%), Metals (excl. Cans) (7%), Plastic bottles/containers (7%), Glass (4%), Steel cans (4%), Paper (4%), Food scrap (2%), Plastic bags/papers (2%), Cardboard (2%), Textiles (2%), and Others (2%). There is also a 0% slice for Steel cans.</p>
Food Scrap	3.80%	
Paper	6.93%	
Cardboard	0.27%	
Plastic bags/papers	6.52%	
Plastic bottles/containers	6.52%	
Diapers	15.08%	
Glass	2.17%	
Metals <sup>(2)</sup>	8.83%	
Steel cans	(2.83%)	
Aluminum cans	(1.77%)	
Textiles	6.79%	
Others	4.35%	
Total	100.00%	

Source: (1) Solid Waste Characterization and Generation Study 2011.VAITELE.

(2) To obtain the breakdown of steel and aluminum cans with in the metals component, the results of waste composition survey, Tokyo. 2005 (breakdown of “metals” into steel cans at 32%, and aluminum cans, 20%) were considered.

## 2) Relevant Institutional System

The Division of Environment and Conservation, a unit of the Ministry of Natural Resources and Environment is responsible for formulating the policies and regulations related to the management of solid wastes in Samoa. Relevant SWM laws and regulations are as follows:

- Land and Environment Act ,1989
- National Waste Management Policy, 2001
- Plastic Bag Prohibition Regulation, 2006
- National Chemical Management Strategy, 2007-2017
- Waste Management Act, 2010

### 3) Related Policies and Plans

With the support of SPREP, Samoa has prepared the National SWM Strategy (Draft). This Strategy attaches priority to the following three issues:

- Reduction of the generated waste amount
- Improvement of the waste treatment and disposal facilities and upgrading of the waste services
- Strengthening the institutional capabilities of the SWM responsible officials and service providers and developing the activities

In line with the Strategy, the Ministry of Natural Resources and Environment (MNRE) is planning to introduce separate collection and composting of organic wastes. Together with J-PRISM, MNRE will introduce separate collection and composting pilot projects will be started. Presently the targeted areas are being surveyed and the pilot project implementation should start by mid-2012.

### 4) Relevant Recyclers and Stakeholders

Four recycling companies are operating in Samoa. In Samoa there is no environmental licensing system for the recycling companies to monitor permit and monitor their activities within the context of protecting the environment, however the Ministry of Revenue issues them a business license to engage in recycling business. The four recycling companies are;

- Pacific Recycle
- West End
- Waste Management
- Samoa Breweries Limited

The three companies of Pacific Recycle, West End and Waste Management process scrap metal from waste vehicles and other products and export the scrap metal to New Zealand and other countries. Samoa Breweries Limited collects the returnable glass bottles under a deposit system through their distributors, at the cash-back value of 20 cents for 750 ml bottles and 10 cents for 450 ml bottles. Activities of the recycling companies in Samoa are depicted in Figure 2-6.



**Figure 2-6 Recycling Companies in Samoa**

- 5) Conditions of collection and recovery, treatment (intermediate treatment, disposal site conditions, treated amounts, etc.) and treatment costs

Waste collection service in Samoa is provided by the private sector. In the year 2000 the collection service covered the capital city, Apia and its surroundings, extending to Savaii Island in 2006, and expanding to cover the whole country by 2008. MNRE has divided the country into 15 collection zones and contracted 8 private companies to provide the services. Contract amounts are lump sum and are not determined by actual waste amounts collected. The service coverage is reportedly extended to 95% of the population, with the exception of the areas where there are access difficulties because of lack of roads, etc.

The collection companies also collect the bulky wastes once every three months, free of charge. The collected bulky wastes include white goods, furniture, waste vehicles, and etc. covering almost all types of bulky wastes. The collection dates are informed to the citizens through TV, radio and newspapers. All the waste is transported to the landfill; however the bulky wastes are placed in a designated area in front of the landfill entrance. These bulky wastes placed at this area may be taken up by anybody.

In each of the two islands of Upolu and Savaii there is a semi-aerobic sanitary landfill that has been developed in cooperation with JICA, through improvement of existing disposal sites originally there. Tafaigata sanitary landfill, located on Upolu island has an area of 100 acres, of which presently 10 acres (about 40 ha) are utilized. The present used area has an estimated remaining life of 6 years after which an expansion plan will be implemented. At the end of 2003 work commenced on improving that landfill into a semi-aerobic sanitary landfill and the project was completed in 2005. The facilities at the landfill include an administration building, incinerator for infectious waste treatment (maximum treatment capacity of 1 ton/day), and a leachate treatment pond. The sanitary landfill operation has been contracted out to a private operator for a contract period of three years at a contract amount of 250,000 Samoan Tala.

- 6) Existing SWM Services and Recycling in Savaii



Savaii, with a land area of 1,700km<sup>2</sup> and a population of about 20,000, is the second largest island in Samoa. As is the case with the other islands, waste collection in Savaii is entrusted to the private sector by the Environmental Protection Department of MNRE. The collected wastes are treated in the disposal site in the eastern part of the island. During the site observation, some abandoned vehicles and heavy equipment were seen in some places in the island.



**Figure 2-7 Discarded Heavy Equipment and Vehicles**

**(2) Targeted Recyclable Waste Goods generation amounts and recycling conditions**

1) Collection and Recycling of Discarded Vehicles and White Goods

The numbers of registered vehicles and newly registered vehicles in Samoa are shown on an annual base from 1997 to the present in Table 2-9. In September 2009 driving on the left-hand side of the road was introduced in Samoa in place of right-hand traffic. The reason behind this change was to satisfy the desire of the citizens of the country to purchase second-hand Japanese vehicles from nearby countries employing the left-hand traffic system as Australia, New Zealand and Japan itself. This is also the reason for the increase in newly registered vehicles observed in 2009.

**Table 2-9 Total Registered Vehicles and Annual Registrations (Samoa)**

Year	Registered vehicles (unit: vehicle)	New registered vehicles (unit: vehicle)
1997	7,037	1,014
1998	5,813	836
1999	10,529	707
2000	6,547	--
2001	7,731	--
2002	9,196	--
2003	11,288	502
2004	13,485	506
2005	14,400	915

Year	Registered vehicles (unit: vehicle)	New registered vehicles (unit: vehicle)
2006	15,012	612
2007	16,215	1,060
2008	8,064	850
2009	11,505	1,907
2010	13,950	1,957
2011	16,394	2,007

Note: Numbers of registered and newly registered vehicles in 2010 are average of those of year 2009 and year 2011. Source: Land Transport Authority

The breakdown of the newly registered vehicles by type for the year 2011 is shown in Table 2-10.

**Table 2-10 Breakdown of Newly Registered Vehicles by type in 2011 (Samoa)**

Types	Vehicle number
Private cars	577
Pick-ups	243
Truck 10whls	13
Truck 6whls	475
Machineries	59
Van	322
Buses	26
Taxis Design	247
Motor Cycles	13
Other vehicles	32
Total Registered Vehicles	2,007

Source: Land Transport Authority

The recycling companies in Samoa collect the discarded vehicles, process them into scrap metal and export the processed materials. This activity is mainly done in the main island, and many discarded vehicles can be observed on Savaii and the other islands.

Ownership figures for white goods in Samoa are described in the following Table 2-11.

**Table 2-11 Total White Goods Units Owned by Samoan Households**

Year	Ownership ratio							Import		
	2001 <sup>(1)</sup>		2006 <sup>(1)</sup>		2011 <sup>(2)</sup>			2009	2010	2011
Total Households	23,059		23,813		24,354					
Items	Household Ownership rate	Owned units	Household Ownership rate	Owned units	Household Ownership rate	Units owned by businesses and offices	Owned units			
Televisions	67.6%	15,590	63.3%	15,080	70.0%	+5%	17,900	1,776	679	2,030

Year	Ownership ratio							Import		
	2001 <sup>(1)</sup>		2006 <sup>(1)</sup>		2011 <sup>(2)</sup>			2009	2010	2011
Total Households	23,059		23,813		24,354					
Items	Household Ownership rate	Owned units	Household Ownership rate	Owned units	Household Ownership rate	Units owned by businesses and offices	Owned units			
Refrigerator, Freezers	55.9%	12,899	60.7%	14,445	65.0%	+5%	16,622	1,699	2,419	2,471
Washing machines	-	-	-	-	30.0%	+5%	7,671	231	571	348
Microwaves	-	-	-	-	50.0%	+5%	12,786	1,101	1,969	2,583
Air conditioners	-	-	-	-	30.0%	+5%	7,671	1,735	2,325	1,729
Computers	5.7%	1,319	10.4%	2,472	25.0%	+16,998 unit <sup>(3)</sup>	23,087	2,147	3,142	2,573

Source: (1) Ownership ratio is from Samoa census Report, Import is Custom office, (2) JICA Study Team estimates, (3) Based on estimates of total numbers of professionals, officials, technical staffs and clerks using PCs

The figures for 2001 and 2006 were obtained from the census data. The ownership rates of televisions and refrigerators remained nearly the same for both years. For the year 2011, the JICA Study Team estimated the figures based on the interview survey and the trend of the household ownership.

2) Collection and Recycling of pet bottles, waste paper and cans

At present there is no separate collection of pet bottles, waste paper and cans in Samoa. The recycling companies in Samoa collect the cans and export them after processing, by separation of aluminum and tin cans and crushing each individually into bales. In 2011 the generated amounts for these items were estimated as shown in Table 2-12.

**Table 2-12 Generated Amounts of Pet Bottles, Paper and Cans (Samoa, 2011)**

Recyclable Waste Goods	unit	Pet bottle	Paper	Cardboard	Steel cans	Aluminum cans
Generation amount	ton/year	1,687	1,754	67	742	472
Unit generation amount	g/capita/day	25	26	1	11	7

Source JICA Study Team

3) Existing Recycling Activities in Samoa

Presently there are no recycling facilities in Samoa. All recycled waste materials are exported for recycling abroad.

4) Export Destination Countries of the Recycled Waste Materials exported from Samoa

Based on the interview survey results importing countries and amounts are described in Table 2-13. Recycling companies decide the countries to export to subject to arrangement with agents, transport costs and other factors.

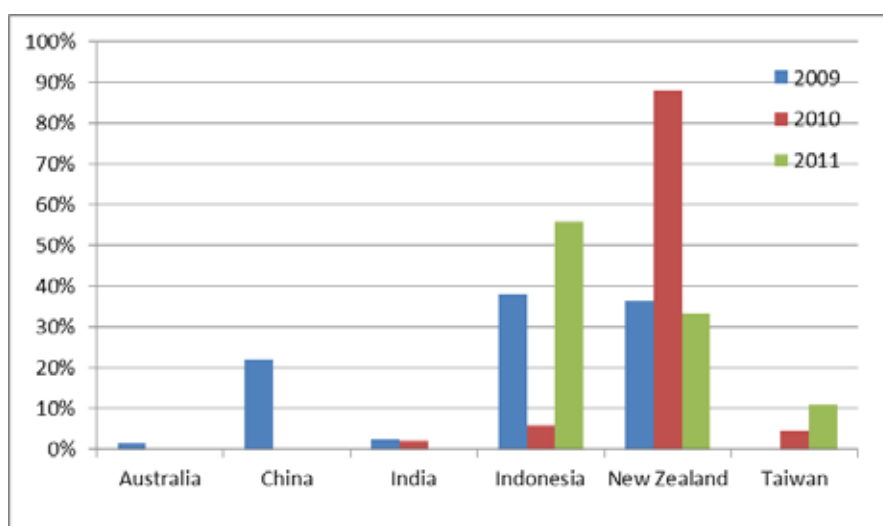
**Table 2-13 Export Destination Countries of the Recycled Waste Materials**

Recycling Company	Ferrous Metals			Non-ferrous Metals			Batteries	
	Export amount (ton/year)	Export Destination Countries	Unit rate	Export amount (ton/year)	Export Destination Countries	Unit rate	Export amount (ton/year)	Export Destination Countries
Company A	1,200	NZ, Australia	SAT536	216	NZ, Australia	SAT1,125	Exported as non-ferrous metals	
Company B	960	Singapore, China	NZ\$250	216	Singapore, China	-	60	India, Fiji
Company C	960	NZ, Singapore	NZ\$300	216	NZ, Singapore	ND\$1,000-10,000	20	NZ or Singapore

Source: JICA Study Team

One of the recycling companies described their experience of sending one standard container (20 ft.) to New Zealand containing waste pet bottles. The container was rejected at the New Zealand port because it did not meet the cleanliness conditions set by the Biosecurity authorities there for being recycled. The company found it easier to pay for the costs of disposing the shipment in a landfill in New Zealand (NZ\$ 6,000) rather than bringing the container back to Samoa.

Exports data for the last three years was collected from the Customs department and is portrayed in the graph in Figure 2-7.



**Figure 2-8 Exports Destinations in the last three years**

The amount of exports from the customs data is about one third of the amounts reported by the recycling companies. However the customs data was used to understand the destinations of the recycled waste materials exports. Indonesia and New Zealand remained the two main export

destinations during the last three years.

5) Regulations on movement of hazardous wastes

Hazardous substances and hazardous wastes are regulated by the Environment Management Act 2010, as follows;

“hazardous waste” includes the wastes and substances specified in Schedule 2 if they are prohibited in Samoa in accordance with the applicable international conventions, or have been imported or used in Samoa in a manner which breaches the relevant conventions, and:

(a) any wastes which are, or which have the potential to be, toxic or poisonous, or which may cause injury or damage to human health or the environment;

(b) any specific substance, object or thing determined under section 6 to be a hazardous waste; and

(c) any other matter or thing deemed under international conventions to be hazardous wastes or to have the characteristics of hazardous wastes from time to time.

Of relevance to this Study, only waste batteries need to be considered and the movement of waste batteries is regulated by the provisions of the Basel and/or Waigani hazardous waste movement regulations.

**2.2.3 Tonga**

**(1) Existing Solid Waste Management conditions**

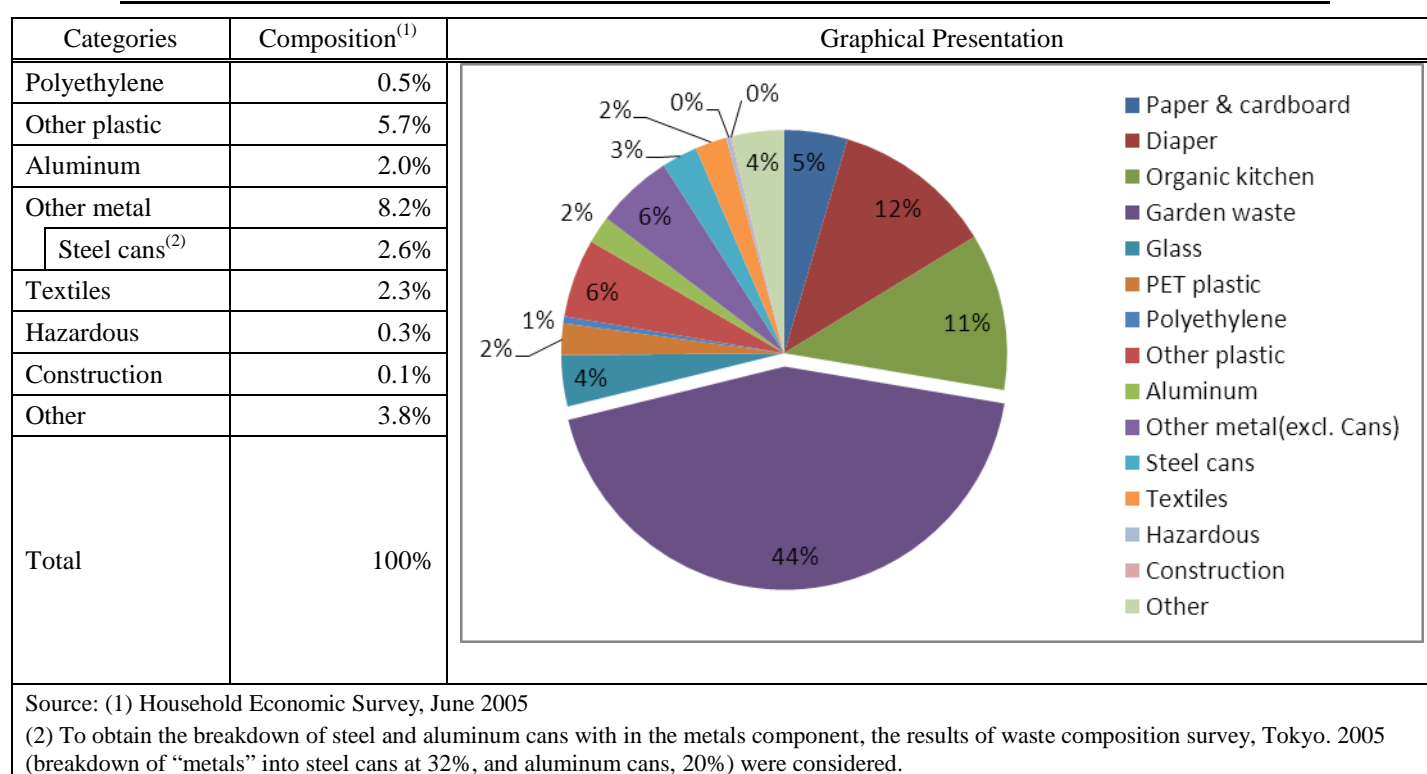
1) UGR and Composition of Municipal Solid Waste

The unit generation rate for domestic waste was determined to be 0.47 kg/cap/day based on a survey implemented in 2008 (Tongatapu Waste Characterization Survey, 2008). With a population of 102,409 persons in 2008, the total generated domestic waste amount was 17,568 tons in that year.

The waste composition is shown in Table 2-14.

**Table 2-14 Solid Waste Composition, Tonga (2008)**

Categories	Composition <sup>(1)</sup>	Graphical Presentation
Paper & cardboard	4.6%	
Diaper	11.7%	
Organic kitchen	11.4%	
Garden waste	43.6%	
Glass	3.7%	
PET plastic	2.3%	



## 2) Relevant Institutional System

The Ministry of Environment and Climate Change (MECC) is responsible for SWM in Tonga, while financial matters related to the SWM sector fall under the jurisdiction of the Ministry of Finance. In 2009 MECC was detached from the Ministry of Lands, Survey & Natural Resources (MLSNR) and became an independent ministry.

Under the SWM project implemented during the period from 2006 to 2009, through AusAID, the Waste Authority Ltd., (WAL) was established. At present WAL falls under the jurisdiction of MECC. WAL provides waste collection for all the area of Tongatapu Island and operation of the Tapuhia solid waste treatment facility (disposal site). MOH provides SWM for the remote islands.

Environmental laws and regulations, encompassing SWM are listed in Table 2-15.

**Table 2-15 Environmental Related Legislation in Tonga**

Legislation	Issued Year	Issuing Authority
EIA Act 2003	2003	MECC
Waste Management Act 2005	2005	MECC
Hazardous Waste and Chemicals Act 2010	2010	MECC
Environment Management Bill 2005	2005	MECC
Marine Pollution Act 2004	2004	MLSNR
Public Health Act 2002	2002	MOH
Source: JICA Study Team		

3) Related Policies and Plans

No national level SWM policies or plans were identified. At present Tonga is receiving support from SPREP to prepare the SWM national strategy.

4) Relevant Recyclers and Stakeholders

In order for a private company to engage in waste collection and recycling activities it must first receive a letter of recommendation from the Ministry of Environment and Climate Change (MECC), which the company would then submit together with an application to the Ministry of Labor, Commerce & Industry (MLCI) to receive a license to engage in the SWM activities.

Since 2008, five companies have been issued licenses by MLCI to engage in recycling activities. However at present only one company, GIO Recycling Ltd. is presently active. The company although belonging to Tonga is also active in Papua Island. The five companies originally licensed are identified below, and some of their activities are shown in Figure 2-8;

- GIO Recycling Ltd.
- Sunshine Enterprise
- Ata Rd Recycling
- Sione Scrap Metal
- Pacific Express Investment Trading Ltd.



**Figure 2-9 Recycling Company in Tonga (GIO Recycling Ltd.)**

5) Conditions of collection and recovery, treatment (intermediate treatment, disposal site conditions, treated amounts, etc.) and treatment costs

The number of customers served by WAL is 2,987 in Tongatapu Island, of which 2,541 are general households. There are 10,000 households in Tongatapu, of which around 3,000 households are in Nuku'Alofa. WAL provides collection service to 1,931 of these households (collection coverage

rate in Nuku’Alofa is 65%). WAL daily collects around 20 tons of waste. The remaining private collectors collect about 5 ton/day.

A monthly collection service charge of 10 T\$ is levied on general households by WAL. This charge is collected 4 to 5 times per month (about once a week). From December 2011, WAL set a new regulation designating specific collection bags for waste discharge. Four to five of these black bags, with WAL logo are distributed to each household once a month for use during that month. Initially the waste was collected even if it was put in different bags and covered with the designated collection bags. However the robbery of the designated bags became common and WAL instructed that the waste should be placed inside the designated bags (but still WAL is collecting waste placed in other bags and covered with the designated collection bags).

The levying of collection charges has now spread to some businesses and institutions, and from December 2011 charges of 17T\$, 25T\$ and 64T\$ per month have been set.

There are other companies collecting waste in addition to WAL. Waste Management is one of these companies. Other than solid waste the company also collects sewage and sludge. The company provides services to private businesses, general households, totaling about 300 customers. Waste collection charges range from 100T\$ to 300T\$ (charge for collection of waste bin once a week is 200T\$). Separate collection was tried, but abandoned because of the high costs involved and presently the waste is collected in mixed form and taken to the disposal site. Previously glass bottles were also collected separately but again due to high costs, these are collected together with the mixed waste.

Tapuhia is the only disposal site and it is operated by WAL. The Tapuhia site was originally a quarry site which was purchased by the government and with the support of AusAID facilities of workshop, resources separation area, sewage settling tank, infectious waste incinerator plant, drainage water treatment plant, and sanitary landfill were constructed. The design capacities of the landfill and sewage sludge disposal pit are 6,500 ton/year and 3.5 million liters/year respectively.

The landfill bed is covered with a geo-membrane, which in turn is overlaid with a clay layer. The leachate is pumped up from the waste disposal area, and recirculated to the waste disposal area, to improve its quality and allow for its evaporation. However it is not clear whether all the leachate is collected from the waste layers and if it is re-circulated over the total area of the landfill facility.

## **(2) Targeted Recyclable Waste Goods generation amounts and recycling conditions in Tonga**

### **1) Collection and Recycling of Discarded Vehicles and White Goods**

The newly registered vehicles in Tonga are shown in Table 2-16 for the period of 2005 to 2011. A large increase was observed starting from 2009.



**Table 2-16 Annual Vehicles Registration (Tonga)**

Year	2005	2006	2007	2008	2009	2010	2011
Motor Cycle	0	0	0	0	2	55	63
Motorized Tricycle	0	0	0	0	0	10	3
Private Motor vehicle	86	95	117	102	753	1882	549
Taxi/Rental Car	7	5	8	2	53	101	45
Passenger Bus/Lorry	0	3	2	4	20	48	28
Light Goods Vehicle	139	132	121	131	939	2604	777
Tractor	0	0	0	0	3	23	11
Heavy Plant	0	0	0	0	13	26	18
Invalid Carrage	0	0	0	0	0	0	0
Heavy Goods Vehicle	64	70	71	77	570	1287	298
Total	296	305	319	316	2353	6036	1792
Source: Tonga Ministry of Transport Head Office							

The 2006 national census results indicated that 10,088 households owned vehicles. On the other hand, as indicated in the following Table 2-17, 74% of the vehicle types registered in 2006 may be classified as vehicles for private use owned by households, while the vehicles types for business use were 26%. Knowing the number of households owning vehicles, and applying the 2006 ratio of business to private related vehicles, the business related vehicles number may be estimated at 3,466 vehicles, and the total would be 13,554 vehicles in 2006 as indicated in Table 2-17. Based on the past trend, and assuming 17 years of life-span of the vehicles, the Study Team estimated the numbers of vehicles registered from 2006 to 2011 as shown in the same table.

**Table 2-17 Total Vehicles Registration (Tonga, 2006 - 2011)**

Year	No. of HH that own vehicles <sup>(1)</sup>	Newly registered vehicles <sup>(2)</sup>			Registered vehicles			Discarded vehicles <sup>(5)</sup>
		Household	Business	Total	Household	Business	Total	
2006	10,088	227 (74%)	78 (26%)	305 (100%)	10,088	3,466 <sup>(3)</sup>	13,554	797
2007				319			13,076 <sup>(4)</sup>	769
2008				316			12,623 <sup>(4)</sup>	743
2009				2,353			14,233 <sup>(4)</sup>	837
2010				6,036			19,432 <sup>(4)</sup>	1,143
2011				1,792			20,081 <sup>(4)</sup>	1,181
Notes: (1) Source is National census, 2006, (2) Vehicle types registered to households are assumed to be Motor Cycle, Motorized Tricycle, Private Motor vehicle and Light Goods Vehicle, and other types are registered to Business, (3) Estimated based on household to business ownership ratios for the newly registered vehicles, (4) Estimated based on the No. of vehicles and discarded vehicles in previous year and newly registered vehicles, (5) Estimated assuming 17 years of the life-span								

For White Goods ownership data is available from the national censuses for the years of 1996 and 2006, as shown in Table 2-18. Ownership rates of televisions, refrigerator and computers increased in 2006 compared with 1996. Ownership rates of television sets, refrigerators and washing

machines are high, while for the rest of the goods the rates are below 50%. For the year 2011, the JICA Study Team estimated the figures based on the interview survey and the trend of the household ownership.

**Table 2-18 Total White Goods Registration (Tonga, 2006)**

Year	1996 <sup>(1)</sup>		2006 <sup>(1)</sup>		2011 <sup>(2)</sup>		
No. of Households	15,670		17,462		18,053		
Items	Household Ownership rate	Owned units	Household Ownership rate	Owned units	Household Ownership rate	Units owned by businesses and offices	Owned units
Televisions	40.1%	6,284	71.7%	11,235	80.0%	+5%	15,165
Refrigerator, Freezers	47.6%	7,459	65.0%	10,186	70.0%	+5%	13,269
Washing machines	-	-	57.9%	9,073	65.0%	+5%	12,321
Microwaves	-	-	15.0%	2,351	20.0%	+5%	3,791
Air conditioners	-	-	15.0%	2,351	20.0%	+5%	3,791
Computers	1.4%	219	15.7%	2,460	20.0%	+7,569 <sup>(3)</sup>	11,180
Total		13,962		37,656			59,517

Source: (1) National Census for 1996 and 2006, (2) JICA Study Team estimate, (3) Based on estimates of total numbers of professionals, officials, technical staffs and clerks using PCs

The purchase prices for discarded vehicles, white goods, cans and paper from individuals and businesses that bring these goods by themselves were reported as shown in Table 2-19.

**Table 2-19 Purchase prices of discarded products**

Discarded Products	(Tonga dollar)/kg
Cast Aluminum	0.60
Domestic Aluminum	0.60
Aluminum Cans	0.50
Brass	0.70
Clean Copper	5.00
Burned Copper	1.00
Electric Motors	0.10
Radiator	0.60
Stainless Steel	0.50
Lead	0.20
Batteries	0.15
Cast Iron	0.05
Light Gauge (car body) <sup>(1)</sup>	0.03
E-waste	0.05

Note: (1) Light Gauge: car body, roofing iron, ladder frame, sheet metal, barbered wire, food cans

## 2) Collection and Recycling of pet bottles, waste paper and cans

Domestic waste can be broadly classified into 1) cans and bottles, and 2) other wastes. Under the AusAID specific containers have been provided to households and in all villages for the discarding of cans and bottles. These containers were managed by the AusAID project up to 2009, but have since been transferred to the private company, GIO. Once these containers are filled up, GIO collects them, and depending on the amounts sometimes paying a small amount of money which may be used by the village for social purposes. In addition to this, a space is set aside within the landfill site to stockpile discarded steel and aluminum cans, pet bottles, and white goods. However there are complaints that the area is not large enough and sometimes the discarded goods are placed in the disposal area. GIO Recycling Company collects these goods on a periodic basis.

The generated amounts of pet bottles, waste paper and cans in 2008 are estimated as shown in Table 2-20.

**Table 2-20 Generated amounts of waste pet bottles, paper and cans (Tonga, 2008)**

Waste goods	unit	Pet bottle	Paper & cardboard	Steel cans	Aluminum
Generation amount	ton/year	299	822	336	449
Unit generation amount	g/capita/day	8	22	9	12
Source: JICA Study Team					

## 3) Existing Recycling Activities in Tonga

Presently there are no recycling facilities in Tonga. All recycled waste materials are exported for recycling abroad.

## 4) Export Destination Countries of the Recycled Waste Materials exported from Tonga

At present the sole recycling company in Tonga, GIO Recycling exports all the recycled waste materials it processes to New Zealand. In 2011 GIO Recycling exported 629 tons of materials, as described in Table 2-21.

**Table 2-21 Exported Recycled Waste Materials (Tonga, 2011)**

Recycled Waste Materials	Exported Amount (ton)
Ferrous metal	544
Non-ferrous metal	23
Paper	12
Batteries	50
Source: JICA Study Team	

5) Regulations on movement of hazardous wastes

Hazardous wastes are regulated by the Hazardous Waste and Chemicals Act 2010, as follows;

“Hazardous waste” means all wastes of any description which ;  
 (a) are regarded as hazardous wastes under the Basel or Waigani Conventions;  
 (b) designated as hazardous wastes under any law in the Kingdom or by regulations made under this Act; or  
 (c) any substances which appears in a list of hazardous wastes declared by the Minister;

Of relevance to this Study, only waste batteries need to be considered and the movement of waste batteries is regulated by the provisions of the Basel and/or Waigani hazardous waste movement regulations.

**2.2.4 Tuvalu**

**(1) Existing Solid Waste Management conditions**

1) UGR and Composition of Municipal Solid Waste

The municipal solid waste unit generation rate was surveyed to be 0.43 kg/cap/day in 2000. The waste composition analysis results are shown in Table 2-22.

**Table 2-22 Municipal Solid Waste Composition (Tuvalu, 2000)**

Waste type	Composition (%) <sup>(1)</sup>	Graphical Presentation
Kitchen waste, Yard waste	52.4%	<p>The pie chart displays the following data points:</p> <ul style="list-style-type: none"> <li>Kitchen and Yard waste: 52%</li> <li>Paper: 10.4%</li> <li>Plastic (including PET bottle): 9.3%</li> <li>Glass/ Ceramics: 9.5%</li> <li>Metals (excl. Cans): 9.8%</li> <li>Steel cans: 3.1%</li> <li>Aluminum cans: 2.0%</li> <li>Textiles: 2.2%</li> <li>Construction &amp; Demolition: 3.2%</li> <li>Potentially hazardous: 0.6%</li> <li>Others: 2.5%</li> </ul>
Paper	10.4%	
Plastic (including PET bottle)	9.3%	
Glass/Ceramics	9.5%	
Metals (tin, aluminum)	9.8%	
Steel cans <sup>(2)</sup>	3.1%	
Aluminum cans <sup>(2)</sup>	2.0%	
Textiles	2.2%	
Construction, Demolition	3.2%	
Potentially hazardous	0.6%	
Others	2.5%	
Total	100%	

Source: (1) Source: Solid waste education and awareness in Pacific Island Countries, SPREP 2000  
(2) To obtain the breakdown of steel and aluminum cans with in the metals component, the results of waste composition survey, Tokyo. 2005 (breakdown of “metals” into steel cans at 32%, and aluminum cans, 20%) were considered.

## 2) Relevant Institutional System

The Ministry of Home Affairs has the main responsibility for SWM, which it discharges through the Solid Waste Agency of Tuvalu (SWAT). SWAT staff is formed of 4 managerial staff, 2 drivers, and 5 workers.

The laws and regulations related to SWM are as follows:

- Public Health Act, Fale Kauple Act
- Environment Protection Act (2007)
- Waste Operation and Public Act (2009, prepared under EU aid)
- Litter Control Legislation (draft)

The collection and transport of waste and disposal site operations in Funafuti are implemented by Kauple municipal authority. In addition to this SWAT collects the green wastes three days a week (Tuesdays, Wednesdays and Thursdays).

## 3) SWM and Recycling Plans and Policies

The National Solid Waste Management Plan is scheduled to be prepared under assistance from SPREP and EU. For the capital city of Funafuti the “Integrated Solid Waste Management Plan in Funafuti” has been developed under assistance from ADB. The review of the Funafuti plan and inclusion of the outer and remote islands in an “Integrated Solid Waste Management Plan” is being considered in discussion with SPREP.

In Tuvalu and unlike other public services there is no separate budget or accounting allocated for SWM. At present the government is considering introduction of a Waste Levy to ensure that SWM services are sustainable. There is also interest to introduce CDL system (container deposit legislation).

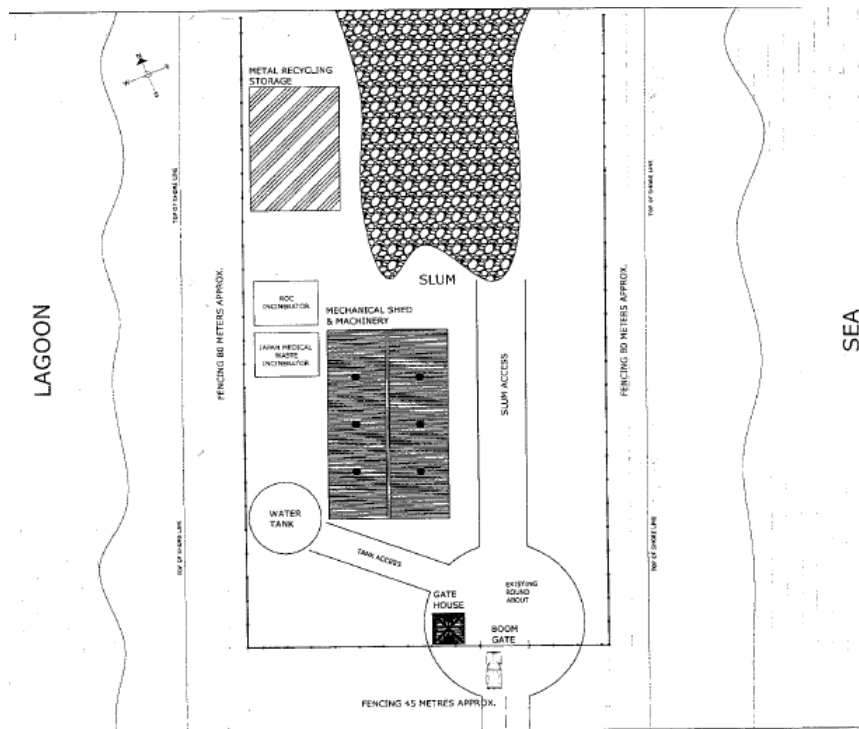
## 4) Relevant Recyclers and Stakeholders

There is only one recycling company, and this company has no staff; the work is done by the company owner. This company targets waste cans, bulky wastes (vehicles, white goods, etc.) and periodically visits businesses and other concerns to collect such wastes. The company has no equipment such as cutter and compactor and depends on primitive tools as saw and hammer to process the waste goods. There is no space for loading containers at the company’s yard, so this activity is done at a space in the port. Photographs of the company’s processing yard are shown in Figure 2-9.



**Figure 2-10 Recycling Company in Tuvalu**

On the northern end of Fongafale Island the disposal site improvement project will be implemented. Presently the disposal is similar to illegal open dumping, but the plan is to improve this situation and furthermore install a facility for cutting and stockpiling bulky wastes. The improvement plan for the disposal site is shown in Figure 2-10. The EU plan will not introduce separate collection, but provide for separation of the mixed waste collected and transported to the disposal site.



**Figure 2-11 Improvement Plan for Landfill Site in Funafuti**

- 5) Conditions of collection and recovery, treatment (intermediate treatment, disposal site conditions, treated amounts, etc.) and treatment costs

Kauple collects the discharged waste from the containers it has distributed to each household. For this service the residents pay AU\$ 40/household/year to the municipality. There are two disposal

sites in Tuvalu on Fongafale Island, in the northern area and the northern tip of the island. The disposal site on the northern area was constructed by AusAID. It is filled up and will soon be closed. From now onwards the northern tip disposal site will only be used and there is a large scale plan to improve this disposal site within the Tuvalu Waste, Water and Sanitation Project financed by EU.

The green waste collected by SWAT is transported to the compost plant constructed by AusAID for producing compost. The compost is sold at AU\$2 per bucket and is used in vegetable gardens. The largest consumer is the Taiwanese experimental farm, which purchases around 70% of the produced compost. However a large amount of green waste is discharged together with the domestic waste and collected by Kauple and disposed at the disposal site without composting.

Kauple has reported that the domestic waste is collected almost daily from the households.

Taiwan has donated a waste incinerator, but after Tuvalu signed the Stockholm Convention<sup>2</sup>, the government is prohibited from using this incinerator. An incinerator for medical waste has been provided by another donor country, but it is also presently not in use. A shredder machine for plastic waste has been donated by Taiwan but it is not in use.

## (2) Targeted Recyclable Waste Goods generation amounts and recycling conditions in Tuvalu

### 1) Collection and Recycling of Discarded Vehicles and White Goods

The numbers of registered vehicles by types in 2004/'05, 2010 and 2011 are shown in Table 2-23. The figure for 2011 was estimated by the JICA Study Team assuming 20% of household ownership in 2020. Unlike the other island countries, the road network in Tuvalu is not well developed and the existing roads are narrow and therefore the diffusion rate of vehicles is small and mainly motorcycles are used for transport.

**Table 2-23 Number of Registered Vehicles by type (Tuvalu, 2004 - 2011)**

Year	Motorbike	Car, Van	Truck	Total
2004/05 <sup>(1)</sup>	543	8	10	561
2010	1,392	138	51	1,581
2011 <sup>(2)</sup>	-	-	-	1,617
Source: (1) Household Income and Expenditure Survey (HIES) 2004/05 and 2010, (2) JICA Study Team estimate				

In Tuvalu there is the vehicle registration system and new vehicles are registered and issued number plates. The system calls for annual renewal of the vehicles registration upon payment of the required fees, but reportedly most of the vehicles do not renew their registrations. It was reported that

<sup>2</sup> The Stockholm Convention (2001) aims to eliminate the production, use and emissions of Persistent Organic Pollutants (POPs).

there are about 150 discarded 4-wheel drive vehicles in Funafuti city. There is hardly any collection or recycling of discarded vehicles there. For Funafuti Island only the Kauple registers the vehicles at the time of procurement and then renews the registration annually.

The ownership figures for white goods are shown in Table 2-24. For the years of 2004/'05 and 2010, the ownership rates of all white goods except for computers had did not show any significant changes. For the year 2011, the JICA Study Team estimated the figures based on the interview survey and the trend of the household ownership.

Unlike the other island countries the households owning television sets are few, one reason being that there is no television broadcasting channel in Tuvalu and radio is the main mass media for communication. Televisions are used to watch DVD and video tapes. Some discarded white goods are temporarily stored in the compost plant constructed by AusAID, but most of the discarded goods are directly brought to the landfill for disposal.

**Table 2-24 Household Ownership of White Goods**

Year	2004/05 <sup>(1)</sup>		2010 <sup>(1)</sup>		2011 <sup>(2)</sup>		
No. of Households	1,576		1,594		1,597		
Items	Household Ownership rate	Owned units	Household Ownership rate	Owned units	Household Ownership rate	Units owned by businesses and offices	Owned units
Televisions	54%	851	54%	855	55%	+5%	922
Refrigerator, Freezers	90%	1,425	90%	1,434	90%	+5%	1,509
Washing machines	70%	1,109	67%	1,065	70%	+5%	1,174
Microwaves	5%	78	4%	63	5%	+5%	84
Air conditioners	3%	45	4%	63	5%	+5%	84
Computers	12%	184	31%	495	30%	+721 <sup>(3)</sup>	1,187
Total		3,692		3,975			4,960
Source: (1) Household Income and Expenditure Survey (HIES) 2004/2005 and 2010, (2) JICA Study Team estimates, (3) Based on estimates of total numbers of professionals, officials, technical staffs and clerks using PCs							

## 2) Collection and Recycling of Waste pet bottles paper and cans

In Tuvalu the private recycling company collects a small amount of aluminum cans. Other waste items as pet bottles and paper are disposed of at the disposal site.

Estimates of the amounts of waste pet bottles, paper, steel and aluminum cans in 2000 are shown in Table 2-25.



**Table 2-25 Waste Pet Bottles, Paper and Cans Amounts (Year 2000)**

Year 2000	unit	Pet bottle	Paper	Steel cans	Aluminum cans
Generation amount	ton/year	17	152	44	10
Unit generation amount	g/cap/day	5	45	13	3
Source: JICA Study Team					

## 3) Existing Recycling Activities in Tuvalu

Presently there are no recycling facilities in Tuvalu. All recycled waste materials are exported for recycling abroad.

## 4) Export Destination Countries of the Recycled Waste Materials exported from Tuvalu

The recycling company reported that since 2008 it has been exporting scrap metal to Australia and New Zealand, in the amounts indicated in Table 2-26.

**Table 2-26 Recycled Waste Materials Export Destinations**

Year	No. of containers exported	Qty. (ton)	Destination
2008	Non-Ferrous: 2 containers	32 ton	Australia
2009	Ferrous: 2 containers Non-Ferrous: 1 container	52 ton	New Zealand
2010	Ferrous: 5 containers Non-Ferrous: 1 container	106 ton	New Zealand
Note: Unit weight per container of Ferrous and Non-Ferrous are assumed to be 18ton and 16 ton, respectively. Source: JICA Study Team interview with recycling company			

## 5) Regulations on movement of hazardous wastes

Hazardous wastes are regulated by the Wastes Operations and Services Act 2009, as follows;

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>(a) any wastes which are, or which have the potential to be, toxic or poisonous, or which may cause injury or damage to human health or the environment, including engine oils or other lubricating oils used in relation to machinery, and oil based paints and any chemical used in relation to paints;</p> <p>(b) any specific substance, object or thing determined under this Act or any law to be a hazardous waste; and</p> <p>(c) any other matter or thing deemed under international conventions applicable to Tuvalu to be hazardous wastes or to have the characteristics of hazardous wastes from time to time;</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Of relevance to this Study, only waste batteries need to be considered and the movement of waste batteries is regulated by the provisions of the Basel and/or Waigani hazardous waste movement regulations.

## 2.2.5 Vanuatu

### (1) Existing Solid Waste Management conditions

#### 1) UGR and Composition of Municipal Solid Waste

The results of the waste amount and composition survey implemented by the Environmental Health Unit of Port Vila city in 2011 are presented in Table 2-27.

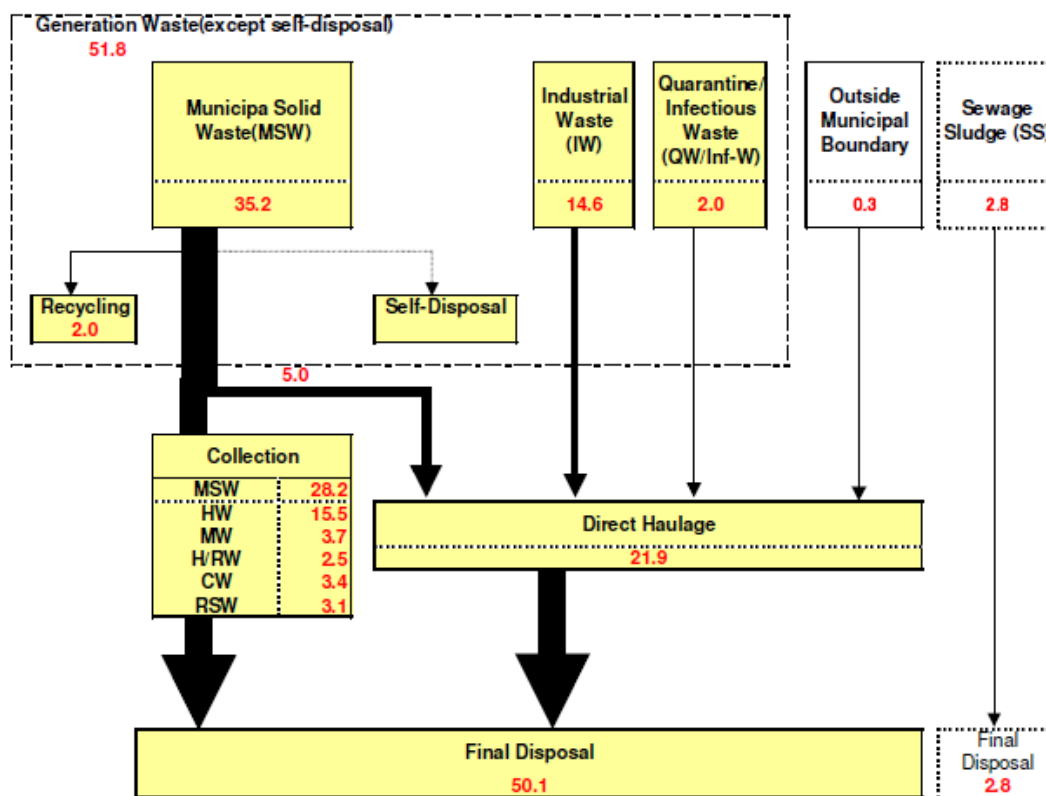
**Table 2-27 Solid Waste Composition, Port-Vila, 2011**

Items	Composition <sup>(1)</sup>	Graphical Presentation
Vegetable/Putrescible	61.50%	<p>Detailed description of the pie chart: The chart is divided into 13 segments. The largest segment is blue, representing 'Vegetable/ Putrescible' at 62%. Moving clockwise from the top, the segments are: light blue (Miscellaneous, 9%), red (Glass/ Ceramics, 8%), green (Paper, 6%), purple (Plastics, 5%), teal (Metals (excl. Cans), 3%), orange (Steel cans, 3%), light blue (PET Bottles, 1%), red (Textiles, 1%), light green (Bones, 1%), purple (Aluminum cans, 1%), and light blue (Miscellaneous, 1%).</p>
Glass ceramic	7.82%	
Paper	6.14%	
Plastics	5.26%	
Metals	3.75%	
Steel cans	1.20%	
PET Bottles	2.61%	
Textiles	1.44%	
Bones	1.28%	
Aluminum cans	0.85%	
Miscellaneous	9.35%	
Total	100%	

Note: (1) Source: The composition survey in 2011 by Environmental Health Unit in Municipality of Port Vila  
(2) To obtain the breakdown of steel and aluminum cans with in the metals component, the results of waste composition survey, Tokyo. 2005 (breakdown of “metals” into steel cans at 32%, and aluminum cans, 20%) were considered.

The domestic waste unit generation rate was estimated to be 0.427 kg/cap/day (Source: Draft solid waste management plan for Port Vila Municipal Council 2008).

The solid waste management flow for Port Vila city is shown in Figure 2-11 (same source as above). The city generates 35 tons per day of municipal waste and 15 tons per day of industrial waste. Almost all of the generated waste is collected and transported to the disposal site.



(unit: Ton/year)

HW: Household Waste	MW: Market Waste
H/RW: Hotel/Restaurant Waste	CW: Commercial Waste
RSW: Road Sweeping Waste	

Source: Draft solid waste management plan for Port Vila Municipal Council 2008

**Figure 2-12 Solid Waste Flow in Port Vila City**

2) Relevant Institutional System

The main organization responsible for solid waste management in Vanuatu is the Department of Environment Protection and Conservation (DEPC) which belongs to the Ministry of Land and Natural Resources (MLNR). In 2009 the then Environment Unit was upgraded to DEPC.

A number of other organizations are also involved in waste management depending on the type of waste, as described in Table 2-28.

**Table 2-28 Agencies Responsible for Solid Waste Management**

Responsibility	Type of Waste				
	Solid	Sewage/ wastewater	Quarantine	Hazardous	Medical
Policy development	DEPC	DEPC	DLQS	DEPC	PHD
Regulation	DEPC	DEPC	DLQS	DEPC	PHD
Monitoring,	DEPC	DEPC	DLQS	DEPC	PHD

Responsibility	Type of Waste				
	Solid	Sewage/ wastewater	Quarantine	Hazardous	Medical
enforcement					
Operation (e.g., collection & disposal)	Municipal Councils* Provincial Councils*	Rural: DGMWR Urban: UNELCO Sub-urban: PWD	DLQS	DEPC	PHD
Notes: * in designated areas DEPC: Department of Environmental Protection and Conservation DGMWR: Department of Geology, Mines, and Water Resources DLQS: Department of Livestock and Quarantine Services PHD: Public Health Department PWD: Public Works Department Source: Vanuatu National Waste Management Strategy and Action Plans, 2011 – 2016					

SWM and Environmental Conservation are regulated by the Environment Management and Conservation (EMC) Act, 2002. Presently this Act is being upgraded to reflect the climate change issues amongst others. In addition the Pollution (Control) Act and Waste Operations and Services Act proposals are also being considered. Under the Waste Operations and Services Act (draft) the registration and licensing of private waste operators as well as collection of waste services fees are under consideration in order to develop a sustainable SWM system.

### 3) Plans and Policies related to SWM and Recycling

The Priorities and Action Agenda (PAA) 2011 - 2016 has identified the stable disposal of solid waste as an issue requiring countermeasures. In addition in April of 2011 the Vanuatu National Waste Management Strategy and Action Plans, 2011 - 2016 was developed and authorized. This strategy document adopted seven (7) objectives as follows;

1. To support solid waste management activities with practical, effective, enforceable legislation
2. To make solid waste management systems and programmes financially self-sustaining
3. To develop skilled and trained people in Vanuatu to effectively manage solid waste management systems
4. To reduce the amount of waste generated and landfilled
5. To dispose of waste that cannot be avoided, reused, recycled or composted in an environmentally sound manner
6. To upgrade waste collection systems to be well-managed, efficient, and self-sustaining
7. To better coordinate national waste management activities and ensure that the National Waste Management Strategy is implemented and periodically reviewed and updated to achieve the stated goal and purpose

#### 4) Relevant Recyclers and Stakeholders

The survey identified five (5) authorized recycling companies as follows (photographs of their activities are shown in Figure 2-12):

- Recycle Corp (Australian related)
- *Company name under formation* (Korean related)
- Clean Vanuatu (Korean related)
- Ranihal Recycle (Korean related)
- HALEE TRADING (Korean related)

In Port Vila city and its vicinity, Recycle Corp., in cooperation with Port Vila city collects discarded vehicles, white goods and cardboard. This company started operations four years ago with recycling of scrap metal and has expanded its operation this year to cover waste cardboard. In April 2012, the company was informed that VAT would be levied upon its operations, and it is contemplating suspending its operations. This action would leave the residents of Port Vila without any collector of their discarded vehicles and white goods. Information on the business activities of Recycle Corp. is as follows. In 2011 the company shipped about 3,000 tons of scrap metal, and turnover sales were US\$ 1,200,000. The company reported a profit of about 13% of its turnover, i.e. US\$ 150,000. However the company has still not paid back its loans incurred at startup of operations to purchase heavy equipment and land, etc.



**Figure 2-13 Recycling Companies in Vanuatu**

At the Bouffa disposal site a Korean-related recycling company (name of company not yet decided) is collecting scrap metal. A related staff of Port Vila city has reported that daily around 15 tons of metal waste is brought to the disposal site and the recycling company salvages around 2 tons of that waste per day.

The company, Clean Vanuatu does not collect discarded waste goods from the residents and has a plan to salvage the buildings and heavy equipment left behind in the Forari magnesium quarry which was closed down 25 years ago. Also the company is considering salvaging the equipment left behind

from World War II in Espiritu Santo Island.

Ranihal Recycle is a company operating in Espiritu Santo Island. The fifth company, Halee Trading was introduced to the team by the shipping company.

- 5) Conditions of collection and recovery, treatment (intermediate treatment, disposal site conditions, treated amounts, etc.) and treatment costs

SWM of Port Vila city is administered by the city's Environment Health Division (EHD). There are five sections in EHD; 1) Landfill, 2) Sanitation, 3) Green Spaces, 4) Cemetery, and 5) Dispensary. The Landfill section is responsible for operation of the disposal site and the Sanitation Section provides the waste collection and road cleaning services. The collection fleet of Port Vila city is composed of 5 open trucks (2 are out of order) and 2 compactors (of which one is out of order). In addition there are five private collection companies as well. Private companies enter into agreements directly with residents and businesses to collect their waste.

The Bouffa disposal site, serving Port Vila city was constructed in 1994 on an area of 48 hectares. It has a design life of 50 years. The land is privately owned and is leased to the city. The area where municipal waste is being disposed has been upgraded to a semi-aerobic landfill through aid from JICA. In an area separate from the municipal waste disposal area, space has been set aside for provisional placing of industrial solid waste and scrap materials. A Korean related recycling company is collecting scrap materials from this area. There is no aeration equipment in the leachate pond, and the leachate quality is being improved through re-circulation back to the waste disposal area. The size of the leachate pond is small and over flow of the leachate at times is reported. At present, together with J-PRISM, EHD has started a study for the landfill future development plan.

At present there is no system for charging collection fees, the city is cooperating with the Department of Environment Protection and Conservation (DEC) to introduce yellow bag system (designated bags to be sold) in order to reduce the waste generation. However due to forthcoming general elections, this plan has been postponed. The system calls for selling 50 kilogram bags for 80 vatu each, and 10 kg bags for 50 vatu each. The city is keen to implement this system as soon as the elections are over.

- 6) Existing SWM Services and Recycling in Malakula Island

Malakula Island belongs to Malampa province located in the central region of Vanuatu, and is the second largest island of Vanuatu. Malampa Province is made up of three main islands, and has a total population of 36,100 and the land area of 2,770 km<sup>2</sup>. With a population of 30,000, Malakula Island is the largest island among the three. Lakatoro, the capital of the Malampa Province is located in Malakula.

In Malakula, administrative agency of Lakatoro Province collects waste. Using two waste trucks, they collect waste twice a week and transport it to a disposal site situated on land owned by a private company. The wastes brought to the landfill site are left without treatment. Occasionally, the private company that owns the land levels ground with heavy equipment. Medical waste is also brought to the disposal site to be burnt separately from the other wastes. At present, the Province plans to develop a waste treatment plant elsewhere.

Used cars have been left discarded in private lands or in some other places in the island. In the island, a few people possess TV, while there are no washing machines. Moreover, PCs are usually used to watch DVDs, and old refrigerators are reused as a container to collect rain water. Therefore, presumably there are little white goods discarded in this island.



**Figure 2-14 Discarded Vehicles and Disposal Site**

#### 7) Existing SWM Services and Recycling in Tanna

Tanna is a volcanic island with a land area of 550 km<sup>2</sup>, which belongs to Tafea Province located in the southernmost part of Vanuatu. Tafea Province has a total population of 27,000 and its capital city is in Tanna. Population of Tanna is about 8,000.

There is no waste collection by a public agency, and the residents dispose of waste in their own gardens. Businesses such as shops and hotels bring their waste to a disposal site to dispose of on their own. There is only one disposal site in Tanna, which is managed by the Provincial government. This disposal site has been used since 1960's, but it has been drawing complaints from land owner. Therefore, the government is now seeking for an alternative area for disposal site. The waste in the disposal site is burned for volume reduction.

In Tanna, most of the areas have no electric power except for some areas including the provincial capital city, and consequently Tanna has extremely low rates of white goods ownership. In addition, while business offices and hotels possess cars, there are few individually owned cars. There is a car repair shop belonging to the Provincial Ministry of Public Works, where many vehicles have been discarded in poor conditions. There are many other discarded vehicles in private car repair shops

as well. Some car parts have been recovered and cleaned up, and are kept in storage with little chance of finding a buyer.



**Figure 2-15 Discarded Heavy Equipment and Car Parts Kept in Storage**

## 8) Existing SWM Services and Recycling in Espiritu Santo

### a Existing SWM Services

Espiritu Santo belongs to Sanma Province which is located in the northern part of Vanuatu. With a land area of approximately 4,000km<sup>2</sup>, Espiritu Santo is the largest island in the New Hebrides. Luganville, the central town of this island with a population of about 10,000, is Vanuatu's second largest settlement. Luganville has an international port where overseas liners put in.

In Luganville, the city council collects wastes from households, business offices and restaurants using two waste collection vehicles, and brings them to the disposal site. This waste collection covers most of the urban district with a well-paved road, and amounts to about 6,000 tons/year. On the other hand, industrial wastes are brought to the disposal site by generators themselves, however the city council has little understanding of the disposal amount.

There is only one disposal site within Espiritu Santo, which has already been used for 40-50 years. This is an uncontrolled dumping site with no adequate treatment conducted. Wastes are piled randomly, and bulldozed only twice a year. Valuables such as cans are also dumped in the site, which are collected by waste pickers and sold to the recyclers. This dumping site, however, is situated near to the airport and it is attracting birds which is a problem for the airport. It is therefore going to be closed shortly.

### b Existing Recycling

Some discarded heavy equipment and vehicles were observed in the industrial area of Luganville. In the sea, there was also much heavy equipment discarded by the US Army, which the Korean recycling company, one of the recyclers the JICA Study Team interviewed, expressed an interest in salvaging. In addition, there is a large quantity of scraps at an old port and a food factory



building that were developed by a Japanese food manufacturer and have been left untouched.



**Figure 2-16 Discarded Scraps**

There are two recycling companies in this town, both of which purchase scraps from residents and businesses to export. They used to export 10-15 TEU of scraps a month until early 2012. But after the government suddenly started imposing a tax on the scrap exports in May 2012, they have significantly reduced the export amount and currently export 1-2 TEU a month only. Some discarded heavy equipment and scraped vehicles were observed at the domestic port. Korean scrap dealers dismantle equipment and vehicles to scrap at this site.



**Figure 2-17 Scraps Kept at the Domestic Port**

**(2) Targeted Recyclable Waste Goods generation amounts and recycling conditions in Vanuatu**

Recycling companies are operating in the capital city of Port Vila and the second largest city of Luganville. These recycling companies process scrap metals from discarded vehicles, white goods and construction and demolition wastes and export the scrap to New Zealand and Korea. Recycling activity is concentrated on scrap metal and unfortunately the activity does not extend to other recyclable waste materials. Apart from these two cities, the only other sources for collection of waste

metal products are the discarded mining equipment and military bases. However these other sources are of a temporary nature and once the discarded equipment is dismantled and salvaged the sources will become dry. The nature of the business is different for the recycling companies targeting waste products generated from the residents and businesses.

- 1) Collection and Recycling of discarded vehicles, white goods, and electric equipment

The newly registered vehicles during the last three years, by vehicle type are shown in Table 2-29. The data for the two cities of Port Vila and Luganville are actual figures while those for the rural areas are estimates made based on the population. The data shows that every year more than 4,500 vehicles were newly registered.

**Table 2-29 Vehicles Newly Registered**

Year	Port Vila and Luganville <sup>(1)</sup>						Rural area <sup>(2)</sup>	Total
	Motorcars	Pick-Ups	Trucks	Buses	Motor cycle	Sub total		
2009	391	385	105	151	86	1,118	3,540	4,658
2010	380	360	98	209	110	1,157	3,664	4,821
2011	426	355	68	229	94	1,172	3,711	4,883

Source: (1) Rates and Tax Office, Department of Customs and Inland Revenue, (2) Estimation based on the population

In 2009 the number of households owning vehicles was 4,139, as shown in Table 2-30.

**Table 2-30 Household Ownership of Vehicles (Vanuatu, 2009)**

Year	Households	Vehicles owned by households		
		Motor vehicle	Motor cycle	Total
2009	47,373	3356	783	4,139

Source: 2009 National Population and Housing Census

It was assumed that newly registered trucks and buses are belonging to the business sector and all other vehicles belong to the households. Adopting the business to households ownership ratio, and knowing the household owned vehicles numbers of 4,139 vehicles, the total number of registered vehicles in Vanuatu in 2009 was estimated to be some 5,400 vehicles (refer to Table 2-31).

**Table 2-31 Total Numbers of Registered Vehicles (Vanuatu, 2009)**

/	New registration in Port Vila and Luganville			Registered vehicles		
	Households <sup>(1)</sup>	Business entities <sup>(1)</sup>	Total	Households <sup>(2)</sup>	Business entities <sup>(3)</sup>	Total
No. of vehicles	862 (77%)	256 (23%)	1,118	4,139 <sup>(2)</sup>	1,229	5,368

Notes: (1) Trucks and Buses are "Owned by Business entities". The others are "Owned by Households". (2) 2009 National Population and Housing Census described in Table 2-31 (3) Estimation based on the ratio of the new

/	New registration in Port Vila and Luganville			Registered vehicles		
	Households <sup>(1)</sup>	Business entities <sup>(1)</sup>	Total	Households <sup>(2)</sup>	Business entities <sup>(3)</sup>	Total
registration.						

Assuming a life-span of 14 years, the JICA Study Team has estimated that the total registered vehicles in 2010 and 2011 are 9,806 and 13,948 vehicles respectively (refer to Table 2-32).

**Table 2-32 Total Numbers of Registered Vehicles (Vanuatu)**

Year	Newly registered vehicles	Total registered vehicles <sup>(1)</sup>	Discarded vehicles <sup>(2)</sup>
2009	4,658	5,368	383
2010	4,821	9,806	700
2011	4,883	13,989	999

Notes: (1) Estimated based on the “Newly registered vehicles” in that year plus the “Total registered vehicles” in the previous year minus the “Discarded vehicles” in the previous year, (2) Estimated by dividing the “Total registered vehicles” by the vehicle life-span, assumed to be 14 years

The number of households owning white goods and the number of units imported for the last three years are shown in Table 2-33. For the year 2011, the JICA Study Team estimated the figures based on the interview survey and the trend of the household ownership.

**Table 2-33 Ownership of White Goods**

Year	Ownership					Number of imported units <sup>(2)</sup>		
	2009 <sup>(1)</sup>		2011 <sup>(3)</sup>			2009	2010	2011
No. of Households	47,373		50,911					
Items	Household Ownership rate	Owned units	Household Ownership rate	Units owned by businesses and offices	Owned units			
Televisions	37.0%	17,528	40%	+5%	21,383	-	-	-
Refrigerator, Freezers	13.0%	6,158	20%	+5%	10,691	2,437	1,553	2,815
Washing machines	-	-	20%	+5%	10,691	5,711	328	438
Microwaves	-	-	10%	+5%	5,346	-	-	-
Air conditioners	-	-	10%	+5%	5,346	1,667	8,773	7,181
Computers	8.0%	3,790	10%	+19,187 <sup>(4)</sup>	24,278	9,979	4,218	3,502

Source: (1) 2009 National Population and Housing Census, (2) custom office, (3) JICAT Study Team estimate, (4) Based on estimates of total numbers of professionals, officials, technical staffs and clerks using PCs

## 2) Collection and Recycling of waste Pet bottles, paper, and cans

Recycle Corp. has been collecting metal cans continuously and exporting the scrap metal. The company also recently commenced collection of waste paper and cardboard but this activity has been temporarily suspended due to the reports of VAT being imposed on the company's activities.

The estimated generated amounts of waste pet bottles, paper and cans for 2008 are shown in Table 2-34.

**Table 2-34 Generated amounts of waste pet bottles, paper and cans (Vanuatu, 2008)**

UGR	unit	Pet bottle	Paper	Steel cans	Aluminum cans
Generation amount	ton/year	921	2,176	418	335
Unit generation amount	g/capita/day	11	26	5	4

Source: JICA Study Team

### 3) Existing Recycling Activities in Vanuatu

Presently there are no recycling facilities in Vanuatu. All recyclable waste materials are exported for recycling abroad.

### 4) Export Destination Countries of the Recycled Waste Materials exported from Vanuatu

The export destinations and selling prices for the recycled waste materials, obtained from the interview survey are shown in Table 2-35. The leading export destination is Korea, followed by many destinations in Asia and the Middle East. Recycle Corp. emphasized that the export destination is determined based on the best profit that may be obtained at the time of export. The company's owner is from Australia, but the company does not export to Australia because of the very strict quarantine laws enforced there; shipments are rejected at the slightest signs of dirt, etc. The selling prices of scrap metal are similar to those reported in Samoa and Tonga.

**Table 2-35 Export Countries Destinations and Selling Costs**

Material	Selling price (US\$/ton)	Export Destination
1. Scrap	US\$500/ ton	Korea
2. Aluminum	US\$12,000/ ton	Korea
3. Scrap	US\$300 - US\$400/ ton	New Zealand, Abu Dhabi, India, Korea, Vietnam, Fiji, etc.
4. Cardboard	US\$200/ ton	As above
5. Office goods	US\$400/ ton	As above

Source: JICA Study Team interviews with recycling companies

The actual export amounts of recycled waste materials, as reported by the interviewed recycling companies are shown in Table 2-36.

**Table 2-36 Actual Recycled Waste Exported Amounts and Destinations**

Recycling Company	Recycled Waste Material	Export Amount	Main Export destination
Recycle Corp	Scrap	3,000 ton/ year (150 TEU container/ year)	NZ, Asia

Recycling Company	Recycled Waste Material	Export Amount	Main Export destination
Name under formation	Scrap (collected from Bouffa disposal site)	2 ton/ day => 500 ton/ year (25 TEU container/ year)	
Clean Vanuatu	Scrap	2,000 ton/ year (projection) (100 TEU container/ year)	
Ranihal Recycle	Scrap	4,800 ton/ year <sup>(1)</sup> (240 TEU containers/ year)	Korea, NZ
HALEE TRADING	Scrap	1,440 ton/ year <sup>(1)</sup> (72 TEU containers/ year)	Korea, NZ
	Total	11,740 ton (587 TEU containers/ year)	
Source: JICA Study Team			

Information received from the customs agency did not show the destinations of the exports so it was not possible to determine more accurate amounts by export destination.

#### 5) Regulations on movement of hazardous wastes

The Waste Operations and Services Act (draft) defines Hazardous wastes as follows;

Hazardous waste and Hazardous substance mean:

- (a) any wastes or substances which are, or which have the potential to be, toxic or poisonous, or which may cause injury or damage to human health or to the environment, including all persistent organic pollutants; and
- (b) any specific substance, object or thing determined under any law to be a hazardous waste or a hazardous substance; and
- (c) any other matter or thing deemed under international conventions applicable to Vanuatu to be hazardous wastes or hazardous substances, or to have the characteristics of hazardous wastes or substances;

Of relevance to this Study, only waste batteries need to be considered and the movement of waste batteries is regulated by the provisions of the Basel and/or Waigani hazardous waste movement regulations.

### 2.3 Market Demand for Scrap Metal

At present scrap metals are the main recycled waste materials exported from the PICs, under the activities of private recycling companies. It is therefore necessary to consider the market demand for scrap metal.

Based on data obtained from materials published by the Australian Industry Group (AI)<sup>3</sup> and the Bureau of International Recycling (BIR)<sup>4</sup> the following facts are understood concerning the present market demand for scrap metal.

Scrap metal is an input in the production of steel. In the year 2010 about 1.4 billion tons of crude steel was produced globally The main crude steel producers that together account for around 80% of the global production, were as follows;

(1) China	626.7 million tons
(2) Europe	172.6 million tons
(3) Japan	109.6 million tons
(4) USA	80.5 million tons
(5) India	68.3 million tons
(6) Russia	66.9 million tons
(7) Turkey	29.1 million tons
Total Global Production (incl. other countries)	1,400 million tons

Table 2-37 shows the crude steel production during the periods 2006 to 2010. The share of steel scrap accounted for 37.5% of the global crude steel production in 2010.

**Table 2-37 Global Crude Steel Production**

Global figures	unit	2006	2007	2008	2009	2010
Crude Steel Production	million tons	1,247	1,347	1,327	1,230	1,412
Steel Scrap	million tons	500	540	530	460	530
(Ratio Steel Scrap/Crude Steel) in %	%	40.1	40.1	39.9	37.6	37.5

Source: Bureau of International Recycling (BIR) World Steel Recycling in Figures 2006-2010

Table 2-38 shows the main importers and exporters of scrap metal in the years 2006 to 2010. Globally Turkey and South Korea are the largest importers of scrap metal, and many Korean recycling companies are active in the PICs. On the other hand, Japan is one of the main exporters of scrap metal, as well as Australia which is located close to the PICs.

<sup>3</sup> Economic Research Note, 2010, [www.aigroup.com.au](http://www.aigroup.com.au)

<sup>4</sup> World Markets for Recovered and Recycled Commodities, 2011, BIR, [www.bir.org](http://www.bir.org)

**Table 2-38 Exports and Imports of Scrap Metal**

Exports and Imports in Mln. Tons						
Year	2006	2007	2008	2009	2010	2010
Main Importers						share (%)
Turkey	15.1	17.1	17.4	15.7	19.2	34%
South Korea	5.6	6.9	7.3	7.8	8.1	14%
China	5.4	3.4	3.6	13.7	5.8	10%
India	3.4	3.0	4.6	5.3	3.2	6%
Taiwan	4.5	5.4	5.5	3.9	5.4	9%
EU	7.3	5.1	4.8	3.3	3.6	6%
USA	4.8	3.7	3.6	3.0	3.8	7%
Canada	1.5	1.4	1.7	1.4	2.2	4%
Malaysia	2.9	3.7	2.3	1.7	2.3	4%
Indonesia	1.1	1.3	2.9	1.5	1.6	3%
Thailand	1.4	1.8	3.1	1.3	1.3	2%
<b>Total Main Importers</b>	<b>52.9</b>	<b>52.9</b>	<b>56.8</b>	<b>58.6</b>	<b>56.6</b>	
Main Exporters						
USA	14.0	16.6	21.7	22.4	20.6	36%
EU	10.1	10.6	12.8	15.8	19.0	34%
Japan	7.7	6.4	5.3	9.4	6.5	11%
Canada	4.0	4.1	4.1	4.8	5.2	9%
Russia	9.8	7.9	5.1	1.2	2.4	4%
Australia	1.3	1.5	1.7	1.9	1.6	3%
South Africa	0.6	0.8	1.3	1.1	1.2	2%
<b>Total Main Exporters</b>	<b>47.4</b>	<b>47.9</b>	<b>52.0</b>	<b>56.7</b>	<b>56.4</b>	
Source: Australian Industry Group, 2011						

It is estimated that the global trade figures for exports and imports of scrap metal were 76.7 and 83.0 million tons in 2010<sup>5</sup>. Accordingly in 2010 around 15% of the global demand for scrap metal was covered by international trade (average of 80 million tons divided by total demand of 530 million tons).

It is expected that the global demand for scrap metal will continue in the future because of the importance of steel in the sectors of industry and construction. However the market is subject to fluctuations as evidenced by the sharp increase in the imports of scrap metal by China in 2008, and decline thereafter. Turkey and South Korea have steadily increased their imported amounts of scrap metal.

## 2.4 Companies Procuring Scrap Metal in the Pacific Island

### (1) CMA Recycling, New Zealand

<sup>5</sup> Source: World Markets for Recovered and Recycled Commodities, 2011, Bureau of International Recycling. No explanation is given in the report for the imbalance between export and import figures.

CMA Recycling procures about 180,000 tons of scrap metal yearly, of which 200-250 tons were imported from the Pacific Islands. Among the 180,000 tons of procured scrap metal, 40,000 tons are exported to other countries and the rest are mostly recycled in iron-making factories in New Zealand. Major destinations for export are India and Bangladesh where the company can ship scrap metal at rather low cost.

In the Pacific Islands, the company mainly deals with the recyclers in Samoa (Pacific Recycle), Tonga (Gio Recycling), Fiji (Pacific Scrap), as well as Nouméa in New Caledonia. The company used to deal with many more local suppliers, but decided to have only one supplier per country after having had many issues with them. Some local suppliers often spoiled or destroyed containers and did not take any action to improve despite the repeated requests.

## **(2) S&B KOREA CO., LTD, Korea**

S&B KOREA CO., LTD. has been operating a scrap metal recycling business by Sun & Bright in Fiji, which mainly collects and processes scrap metals. But its core business is trading, so the company handles other materials as well. The company owns three vessels for shipping.

Major buyers of its scraps are companies in Japan and Korea. The company handled 240,000 tons of scraps in 2011, of which only 4,000 tons (less than 2%) were collected and processed by Sun & Bright in Fiji. The reasons of its starting business in Fiji were its market openness to the newcomers as well as the low labour cost. However, the business in Fiji requires a great deal of care and expense but has made little profit, so the company intends to sell its plant there.

## **2.5 Efforts made to enhance Bulky Waste Recycling in the PICs**

### **2.5.1 J-PRISM**

Japanese aid to the Pacific Islands region has been guided by deliberations at a series of Pacific Islands Leaders Meetings (PALM) held every three years since 1997. Japan has been providing official cooperation to the Pacific Island Countries (PICs) in the field of Solid Waste Management since the year 2000. This cooperation was implemented on a wide range of levels: technical assistance, facility construction under the Japanese grant aid program, grassroots funding of small-scale projects and dispatch of volunteers.

The Hokkaido Declaration issued in PALM 5, in 2009 launched the Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Islands Countries, known as J-PRISM. J-PRISM activities cover eleven (11) Project member countries under a regional cooperative framework and the project is scheduled to be implemented over a 5-year



period from 2011 to 2016. The five PICs surveyed in this Study are included in the J-PRISM project.

The objective of J-PRISM Objective is to strengthen the region's capacity through implementing the RS2010-2015 at both national and regional levels. J-PRISM focuses on the development of individual as well as institutional capacities in the SWM sector through sharing of Japan's technology and experience. In partnership with SPREP, and based on the three identified pillars J-PRISM is implementing the SWM capacity development in 11 Pacific Island Countries, during the project duration period of 2010 to 2015. The five PICs covered under this Project are included in the 11 PICs.

**Table 2-39 Summary of J-PRISM activities in the 5 PICs targeted under this Project**

Country	Brief description of J-PRISM activities
Fiji	Prepare the national strategy for waste minimization and implement throughout the country. In addition develop the 3Rs training program.
Samoa	Realize waste reduction in the capital Apia through increased public awareness and strengthening of 3Rs activities. In addition strengthen the landfills operation skills and develop a landfill operations training program for other PICs in Samoa.
Tonga	Improve waste collection and landfill conditions through development of the collection and disposal operations capabilities.
Tuvalu	Give strong emphasis to waste minimization through developing capacities of the waste management authorities in order to reduce the waste amounts.
Vanuatu	Objectives are to minimize waste in Port Villa and Luganville, promote recycling, and improve the operating capacity for the disposal site while decreasing the amounts of waste arriving there. In addition to develop a training program for landfill operation.
Source: J-PRISM Pre-implementation Evaluation Table	

### 2.5.2 RSWMS 2010-2015

To promote cooperation in the Pacific islands region and to provide assistance in order to protect and improve the environment and to ensure sustainable development for present and future generations, SPREP was established in 1993 in Samoa. It is composed of 21 Pacific Island Countries and five donor countries.

In this context the Pacific Regional Solid Waste Management Strategy 2010 – 2015 (RSWMS 2010-2015) was adopted by the SPREP member countries in November 2009. The RSWMS 2010-2015 Vision is “A healthy and a socially, economically and environmentally sustainable Pacific for future generations.” The Overall Goal is that “PICs and Territories will adopt cost-effective and self-sustaining SWM systems to protect the environment, in order to promote a healthy population and encourage economic growth.”<sup>6</sup>

RSWMS 2010-2015 has identified nine key strategic priority areas and allocated 41 high-level

<sup>6</sup> Preparatory Survey Report on J-PRISM

actions to these areas. The implementation plan is shown in Table 2-40.

**Table 2-40 RSWMS 2010-2015 Implementation Plan**

ACTION		TIME FRAME	LEAD AGENCY
<b>SUSTAINABLE FINANCING</b>			
1.	Update and disseminate regional information on the application of economic instruments	2012	SPREP
2.	Formulate a plan to implement appropriate economic instruments in each PIC	2011	CA <sup>(1)</sup>
3.	Use a regional approach to develop sustainable financing initiatives	2010	SPREP
<b>INTEGRATED SOLID WASTE MANAGEMENT</b>			
4.	Develop a model 4R regional strategy	2011	SPREP
5.	Develop National 4R strategies	2011	CA
6.	Assess and demonstrate new recycling methods	2013	SPREP
7.	Develop regional guidelines for waste disposal and environmental monitoring of disposal	2010	SPREP
8.	Improve existing disposal sites	2010-2015	CA
9.	Develop new landfills	2010-2015	CA
10.	Research and develop suitable disposal techniques for different solutions	2010	SPREP
11.	Develop regional options for managing difficult wastes	2011	SPREP
12.	Develop and action plan for improving the waste collection service	2011	CA
<b>LEGISLATION</b>			
13.	Undertake a sub-regional project to review and develop draft solid waste legislation	2010-2011	SPREP
14.	Enhance capacity of PICTs to enforce legislation through regional resources and initiatives	2012	SPREP
15.	Develop and implement enforcement plans in each country	2012	CA or MA <sup>(2)</sup>
16.	Engage the office of the Attorney General in each PICT	2010	CA or MA
<b>AWARENESS, COMMUNICATION &amp; EDUCATION</b>			
17.	Develop and disseminate a model national communication strategy	2011	SPREP
18.	Develop a national integrated communication strategy which encompasses social marketing	2011	CA
19.	Develop a Pacific Year of Action Against Waste Campaign	2012	SPREP
20.	Conduct regular regional waste forum or conference	2012-2013	SPREP
21.	Activate and implement existing education/awareness plans	2010	CA
<b>CAPACITY BUILDING</b>			
22.	Develop regional benchmarks in solid waste management	2010	SPREP
23.	Assess capacity gaps for solid waste management in PICTs	2011	CA
24.	Develop regional training priorities	2011-2012	SPREP
25.	Implement capacity building programmes, to address capacity gaps	2012	CA
26.	Conduct an annual training course in municipal solid waste management	2010-2015	SPREP
27.	Develop and deliver a specific training programme for atolls	2012	SPREP
28.	Develop a country attachment scheme	2013	SPREP
29.	Develop a solid waste training programme in conjunction with regional institutions	2010	SPREP
30.	Develop and maintain a regional inventory of skilled people	2010	SPREP
<b>ENVIRONMENTAL MONITORING</b>			
31.	Develop national environmental monitoring plans	2013	CA
32.	Develop institutional capacity of national, sub-regional, and regional laboratories for environmental monitoring	2014	SPREP

ACTION		TIME FRAME	LEAD AGENCY
POLICY, PLANNING, and PERFORMANCE			
33.	Develop national waste management policy, Strategy and action plan	2013	Government, CA
34.	Strengthen regional coordination of solid waste management	2010-2015	SPREP
35.	Establish and review national coordination of solid waste management	2010-2015	Government
36.	Develop standardized system for collecting, storing and analyzing waste management data	2011-2012	SPREP
SOLID WASTE INDUSTRY			
37.	Implement institutional and economic incentives, and subsidies based on market conditions	2010	CA
38.	Provide information and data on the solid waste sector to increase awareness of viable opportunities	2010-2015	CA
39.	Cultivate and strengthen partnerships with key stakeholders	2010-2015	CA, SPREP
MEDICAL WASTE			
40.	Develop model medical waste management strategy	2013	SPREP
41.	Develop a national medical waste management strategy	2013	CA
Notes: (1) CA; Coordinating Agency for solid waste management, (2) MA; Monitoring agency for solid waste management			
Source: Pacific Regional Solid Waste Management Strategy 2010 – 2015, SPREP, 2010			

This Study provides data, analysis and recommendations which are closely related to two of the key strategic priority areas; namely Integrated Solid Waste Management and Solid Waste Industry. The activities highlighted in yellow are expected to benefit from the findings of this Survey.

### 2.5.3 Preliminary Survey Report on Large/ Bulky Waste Management in the Pacific Islands

In 2004 JICA implemented a survey on the management of large and bulky wastes in four Pacific Island Countries (Samoa, Fiji, Palau and the Marshall Islands). The survey focused on used cars and electric goods.

Valuable data from that Survey on the estimated amounts of waste used cars and electric goods, in 2003 and future forecasts were reviewed by this Study and correlated with our estimates as appropriate.

The 2004 Survey report aptly summarized the condition at that time as follows;

*“With exports largely stagnating from these island nations, poor in both technology and resources, the import of many goods has increased markedly, and the material flow is biased in favor of imports from advanced industrial nations to the island nations. Because the cost of marine transport is high in the island nations, it is economically difficult to export the resources collected for recycling to industrialized nations. Furthermore, domestic recycling is difficult since there is no technological base for domestic recycling; and even if it existed, there isn’t a large*

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*enough market for recycled products. Therefore, most of the imported goods are discarded locally after consumption, and the problems of collection and disposal become evident.”<sup>7</sup>*

Finally the 2004 Survey produced general recommendations, as well as specific ones for each of the countries surveyed. Below are quoted some of the general strategies, policies and recommendations that remain valid to date as follows<sup>8</sup>:

1. *Maximization of the amount of resource recovered from waste:* Usable parts to be collected and re-used as much as possible, and when that is not possible to be recycled as raw materials.
2. *Prevention of environmental pollution by appropriate resource recovery:* Workers engaged in recycling activities need to be protected from health risks through improvement of working conditions and monitoring by relevant agencies.
3. *Maximize use of the private sector:* The involvement of the private sector remains an important factor to react to and deal with market fluctuations, under successful business practices.
4. *Creation of economic incentives for recycling through the Introduction of Economic Instruments:* In order to promote involvement of the private sector in the recycling business, governments of PICs need to introduce economic instruments such as deposit systems, subsidies, tax imposition, tax reduction, tax exemption, or fee collection to make the recycling profitable.
5. *Establishment of recycle fund:* The proposed fund would receive its resources from tariffs imposed on imports and specifically labeled for recycling. The fund may be used for covering portions of the collection and transport costs, including shipping.
6. *Appropriate recycling business operator certification system:* This proposal is relevant to protect the workers against health risks and also the surrounding environment against pollution from the recycling business activities.
7. *Establishment of a monitoring system:* This proposal refers to the need to keep track of the numbers of imported vehicles and white goods and the exported amounts of scrap metal and non-ferrous metals in order to understand the current conditions.
8. *Loan or supply of land to recycling business operators for storing collected resources:* This proposal facilitates the requirement by recycling companies to obtain land areas for

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<sup>7</sup> Source; Preliminary Survey Report on Large/Bulky Waste Management in the Pacific Island Countries, JICA, June 2004 (underlining is not in the original report), p. 74, section 6.3.2, second paragraph

<sup>8</sup> *Italics*, Source as 2 above, p. 79, section 7.1.3, 2) and 3), section 7.1.4, 2), p. 80, 3), section 7.2.2, p. 81, section 7.2.3, p. 82, sections 7.2.6 and 7.2.7, p. 83, sections 7.2.9, 7.2.10, 7.2.13 and 7.2.14

implementing their activities.

9. *Promoting construction of a recycling facility complex:* This proposal would allow for concentrating recycling companies in the same area and thereby making more efficient the collection and transport of recyclable waste to them as well as the overall monitoring of the area by the authorities.
10. *Donor support:* Under this proposal, the international donors are considered to have a role to provide technical support as well as “seed” money for the recycling businesses to grow.
11. *The role of SPREP:* The 2004 JICA Survey recommended that SPREP was the most suitable agency to explain that Survey’s contents and provide technical support to each country for the implementation. This remains very much valid today, as SPREP is urged to also use this 2012 JICA Survey as well.

#### 2.5.4 Good Practices

SPREP and J-PRISM introduced the Survey team to a number of good practices in recycling of bulky wastes in the PICs that were implemented in the last few years. Based on the literature received these good practices are briefly summarized in Table 2-41.

**Table 2-41 Good Practices on Recycling of Bulky Wastes in the PICs**

No.	PIC	Year	Targeted Waste
1	Kiribati	2008	Used vehicles
<p><u>Description<sup>(1)</sup>:</u>            The project was implemented by Lagoon Motors (LM, a local auto company), Icons Metal PTE Ltd. of Indonesia, under the administration of the Ministry of Environment &amp; Lands and Agriculture Development (MELAD) and with the cooperation of JICA and SPREP.            Collection works of scrap metal began by LM in June 2006 and by October 2008 1,803.4 metric tons of scrap metals and 200 tons of bottle gas cylinders were loaded onto the barge hired under the project and in November the barge started for Indonesia for recycling of the loaded waste.            The main constraints that were met during the project implementation were;</p> <ul style="list-style-type: none"> <li>  Reluctance of used car owners to release their waste cars to the project</li> <li>  Lack of appropriate machineries for processing, loading and transport</li> <li>  Shortage of stockpile areas</li> <li>  Limited expertise of the LM workers in this field</li> </ul> <p>To overcome the owners’ reluctance a public awareness campaign was conducted to compliment LM’s operations. The total project cost was AUD\$ 15,050.8 and the cost was shared by SPREP, JICA and LM.</p>			
2	Cook Islands	2010	eDay Cook Islands
<p><u>Description<sup>(2)</sup>:</u>            In December 2010 a national e-waste collection day (eDay) was jointly coordinated in the Cook Islands by the Office of the Prime Minister, National Environment Service, Ministry of Infrastructure and Planning (MOIP), E-Day New Zealand Trust, and others with donor support from the New Zealand Government. A total of 5,154 pieces of E-waste (1,147 computers, 1,101 monitors, 543 printers and scanners, and 476 keyboards) were exported.</p>			

No.	PIC	Year	Targeted Waste
3	Tonga	2010	E waste Management in Tonga
<p><u>Description<sup>(2)</sup>:</u>  A newly created non-profit organization, E-Waste Tonga was established in Nuku'alofa in 2010, and they have subsequently coordinated community workshops with outer islands (Ha'apai and Vava'u) to establish groundwork for implementing E-waste recycling programs. A private recycling company – GIO Recycling reportedly offers an incentive of 10 senti per kilogram of E-waste.</p>			
4	Palau	2011	Beverages Container Deposit System
<p><u>Description<sup>(2)</sup>:</u>  A new beverage container recycling program was launched in April 2011. Under this program every beverage container (empty or filled) manufactured in, or imported into Palau is charged a deposit of 10 cents per container and the funds deposited into a Recycling Fund. Five (5) cents is refunded to the bearer for each container returned to an authorized redemption center, and the remaining 5 cents support the administration of the program.</p>			
5	Tokelau	2011	Recyclable Waste Removal Program
<p><u>Description<sup>(2)</sup>:</u>  In April 2011, Tokelau embarked on a recyclable waste removal program, which by June 2011 had resulted in the removal of over 7 metric tons of recyclable waste to Samoa for further processing and export, and generated revenues to support further recycling. This was achieved under a memorandum of understanding (from 2007) between the environment ministries in both countries and with the partnership of a Samoan recycling company, and with financial and technical assistance from SPREP.</p>			
6	Kiribati	2012	Used vehicles
<p><u>Description<sup>(3)</sup>:</u>  A Project Officer was hired to organize the car wreck collection in South Tarawa. Wrecks were identified for collection and after obtaining the owners' agreement, the information was provided to local crane operators. The operators transported the wrecks to the Betio Materials Recovery Facility for a fixed price.  The landfill wheel loader was used to help the local scrap dealer in piling up the scrap materials salvaged from the used vehicles. A public campaign was organized for several weeks to inform the public on the collection scheme. The project was implemented under the New Zealand/Kiribati Solid Waste Management Initiative Project.</p>			
<p>Sources: (1) End of Phase One Report – Bulky Waste Pilot Project undertaken by Lagoon Motors, 26<sup>th</sup> March 2008  (2) Pacific Waste Line, Issue 2, June 2011, SPREP  (3) The Real Rubbish News, New Zealand/ Kiribati Solid Waste Management Initiative: Project Newsletter, September 2012</p>			

While the information on these projects may not be sufficient to make a detailed analysis, a number of significant similarities are apparent:

- | Most of the projects depend on foreign aid as well as local government subsidies
- | The projects are periodic and not continuous
- | Public awareness campaigns are necessary in order to convince owners of waste goods to release them for collection
- | Local recycling companies provide support to these projects
- | Foreign aid donors support to identify the countries where the waste goods will be exported to

There is no clear information available as to whether shipping companies supported these

projects through offering reductions in shipping costs or increasing ship calls

## **2.6 Summation of RWG and RWM Conditions in the PICs**

The findings of the Study on the RWG and RWM by item and country are provided in the following Tables 2-42 to 2-46. The tables are designed to discuss the issues related to each item of the RWG and RWM separately. It should be noted however, that for “Other Metal Products” information is provided only for Fiji since it is a substantial amount in that country. The amounts introduced in the Tables have been prepared based on the findings described in this Chapter and the estimation processes shown in the following Chapter 3.

**Table 2-42 Present status of Recyclable Waste Goods supply and Recycled Waste Materials quantities; (1) Fiji**

No.	Recyclable Waste Goods					Recycled Waste Materials			
	Waste Goods	Generated amounts (ton/year)	Collection Systems	Recyclers Conditions	Consideration Points	Recycled Waste Materials	Recycling Markets		Consideration Points
							Domestic	Foreign	
1	Vehicles	9,060ton	<ul style="list-style-type: none"> <li>- Owners bring discarded vehicles to recyclers or recyclers collect discarded vehicles in response to the request from the owners.</li> <li>- Recyclers pick up discarded vehicles</li> <li>- Tenders called by government to sell discarded vehicles</li> <li>- Many recyclable materials are stripped from the vehicles before arriving to the yard</li> </ul>	<ul style="list-style-type: none"> <li>- Yards have limited space for work</li> <li>- After removal of engine and all non-metal parts, frame is cut and crushed to fit into container</li> <li>- Some parts are kept for sale as spare parts</li> <li>- Vehicles are stacked up waiting to be dismantled</li> </ul>	<ul style="list-style-type: none"> <li>- Tires, plastic and glass and other non-ferrous metals are mostly not recycled</li> <li>- Recycling equipment used is primitive</li> <li>- Unsafe working conditions</li> <li>- Environmental and health concerns, especially battery recycling.</li> </ul>	Scrap metal: 5,889 ton (Recycling rate is 65%) Spare parts representing negligible share by weight	- Spare parts	- As scrap metal to Korea, Australia, New Zealand etc.	<ul style="list-style-type: none"> <li>- Low demand in domestic market for tires and plastics</li> <li>- Mixing of ferrous and non-ferrous scrap metals and ferrous light and heavy scrap metals in containers is common</li> </ul>
2	White Goods		<ul style="list-style-type: none"> <li>- Owners bring discarded white goods to recyclers or recyclers collect waste goods in response to the request from the owners.</li> <li>- In some areas "Contractors" collect directly from waste generators and bring to recyclers</li> </ul>	<ul style="list-style-type: none"> <li>- Yards have limited space for work</li> <li>- After removal of electric motor, compressor and all non-metal parts, frame is cut and crushed to fit into container</li> <li>- Motors and compressors are exported as heavy metals, mostly without cutting</li> <li>- Rare earth minerals are reported to be salvaged from PC by one recycler</li> </ul>	<ul style="list-style-type: none"> <li>- Plastic and other non-ferrous metals are mostly not recycled</li> <li>- Recyclers have lower interest in the white goods than vehicles due to less metals</li> <li>- Rare earth minerals are mostly not salvaged</li> <li>- Recycling equipment used is primitive</li> <li>- Unsafe working conditions</li> <li>- Dealers are not involved in recycling effort</li> </ul>	Scrap metal: 230 ton (Recycling rate is 20%) Spare parts representing negligible share by weight	- Spare parts	- As scrap metal to Korea, Australia, and New Zealand etc.	<ul style="list-style-type: none"> <li>- Low demand in domestic market for plastics</li> <li>- Mixing of ferrous and non-ferrous scrap metals and ferrous light and heavy scrap metals in containers is common</li> </ul>
2.1	TV	61ton							
2.2	Refrigerator	359ton							
2.3	Washing machine	194ton							
2.4	Microwave	106ton							
2.5	Air conditions	213ton							
2.6	PC	63ton							
3	Cans		<ul style="list-style-type: none"> <li>- Steel and aluminum cans are sold to recycler yards either directly bringing to yard or collected by recycler</li> <li>- Some aluminum cans are sold to drink manufacturers either directly bringing to plant or collected by manufacturer</li> <li>- In some areas "Contractors" collect directly from waste generators and bring to recyclers</li> </ul>	<ul style="list-style-type: none"> <li>- Cans arriving at the yards are pressed and loaded into the containers, often mixed with other scrap metals</li> <li>- Recycling of aluminum cans at beverages manufacturer is operated efficiently with separation, pressing and baling</li> </ul>	<ul style="list-style-type: none"> <li>- Speedy resolution of CDL issue between DOE and manufacturers</li> <li>- Minimum waste separation at source</li> <li>- Recycling equipment used for steel cans is primitive</li> </ul>	Scrap steel cans: 750 ton (Recycling rate is 40%) Aluminum cans : 562 ton (Recycling rate is 40%)	None	<ul style="list-style-type: none"> <li>- Aluminum cans to New Zealand</li> <li>- As scrap metal to Korea, Australia, and New Zealand etc.</li> </ul>	<ul style="list-style-type: none"> <li>- No domestic demand for aluminum and steel cans</li> <li>- Materials for cans manufacture are brought from abroad</li> </ul>
3.1	Steel can	1,875ton							
3.2	Aluminum can	1,405ton							
4	Pet Bottles	2,345ton	<ul style="list-style-type: none"> <li>- Pet bottles are sold to drink manufacturers or recyclers either directly</li> </ul>	<ul style="list-style-type: none"> <li>- Recycling of pet bottles at beverages manufacturer and</li> </ul>	<ul style="list-style-type: none"> <li>- Speedy resolution of CDL issue between DOE and manufacturers</li> </ul>	Pet bottles: 704 ton (Recycling rate is 30%)	None	<ul style="list-style-type: none"> <li>- Pet bottles to New Zealand (%)</li> </ul>	<ul style="list-style-type: none"> <li>- No domestic demand for pet bottles</li> <li>- Materials for pet bottles</li> </ul>



No.	Recyclable Waste Goods					Recycled Waste Materials			
	Waste Goods	Generated amounts (ton/year)	Collection Systems	Recyclers Conditions	Consideration Points	Recycled Waste Materials	Recycling Markets		Consideration Points
							Domestic	Foreign	
			bringing to plant or collected by them - In some areas “Contractors” collect directly from waste generators and bring to recyclers	recyclers is operated efficiently with separation, pressing and baling - Hard plastic caps are removed either before bringing to plant or at plant but thin plastic seal	- No waste separation at source - Waste picking at disposal site				manufacture brought from abroad
5	Paper & Cardboard	13,754ton	- Recyclers collect waste papers in response to the request from the business entities and households. - 2.5 tons of waste papers for one month are sold to toilet paper manufacturer either directly bringing to plant or collected by manufacturer trucks - In some areas “Contractors” collect directly from waste generators and bring to recyclers	- Waste papers including cardboard collected by recyclers are compressed and exported. - Plant operated for toilet paper manufacture - Contaminated paper separated - PR for waste paper recycling done by plant resources - Cardboard is not accepted at the plant	- No waste separation at source for domestic waste - Source separation at offices, etc. sporadic	Paper & Cardboard: 1,375 ton (Recycling rate is 10%)	- Production of toilet paper (3 %)	- Paper to: Korea, Australia, New Zealand, ... - Cardboard to: Korea, Australia, New Zealand, ...	- No domestic demand for cardboard - Domestic demand for waste paper covers 3% of total waste paper generated
6	Other Metal Products	33,649ton				Scrap metal: 28,602 ton (Recycling rate is 85%)			
6.1	Ships		- Waste ships are sold by government through open tender	- Equipment and capacity reportedly available (could not visit yard)	- Concentration on scrap metal - Other materials as plastics, rare earth minerals, etc. are not salvaged		None	- As scrap metal to Korea, Australia, and New Zealand etc.	- No domestic demand for scrap metal
6.2	Construction waste		- Waste is sold to recyclers, but mostly mixed with concrete and other materials	- Yards have limited space for work	- No, or insufficient waste separation at construction and demolition sites - Recycling equipment used is primitive		Reported to be limited	- As scrap metal to Korea, Australia, and New Zealand etc.	- No domestic demand for scrap metal - No domestic demand for other construction waste types
6.3	Heavy equipment (incl. plant)		- Waste plant is sold by government through open tender (e.g. FSC) - Waste equipment is sold to recyclers either directly bringing to plant or collected by manufacturer trucks	- Equipment and capacity reportedly available at specialized yards (could not visit yard) - General yards have limited space for work	- Concentration on scrap metal - Rare earth minerals are not salvaged		None	- As scrap metal to Korea, Australia, and New Zealand etc.	- No domestic demand for scrap metal
6.4	Gas Containers (for households)		- Containers are purchased directly from the gas company by tender - Some containers are	- Containers may be dangerous and some recyclers refuse to export them - Containers are usually	- In some yards, containers were observed to be put into export containers in their original shape			- As scrap metal to Korea, Australia, and New Zealand etc.	- No domestic demand for scrap metal - No manufacturing of gas containers in Fiji

No.	Recyclable Waste Goods					Recycled Waste Materials			
	Waste Goods	Generated amounts (ton/year)	Collection Systems	Recyclers Conditions	Consideration Points	Recycled Waste Materials	Recycling Markets		Consideration Points
							Domestic	Foreign	
			brought to the recyclers by "Contractors"	cut and reportedly not exported in their original condition as this is dangerous					
6.5	Others							- As scrap metal to Korea, Australia, and New Zealand etc.	

Table 2-43 Present status of Recyclable Waste Goods supply and Recycled Waste Materials; (2) Samoa

Tim	Recyclable Waste Goods					Recycled Waste Materials			
	Waste Goods	Generated amounts (ton/year)	Collection Systems	Recyclers Conditions	Consideration Points	Recycled Waste Materials	Recycling Markets		Consideration Points
							Domestic		
1	Vehicles	2,172ton	- Waste collection company collect discarded vehicles every three month without charge - Owners bring discarded vehicles to recyclers or recyclers take waste vehicles in response to the request from the owners. - Recyclers pick up discarded vehicles - Many recyclable materials are stripped from the vehicles before arriving to the yard	- Yards have limited space for work - After removal of engine and all non-metal parts, frame is cut and crushed to fit into container	- Tires, plastic and glass and other non-ferrous metals are mostly not recycled - Recycling equipment used is primitive - Unsafe working conditions - Environmental and health concerns, especially battery recycling. -	Scrap metal: 1,086 ton (50%) Spare parts	- Spare parts	- Scrap metal to: Korea, Australia, New Zealand, etc.	- Low demand in domestic and international market for tires and plastics - Mixing of ferrous and non-ferrous scrap metals and ferrous light and heavy scrap metals in containers is common
2	White Goods		- Waste collection company collect the discarded white goods every three month without charge - Owners bring discarded white goods to recyclers or recyclers take waste vehicles in response to the request from the owners.	- Yards have limited space for work - After removal of electric motor, compressor and all non-metal parts, frame is cut and crushed to fit into container - Basal plates are salvaged	- Plastic and other non-ferrous metals are mostly not recycled - Recyclers have lower interest in the white goods than vehicles due to less metals - Recycling equipment used is primitive - Unsafe working conditions - Dealers are not involved in recycling effort	Scrap metal: 41ton (50%) Spare parts	- Spare parts	- Scrap metal to: Korea, Australia, New Zealand	- Low demand in domestic and international market for plastics - Mixing of ferrous and non-ferrous scrap metals and ferrous light and heavy scrap metals in containers is common
2.1	TV	7ton							
2.2	Refrigerator	45ton							
2.3	Washing machine	13ton							
2.4	Air conditions	18ton							
2.5	PC	21ton							
2.6	Microwave	14ton							
3	Cans		- Cans are sold to recyclers either directly bringing to yard or collected by recycler - Waste pickers remove cans from disposal sites and sell to recyclers or plants	- Cans arriving at the recyclers are pressed and loaded into the containers, often mixed with other scrap metals	- No waste separation at source - Waste picking at disposal site - Recycling equipment used for tin cans is primitive	Scrap steel cans: 175 ton (30%) Aluminum cans : 110 ton (30%)	None	- Aluminum cans to New Zealand, - Scrap metal to: Korea, Australia, New Zealand, etc.	- No domestic demand for aluminum and steel cans
3.1	Steel can	582ton							
3.2	Aluminum can	366ton							
4	Pet Bottles	1,313ton	- Pet bottles are not collected.	- Although a recycler tried to expert PET bottles to New Zealand, the quarantine station in New Zealand rejected the bottles due to law quality.	- There is no recycler for the PET bottles.	Pet bottles: 13 ton (1%)	None	- Pet bottles to New Zealand	Law quality of the exported bottles
5	Paper & Cardboard	1,394ton	- No collection system	- No recycling system	- There is no recycler for the paper and cardboard.	Paper & Cardboard: 0 ton (0%)			

Table 2-44 Present status of Recyclable Waste Goods supply and Recycled Waste Materials; (3) Tonga

No.	Recyclable Waste Goods					Recycled Waste Materials			
	Waste Goods	Generated amounts (ton/year)	Collection Systems	Recyclers Conditions	Consideration Points	Recycled Waste Materials	Recycling Markets		Consideration Points
							Domestic	Foreign	
1	Vehicles	1,872ton	- Owners bring discarded vehicles to a recycler or the recycler picks-up discarded vehicles in response to the request from the owners.	- Yards have limited space for work - After removal of engine and all non-metal parts, frame is cut and crushed to fit into container - The recycler trying to obtain permission from New Zealand for exporting batteries.	- Tires, plastic and glass and other non-ferrous metals are mostly not recycled - Recycling equipment used is primitive - Unsafe working conditions - Low number of recycling companies	Scrap metal: 468 ton (25%) Spare parts	- Spare parts	- New Zealand (100%), etc.	- Low demand in domestic and international market for tires and plastics - Mixing of ferrous and non-ferrous scrap metals and ferrous light and heavy scrap metals in containers is common
2	White Goods		- Owners bring discarded white goods to the recycler or the recycler picks-up discarded goods in response to the request from the owners. - Owner put discarded white goods to deposit boxes.	- Yards have limited space for work - After removal of electric motor, compressor and all non-metal parts, frame is cut and crushed to fit into container - Basal plates are salvaged	- Plastic and other non-ferrous metals are mostly not recycled - Recycling equipment used is primitive - Unsafe working conditions - Dealers are not involved in recycling effort - Low number of recycling companies	Scrap metal: 9 ton (10%) Spare parts	- Spare parts	- New Zealand (100%), etc.	- Low demand in domestic and international market for plastics - Mixing of ferrous and non-ferrous scrap metals and ferrous light and heavy scrap metals in containers is common
2.1	TV	6ton							
2.2	Refrigerator	36ton							
2.3	Washing machine	21ton							
2.4	Microwave	5ton							
2.5	Air conditions	11ton							
2.6	PC	7ton							
3	Cans		- Cans are sold to the recycler either directly bringing to yard or collected by recycler - Residents put cans to deposit boxes	- Cans arriving at the recycler are pressed and loaded into the containers, often mixed with other scrap metals	- Recycling equipment used for tin cans is primitive	Scrap steel cans : 56 ton (15%) Aluminum cans: 49 ton (15%)	None	- Aluminum cans to New Zealand (100%), - Scrap metal to: New Zealand (100%)	
3.1	Steel can	373ton							
3.2	Aluminum can	327ton							
4	Pet Bottles	336ton	- Residents put cans to deposit boxes	- The recycler stocks the pet bottles for future export.		The recycler stocks the pet bottles for future export. However the PET bottles have not yet been exported.	None		Law quantity of collected PET bottles
5	Paper & Cardboard	700ton	- No collection system	- No recycling system	- There is no recycler for the paper and cardboard.	Paper & Cardboard: 0 ton (0%)			

Table 2-45 Present status of Recyclable Waste Goods supply and Recycled Waste Materials quantities (4) Tuvalu

No.	Recyclable Waste Goods					Recycled Waste Materials			
	Waste Goods	Generated amounts (ton/year)	Collection Systems	Recyclers Conditions	Consideration Points	Recycled Waste Materials	Recycling Markets		Consideration Points
							Domestic	Foreign	
1	Vehicles	46 ton	- Owners bring discarded vehicles to a recycler	- The yard has limited space for work - The recycler has no staff. - The recycler does not have basic equipment for cut and compress. They use saw and hammer.	- Recycling equipment used is not suitable - Environmental and health concerns, especially battery recycling. - Only one recycler company	Scrap metal: 9ton (20%) Spare parts	- Spare parts	- Scrap metal to: New Zealand (100%)	- Mixing of ferrous and non-ferrous scrap metals and ferrous light and heavy scrap metals in containers is common
2	White Goods		- Owners bring discarded white goods to a recycler or the Recycler picks-up discarded white goods	- Yard has limited space for work - The recycler has no staff. - The recycler does not have basic equipment for cut and compress. They use saw and hammer.	- Plastic and other non-ferrous metals are mostly not recycled - Recycling equipment used is not suitable - Environmental and health concerns - Only one recycler company	Scrap metal: 1 ton (20%) Spare parts	- Spare parts	- Scrap metal to: New Zealand (100%)	- Mixing of ferrous and non-ferrous scrap metals and ferrous light and heavy scrap metals in containers is common
2.1	TV	0 ton							
2.2	Refrigerator	4 ton							
2.3	Washing machine	2 ton							
2.4	Microwave	0 ton							
2.5	Air conditions	1 ton							
2.6	PC	0 ton							
3	Cans		- The recycler collect cans from restaurants, hotels etc.	- Cans arriving at the recyclers are pressed and loaded into the containers	- Recycling equipment used is not suitable	Scrap steel cans: 15 ton (30%) Aluminum cans: 2 ton (30%)	None	- Aluminum cans to New Zealand (100%), - Scrap metal to: New Zealand (100%)	
3.1	Steel can	49 ton							
3.2	Aluminum can	8 ton							
4	Pet Bottles	17 ton	- No collection system	- No recycling system	- There is no recycler.	Pet bottles: 0 ton (0%)	None		
5	Paper & Cardboard	159 ton	- No collection system	- No recycling system	- There is no recycler.	Paper & Cardboard: 0 ton (0%)			

Table 2-46 Present status of Recyclable Waste Goods supply and Recycled Waste Materials quantities; (5) Vanuatu

No.	Recyclable Waste Goods					Recycled Waste Materials			
	Waste Goods	Generated amounts (ton/year)	Collection Systems	Recyclers Conditions	Consideration Points	Recycled Waste Materials	Recycling Markets		Consideration Points
							Domestic	Foreign	
1	Vehicles	2,146 ton	- Owners bring discarded vehicles to recyclers or recyclers pick up discarded vehicles in response to the request from the owners. - Recyclers pick up abandoned vehicles from landfill site etc.	- After removal of engine and all non-metal parts, frame is cut and crushed to fit into container	- Tires, plastic and glass and other non-ferrous metals are mostly not recycled - Unsafe working conditions - Environmental and health concerns, especially battery recycling.	Scrap metal: 858 ton (40%)		- Scrap metal to: Korea (%), New Zealand (%), India(%), etc.	- Low demand in domestic and international market for tires and plastics - Mixing of ferrous and non-ferrous scrap metals and ferrous light and heavy scrap metals in containers is common
2	White Goods		- Owners bring discarded white goods to recyclers or recyclers pick up the discarded white goods in response to the request from the owners.	- After removal of electric motor, compressor and all non-metal parts, frame is cut and crushed to fit into container - Basal plates are salvaged	- Plastic and other non-ferrous metals are mostly not recycled - Recyclers have lower interest in the white goods than vehicles due to less metals - Dealers are not involved in recycling effort	Scrap metal: 31 ton (30%)		- Scrap metal to: Korea (%), New Zealand (%), India(%), etc.	- Low demand in domestic and international market for plastics - Mixing of ferrous and non-ferrous scrap metals and ferrous light and heavy scrap metals in containers is common
2.1	TV	9 ton							
2.2	Refrigerator	29 ton							
2.3	Washing machine	18 ton							
2.4	Microwave	7 ton							
2.5	Air conditions	15 ton							
2.6	PC	15 ton							
3	Cans		- Cans are sold to recyclers either directly bringing to yard or collected by recycler	- Cans arriving at the recyclers are pressed and loaded into the containers, often mixed with other scrap metals	- No waste separation at source	Scrap steel cans: 124 ton (30%) Aluminum cans: 124 ton (30%)	None	- Scrap metal to: Korea (%), New Zealand (%), India(%), etc.	
3.1	Steel can	412 ton							
3.2	Aluminum can	412 ton							
4	Pet Bottles	916 ton	- No collection system	- No recycling system	- There is no recycler.	Pet bottles: 0 ton (0%)	None		
5	Paper & Cardboard	2,038 ton	- No collection system	- No recycling system	- There is no recycler.	Paper & Cardboard: 0 ton (0%)			

## Chapter 3. Estimates of Present and Projected Waste Materials Generation, Collection and Export under Reverse Logistics

### 3.1 Estimation of Recyclable Waste Goods

#### 3.1.1 Estimation Method

##### (1) Targeted Recyclable Waste Goods

The waste goods that are targeted for recycling and exporting under reverse logistics are described in Table 3-1, as well as the recycled waste materials that may be extracted from these waste goods and exported. In theory more materials may be extracted and recycled, such as glass, fabrics and waste oil but these may not be suitable for exports.

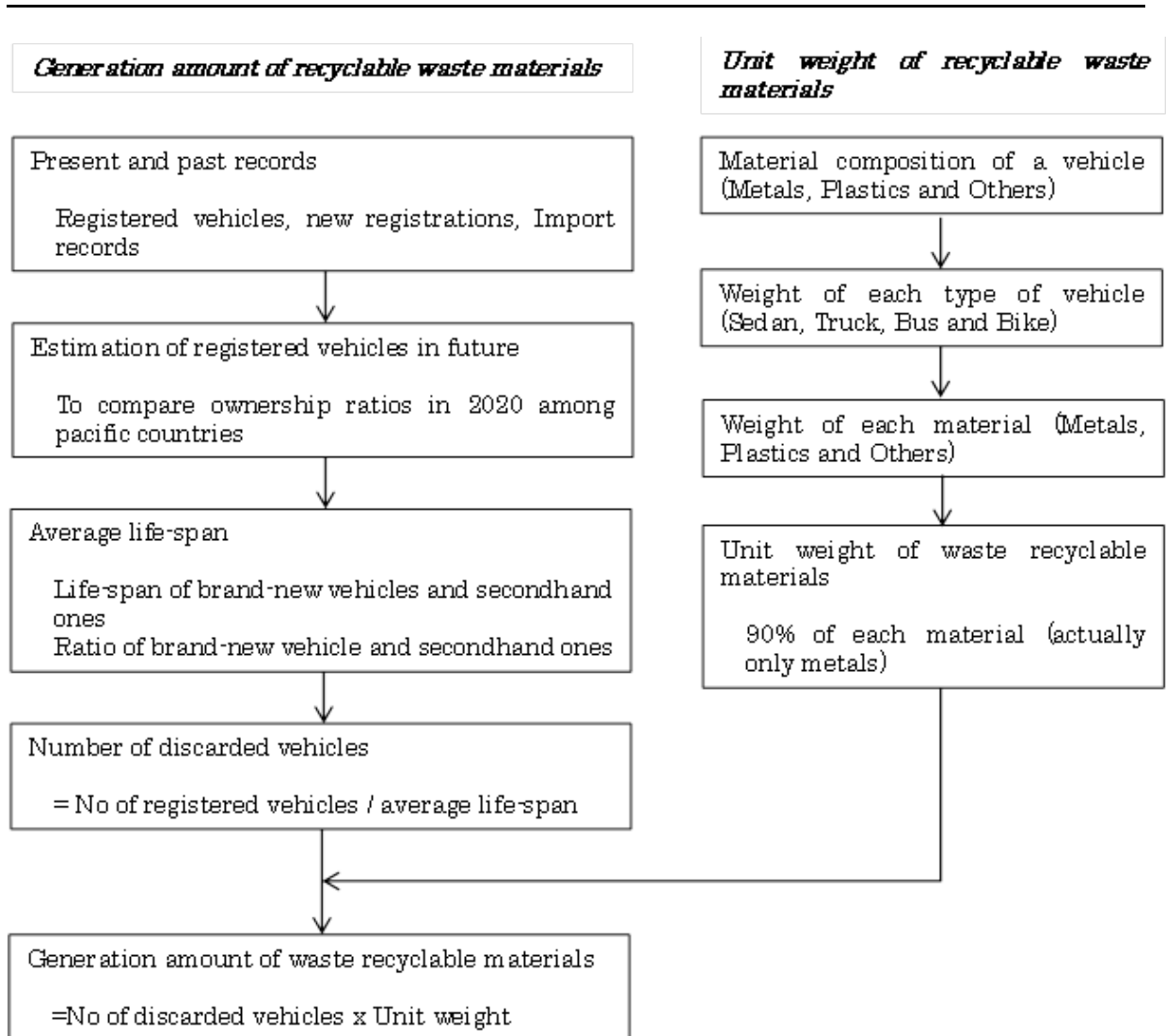
**Table 3-1 Targeted Recyclable Waste Goods and Recycled Waste Materials**

No.	Recyclable Waste Goods	Recycled Waste Materials suitable for Reverse Logistics
1	Vehicles	Metal (ferrous, non-ferrous), plastic
2	White Goods (electrical appliances used in homes and offices)	Metal (ferrous, non-ferrous), plastic
3	All other metal products that have metallic components excluding the above. Examples of these products include construction equipment, ships, furniture, gas cylinders, heavy equipment,	Metal (ferrous, non-ferrous)
4	Cans	Aluminium and tin cans
5	Pet bottles	Plastic
6	Paper & cardboard	Paper & cardboard

Source: JICA Study Team

##### (2) Recyclable Waste Materials from Discarded Vehicles

In order to estimate the future number of discarded vehicles and the amount of recycled waste materials that may be salvaged from them, the calculation process shown in Figure 3-1 was adopted.



**Figure 3-1 Estimation Process for the Amounts of Recycled Materials salvaged from Discarded Vehicles**

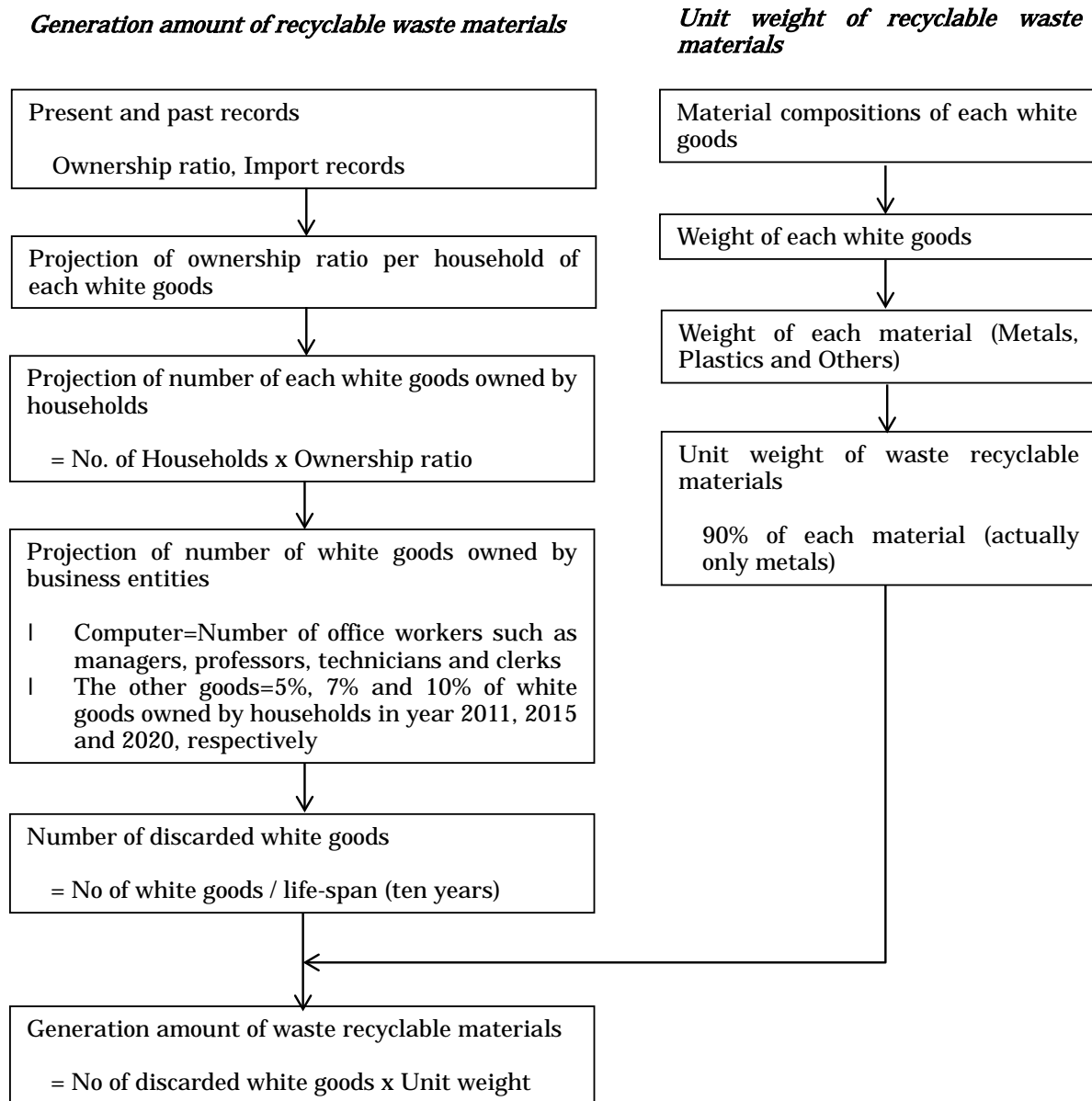
There were basically two estimation flows in parallel; the first was to determine the number of discarded vehicles, by vehicle type to be collected by the recycling companies. The total numbers of registered vehicles for the year 2020 were projected, by vehicle type, taking into account the vehicle ownership rates trend, and socioeconomic projections. The registered vehicles include the vehicles registered in the past years and still in service and the vehicles expected to be registered in 2020. The life span of the vehicles was adopted based on the survey result. Accordingly the total number of discarded vehicles in 2020 was obtained. Not all of the discarded vehicles may be collected by recyclers for salvaging of the recyclable waste materials, and in the case of Fiji a collection rate of 70% in 2020 was assumed. This is higher than the present estimate of the respective value of 60% in that country, assuming that more improvement will be introduced to increase the collection rate. Therefore the number of discarded vehicles that would be collected by the recycler companies was determined.



On the other hand, in the second estimation flow the unit weights of each of the recyclable materials that will be salvaged from the discarded vehicles were estimated. This is necessary to quantify each of the recyclable material types in terms of their weight. The average total weight by vehicle type was assumed considering manufacturers' data and the vehicle types prevalent in the PICs. The ratios of the recyclable materials of the average total vehicle weight, for each vehicle type, were adopted, again based on manufacturers' data. The materials included metal, plastics and others. Considering that it would be difficult to dismantle and collect the total estimated weight of the recycled waste materials, a recovery rate of 90% was assumed for each vehicle. From this estimation flow the unit weights of the recyclable materials (metal weight in kg/vehicle, others weight in kg/vehicle) were determined.

**(3) Recycled Waste Materials from Discarded White Goods**

The estimation method for projection of amounts of recyclable waste materials salvaged from discarded white goods is shown in Figure 3-2.



**Figure 3-2 Estimation Process for the Amounts of Recycled Waste Materials salvaged from Discarded White Goods**

In a similar manner to the estimation process adopted for the discarded vehicles, the collected amounts of discarded waste goods, by type of goods, and the unit weights of each of the recyclable materials in each respective goods, are estimated.

Applying past trends of white goods ownership and rates of imports, future ownership projections of white goods are estimated for each household. On the other hand, white goods owned by businesses, excluding personal computers, are also estimated assuming ratios of 5% of households estimated amount in 2011, 7% in 2015 and 9% in 2020. In the case of computers ownership by business concerns, the estimated projections were linked to the staff numbers, and their positions and assuming that by 2020 there would be one computer per staff of certain levels (managers, technical,

etc.). The average life span for the white goods was assumed to be 10 years.

**(4) Unit Weights for Vehicles and White Goods**

Based on the collection of data both in Japan and the five PICs covered under this Study, the unit weights of recyclable waste materials that may be salvaged from vehicles and white goods were set as shown in Table 3-2.

Table 3-2 Unit Weight of recyclable materials salvaged from vehicles and white goods

Unit Weights of recyclable materials salvaged from vehicles and white goods										
Products	Material composition (%) <sup>(1)</sup>			Collection rate (%) <sup>(2)</sup>			Unit weight(kg) <sup>(3)</sup>	Unit weight per product (kg/product)		
	parts/body	Plastic	parts/bod	Plastic	Others	parts/body		Plastic	Others	
<b>A. VEHICLES</b>										
Sedan	87	-	78	-	22	1,475	1,151	-	324	
Truck	87	-	78	-	22	4,180	3,260	-	920	
Bus	87	-	78	-	22	7,590	5,920	-	1,670	
Motorcycle	87	-	78	-	22	114	89	-	25	
<b>B. WHITE GOODS</b>										
CRT TV	17.8	16.1	16	13	71	28	4	4	20	
Refrigerator	52.4	43.3	47	35	18	58	27	20	11	
Washing machine	61.5	34.7	55	28	17	31	17	9	5	
Microwave	76.9	7.5	69	6	25	20	14	1	5	
AC set	73	18.5	66	15	19	43	28	6	9	
Desktop PC	63.7	4.9	57	4	39	11	6	0	5	

Source: (1) & (3) White goods; White Goods Association Data Book, Japan; Ministry of Economy and Industry, Vehicles; Industry published documents, Japan  
(2) Salvage rate assumed to be 90%

### 3.1.2 Estimation of Recyclable Waste Goods Generated

#### (1) Projections of population and households

Present and projected populations and numbers of households in 2011 and 2020 are shown in Table 3-3 for the five PICs.

**Table 3-3 Projections of Populations and Households**

Populations and Households		Fiji	Samoa	Tonga	Tuvalu	Vanuatu
Year 2011	Population (capita)	854,120	184,864	103,036	9,531	251,500
	Household (number)	177,933	24,354	18,053	1,597	50,911
Year 2020	Population (capita)	875,758	192,508	108,673	9,708	304,025
	Household (number)	182,441	25,360	19,041	1,626	61,543

Notes: Population projections are interpolated from official projections collected from each of the five PICs. Projected numbers of households are estimated based on the same growth rates as those of the population projections

#### (2) Projections of vehicles

In order to estimate the amounts of recycled waste materials from discarded vehicles, ownership rates per 1,000 capita are assumed for the five Pacific Island Countries as shown in Table 3-4. The registered vehicles were estimated based on the ownership per 1,000 capita.

**Table 3-4 Assumptions of Vehicle Projections**

Registered Vehicles		Fiji	Samoa	Tonga	Tuvalu	Vanuatu
Year 2011	Vehicle Ownership per 1,000 capita	96	89	195	170	56
	Registered vehicles	81,787	16,394	20,081	1,617	13,989
Year 2020	Vehicle ownership per 1,000 capita	100	100	200	200	100
	Registered vehicles	87,576	19,251	21,735	1,942	30,403

Source: JICA Study Team

The amounts of recyclable materials<sup>9</sup> that may be salvaged from discarded vehicles were estimated based on the numbers of registered vehicles, life-spans of the vehicles and unit weights of recyclable materials, as shown in Table 3-5. Vehicle life-spans were calculated using the average life-spans of brand-new vehicles and second hand vehicles obtained through this study.

<sup>9</sup> The salvaged recyclable materials referred to here are the potential amounts that may be processed to recycled waste materials.

**Table 3-5 Projections of recyclable materials that may be salvaged from discarded vehicles**

Item / PICs		Fiji	Samoa	Tonga	Tuvalu	Vanuatu
Life-span (years)		17.3	10.3	17.0	10.0	14.0
Year 2011	Discarded Units (vehicle)	4,728	1,592	1,181	162	999
	Total recyclable materials (ton/year)	11,614	2,752	2,400	58	2,751
	-Scrap metals	9,060	2,172	1,872	46	2,146
	-Others	2,554	580	528	12	605
Year 2020	Discarded Units	5,062	1,869	1,279	194	2,172
	Total recyclable materials (ton/year)	12,435	3,234	2,599	69	5,973
	-Scrap metals	9,701	2,553	2,028	55	4,659
	-Others	2,734	681	571	14	1,314

Source: JICA Study Team

**(3) Projections of white goods**

In order to estimate amounts of recyclable materials that may be salvaged from discarded white goods, household ownerships and units of white goods by type owned by businesses and offices in 2011 and 2020 were assumed as shown in Table 3-6.

**Table 3-6 Assumption of White Goods Projections**

Items		Fiji	Samoa	Tonga	Tuvalu	Vanuatu
Year 2011	Household ownership					
	Televisions	80%	70%	80%	55%	40%
	Refrigerator, Freezers	70%	65%	70%	90%	20%
	Washing machines	60%	30%	65%	70%	20%
	Microwaves	40%	50%	20%	5%	10%
	Air conditioners	40%	30%	20%	5%	10%
	Computers	30%	25%	20%	30%	10%
	Units owned by businesses and offices					
	Televisions	7,237	852	723	44	1,019
	Refrigerator, Freezers	6,333	792	632	72	509
	Washing machines	5,428	365	587	56	509
	Microwaves	3,619	609	180	4	255
	Air conditioners	3,619	365	180	4	255
	Computers	50,744	16,998	7,569	708	19,187
	Total units	655,972	85,737	59,517	4,960	77,735
	Televisions	151,985	17,900	15,165	922	21,383
	Refrigerator, Freezers	132,987	16,622	13,269	1,509	10,691
	Washing machines	113,989	7,671	12,321	1,174	10,691
	Microwaves	75,993	12,786	3,791	84	5,346
Air conditioners	75,993	7,671	3,791	84	5,346	
Computers	105,025	23,087	11,180	1,187	24,278	
Year 2020	Household ownership					
	Televisions	90%	70%	90%	60%	70%
	Refrigerator, Freezers	80%	75%	75%	90%	40%

Items		Fiji	Samoa	Tonga	Tuvalu	Vanuatu
	Washing machines	70%	30%	75%	70%	40%
	Microwaves	50%	60%	25%	5%	20%
	Air conditioners	50%	40%	25%	5%	30%
	Computers	40%	35%	40%	50%	30%
	Units owned by businesses and offices					
	Televisions	14,656	1,598	1,542	87	3,877
	Refrigerator, Freezers	13,027	1,712	1,285	132	2,216
	Washing machines	11,399	685	1,285	103	2,216
	Microwaves	8,143	1,369	429	8	1,107
	Air conditioners	8,143	913	429	8	1,662
	Computers	52,029	17,699	7,983	734	23,195
	Total units	794,948	102,592	75,788	5,624	175,822
	Televisions	177,497	19,350	18,679	1,063	46,957
	Refrigerator, Freezers	157,775	20,732	15,566	1,595	26,833
	Washing machines	138,053	8,293	15,566	1,241	26,833
	Microwaves	98,610	16,585	5,189	89	13,416
	Air conditioners	98,610	11,057	5,189	89	20,125
	Computers	124,403	26,575	15,599	1,547	41,658

Source: JICA Study Team

Recyclable materials that may be salvaged from white goods were estimated based on the total units, life-span of the vehicles and unit Weights of recyclable materials as shown in Tables 3-7 and 3-8. It was assumed that the life-span of white goods is 10 years.

**Table 3-7 Estimated recyclable materials that may be salvaged from discarded white goods (Year 2011)**

Item		Fiji	Samoa	Tonga	Tuvalu	Vanuatu
Televisions	Discarded Units	15,199	1,790	1,517	92	2,138
	Total recyclable materials (ton/year)	426	50	42	2	60
	-Scrap metals	61	7	6	0	9
	-Others	365	43	36	2	51
Refrigerator, Freezers	Discarded Units	13,299	1,662	1,327	151	1,069
	Total recyclable materials (ton/year)	771	97	77	9	62
	-Scrap metals	359	45	36	4	29
	-Others	412	52	41	5	33
Washing machines	Discarded Units	11,399	767	1,232	117	1,069
	Total recyclable materials (ton/year)	354	24	38	4	33
	-Scrap metals	194	13	21	2	18
	-Others	160	11	17	2	15
Microwaves	Discarded Units	7,599	1,279	379	8	535
	Total RWG	152	26	7	0	10
	Total recyclable materials (ton/year)	106	18	5	0	7
	-Others	46	8	2	0	3
Air conditioners	Discarded Units	7,599	767	379	8	535
	Total RWG	327	33	17	0	23

Item		Fiji	Samoa	Tonga	Tuvalu	Vanuatu
	Total recyclable materials (ton/year)	213	21	11	0	15
	-Others	114	12	6	0	8
Computers	Discarded Units	10,502	2,309	1,118	119	2,428
	Total RWG	116	26	13	2	27
	Total recyclable materials (ton/year)	63	14	7	1	15
	-Others	53	12	6	1	12

Source: JICA Study Team

**Table 3-8 Projected recyclable materials that may be salvaged from discarded white goods (Year 2020)**

Item		Fiji	Samoa	Tonga	Tuvalu	Vanuatu
Televisions	Discarded Units	17,750	1,935	1,868	106	4,696
	Total RWG	497	54	52	3	132
	Total recyclable materials (ton/year)	71	8	7	0	19
	-Others	426	46	45	3	113
Refrigerator, Freezers	Discarded Units	15,778	2,073	1,557	160	2,683
	Total RWG	915	120	90	9	155
	Total recyclable materials (ton/year)	426	56	42	4	72
	-Others	489	64	48	5	83
Washing machines	Discarded Units	13,805	829	1,557	124	2,683
	Total RWG	428	26	48	4	84
	Total recyclable materials (ton/year)	235	14	26	2	46
	-Others	193	12	22	2	38
Microwaves	Discarded Units	9,861	1,659	519	9	1,342
	Total RWG	197	33	10	0	27
	Total recyclable materials (ton/year)	138	23	7	0	19
	-Others	59	10	3	0	8
Air conditioners	Discarded Units	9,861	1,106	519	9	2,013
	Total RWG	424	48	23	0	86
	Total recyclable materials (ton/year)	276	31	15	0	56
	-Others	148	17	8	0	30
Computers	Discarded Units	12,440	2,658	1,560	155	4,166
	Total RWG	137	29	17	2	46
	Total recyclable materials (ton/year)	75	16	9	1	25
	-Others	62	13	8	1	21

Source: JICA Study Team

#### (4) Projections of waste pet bottles, paper and cans

Projections for the amounts of waste pet bottles, paper and cans were estimated based on the present unit generation rates, waste composition and population forecasts with adjustments. The



present domestic waste unit generation rate was projected to increase annually by 1% to the year 2020, in line with the trends observed in other countries. In the same manner, the waste composition is expected to slightly change with increase in shares of pet bottles, paper and cans and a decrease in organic wastes. Projected unit generation amounts of waste pet bottles, paper and cardboard and cans are shown in Table 3-9.

**Table 3-9 Projected Unit Generation Rates of Waste Pet bottles, Paper and Cans (g/capita/day)**

		Households waste	PET bottles	Papers	Cardboard	Steel cans	Aluminum cans
Latest existing date	Fiji (2007)	403	7	45		6	4
	Samoa (2011)	380	25	26	1	11	7
	Tonga (2008)	470	11	22		12	9
	Tuvalu (2000)	430	5	45		13	3
	Vanuatu (2008)	427	11	26		5	4
Year 2011	Fiji	419 (293)	9 (6)	52 (36)		7 (5)	5 (4)
	Samoa	380 (266)	25 (18)	26 (18)	1 (1)	11 (8)	7 (5)
	Tonga	485 (340)	12 (8)	24 (17)		13 (9)	11 (8)
	Tuvalu	480 (336)	6 (4)	6 (39)		17 (12)	3 (2)
	Vanuatu	439 (307)	13 (9)	29 (20)		6 (4)	6 (4)
Year 2020	Fiji	456 (319)	14 (10)	68 (48)		10 (7)	6 (4)
	Samoa	416 (291)	29 (20)	29 (20)	4 (3)	12 (8)	7 (5)
	Tonga	530 (371)	16 (11)	32 (22)		17 (12)	16 (11)
	Tuvalu	525 (368)	7 (5)	63 (44)		20 (14)	4 (3)
	Vanuatu	481 (337)	19 (13)	38 (27)		8 (6)	10 (7)

Source: Latest existing data from surveys implemented by the respective PICs (chapter 2), adjustments and projections estimated by JICA Study Team

Notes: ( ):UGR in rural area which is 70% of the urban area

Accordingly the Generation amounts of Waste Pet bottles, Paper and Cans were estimated by multiplying the projected populations (Table 3.3) by the unit generation rates (Table 3-9) and the results are shown in Table 3-10.

**Table 3-10 Projection of Generation Amount of Waste Pet bottles, Paper and Cans (ton/year)**

Waste Items		Fiji	Samoa	Tonga	Tuvalu	Vanuatu
Year 2011	Steel cans	2,182	742	489	59	551
	Aluminum cans	1,559	472	414	10	551
	PET bottles	2,806	1,687	376	21	1,193
	Paper and Cardboard	16,211	1,821	903	191	2,662
Year 2020	Steel cans	3,197	843	674	71	888
	Aluminum cans	1,918	492	635	14	1,110
	PET bottles	4,475	2,038	635	25	2,108
	Paper and Cardboard	21,736	2,319	1,269	223	4,217

Source: JICA Study Team

**(5) Projections of Other Metal Products waste amounts**

**a) Factors to be considered**

As explained earlier in Table 3-1 of this chapter, the category of “Other Metal Products” refers to all metallic products that are not included in vehicles, white goods and cans.

The estimation of the generated amount of scrap metal from “Other Metal Products” is shown in the following equation:

$\text{Scrap Metal from "Other Metal Products"} = \text{Total "Other Metal Products" waste} \times \text{Recycling rate}$
---------------------------------------------------------------------------------------------------------------------------

For all types of products which are made of, or include metallic components the factors that determine the amount of scrap metal that is produced from them are basically (1) the products by types, (2) the total number of these products in circulation, (2) the number of these units that are discarded annually because of the end of their life-spans, (4) the number of the discarded units that are collected and brought to the recycling companies for processing, i.e. the recycling rates, (5) and the amount of scrap metal that is actually salvaged from the discarded units brought to the recycling companies and exported as RWM.

Obviously there are many types of products, varying life spans and collection rates.

The Study Team has a general understanding of the total amount of scrap metal that is exported based on the results of the interviews and the comparison with the official HS data. Furthermore the present amounts of scrap metals processed from vehicles, white goods and cans have been estimated based on survey results, official census and statistics data, and manufacturers’ data (products life-spans, amounts of RWM in the goods). Therefore the present total amount of scrap metal derived from “Other Metal Products” was determined.

As explained in the earlier equation, this determined amount is the product of the total “Other Metal Products” waste multiplied by the recycling rates.

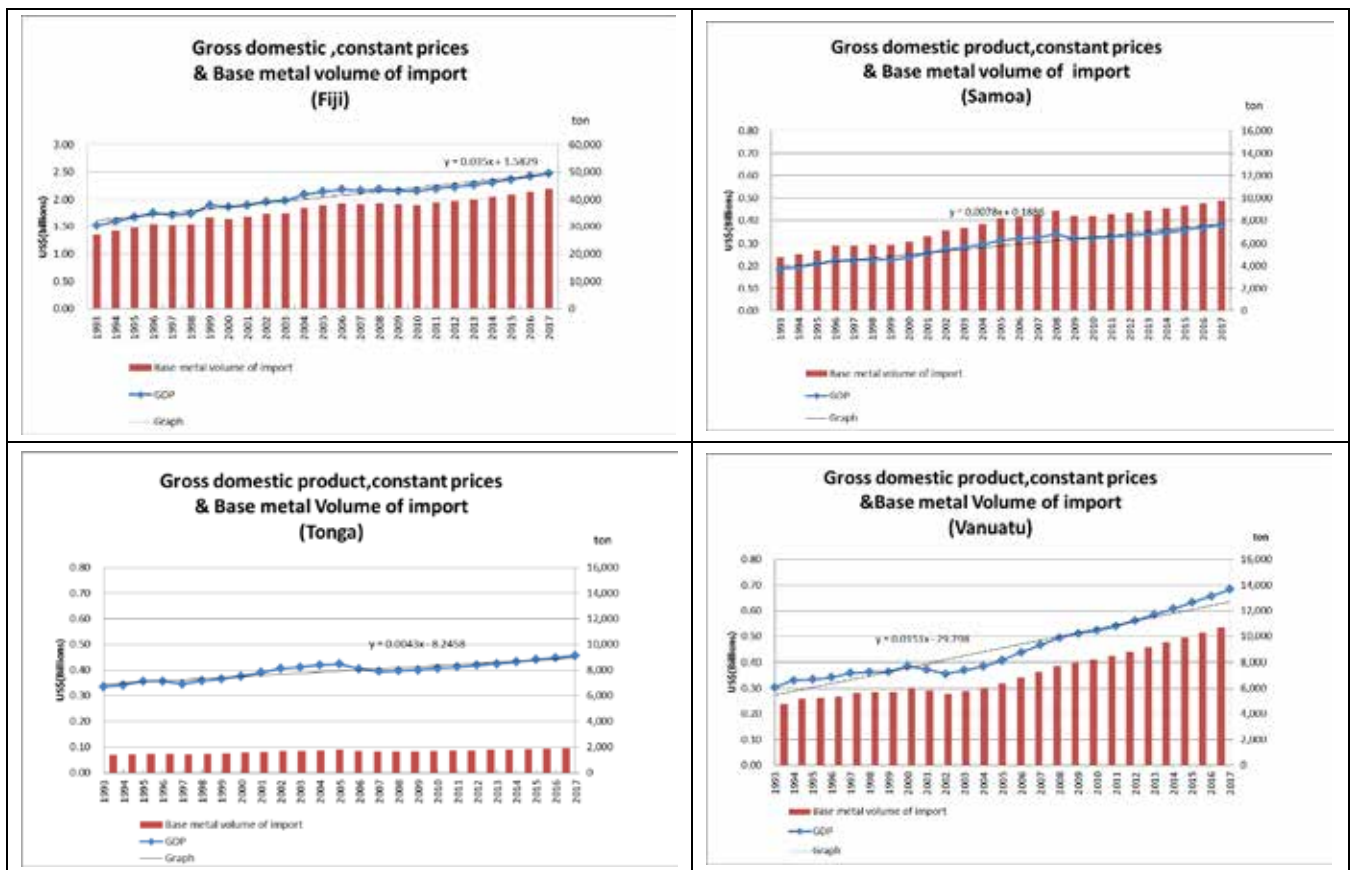
The Recycling Rate depends on the activities of the Collection Contractors and the Recycling Companies in the past few years. How long the Recycling Companies have been active is an important factor. Are the “Other Metal Products” wastes being collected as soon as their life-spans expire, or due to the recently introduced activities of many of the recycling companies are the wastes being collected accumulated over longer periods than their actual life spans?

At this time it is difficult to numerate the diverse factors related to Other Metal Products. The Study Team has adopted the present approach to equate the total “Other Metal Products” waste with the actual amount of other metal products imported annually into each of the five PICs at the time of

decade ago. This method has been adopted both for the present and future projection purposes. This is a safe approach as all “Other Metal Products” imported will eventually become waste, but it is rather general as it is not sensitive to the life-spans of the individual products.

**b) Amounts of imports**

All “Other Metal Products” arrive to the five PICs as products. These products become waste after their lifetime has been expired. Of course depending on the product, the life time is different. In order to estimate the amount of Other Metal Products import amounts the correlation coefficient was determined using the past data from 1993 to 2011 for GDP (expressed in the national currencies) and total imports of Other Metal Products (HS Codes 72xx to 83xx, excluding vehicles and white goods, expressed in tons annually). The derived correlation equations for Fiji, Samoa, Tonga and Vanuatu are shown in the following graphs.



**Figure 3-3 GDP and Other Metal Products**

The projected GDP values for the five PICs were obtained from the IMF homepage, under the title of World Economic and Financial Surveys, World Economic Outlook Database. The National Transport Master Plan of Fiji was also referred to. Using the GDP projections and the correlation equations obtained for each PIC, the projected annual imports of Other Metal Products were obtained.

The projections are up to the year 2010. The results are shown in Table 3-11. Imported amount

of other metal products of Tuvalu is estimated based on the amount of the amount of the other countries and population because of no available date on imported amount.

**Table 3-11 Projected Annual Import Amounts of Other Metal Products**

PICs	Item	Unit	Year									
			2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Fiji	GDP	Bln. US\$	1.90	1.96	1.98	2.09	2.14	2.18	2.16	2.19	2.16	2.15
	Imports	tons	33,649	34,709	35,050	36,968	37,887	38,596	38,264	38,658	38,167	38,106
Samoa	GDP	Bln. US\$	0.26	0.27	0.28	0.29	0.32	0.32	0.33	0.34	0.32	0.32
	Imports	tons	6,645	7,062	7,334	7,639	8,168	8,336	8,488	8,849	8,376	8,392
Tonga	GDP	Bln. US\$	0.39	0.41	0.41	0.42	0.42	0.40	0.40	0.40	0.40	0.41
	Imports	tons	1,639	1,705	1,726	1,765	1,779	1,699	1,658	1,667	1,680	1,708
Vanuatu	GDP	Bln. US\$	0.37	0.36	0.37	0.39	0.41	0.44	0.47	0.49	0.51	0.52
	Imports	tons	5,847	5,590	5,799	6,059	6,376	6,846	7,291	7,741	8,009	8,189

Source: JICA Study Team

### 3.2 Recyclable Waste Goods and Recycled Waste Materials Flows (2011 and 2020)

#### 3.2.1 Recycling Rates

The recycling rates of the Recycled Waste Goods are projected to increase for all the Recyclable Waste Goods in all the five countries. This is based on the assumption that the recycling companies will become more active as the respective governments take initiatives to support this crucial business.

The assumed recycling rates are shown in Table 3-12.

**Table 3-12 Assumed Recycling Rates in 2011 and 2020**

Item	Fiji		Samoa		Tonga		Tuvalu		Vanuatu	
	2011	2020	2011	2020	2011	2020	2011	2020	2011	2020
Vehicles discarded	65%	70%	50%	70%	25%	50%	20%	30%	40%	70%
White goods discarded	20%	50%	30%	40%	10%	20%	20%	20%	30%	40%
Other metal products	85%	90%	50%	60%	1%	5%	20%	25%	60%	70%
Cans	40%	60%	30%	60%	15%	30%	30%	30%	30%	60%
PET bottles	30%	40%	1%	10%	0%	10%	0%	0%	0%	10%
Paper & Cardboard	10%	30%	0%	10%	0%	0%	0%	0%	0%	10%

### 3.2.2 Waste Flows

The present and 2020 projected Recyclable Waste Goods and Recycled Waste Materials flows are described in Figures 3-5 to 3-13. Figure 3-4 shows a sample of the estimation of the RWGs and RWMs to facilitate understanding of the estimation method.

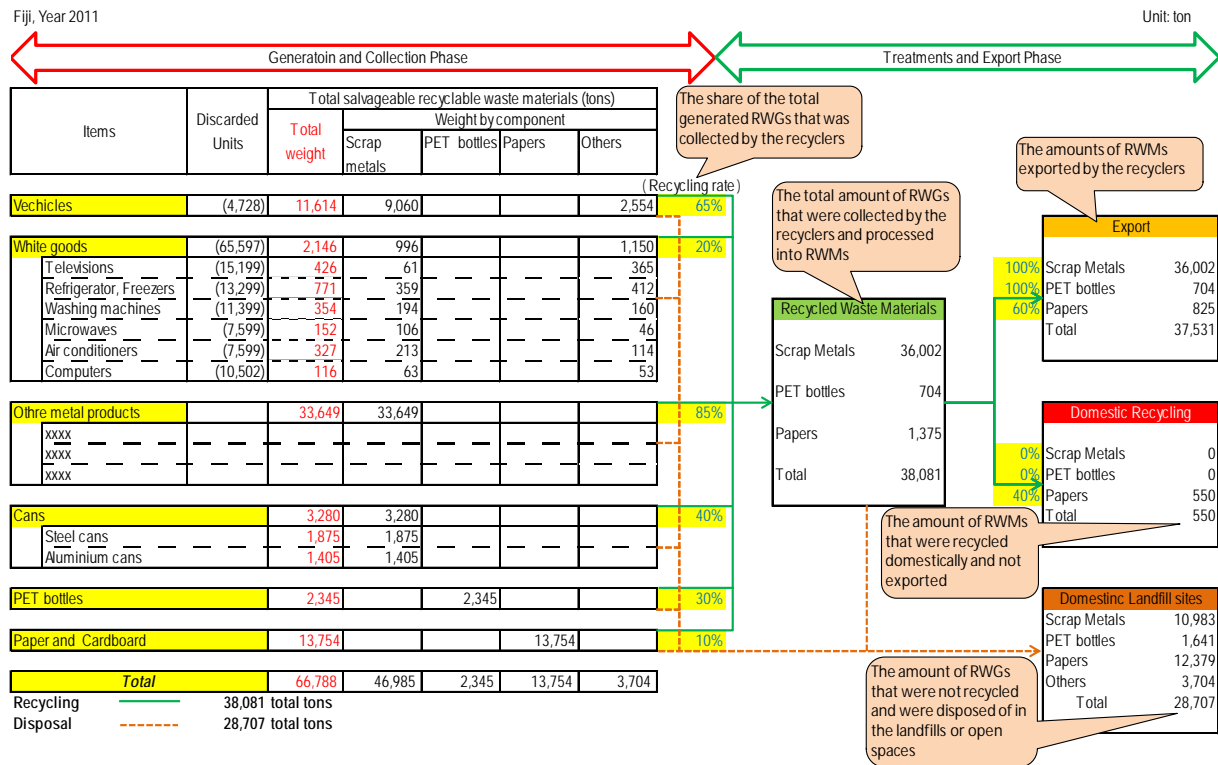


Figure 3-4 Sample flow of the RWGs and RWMs quantities estimation process (for explanation)

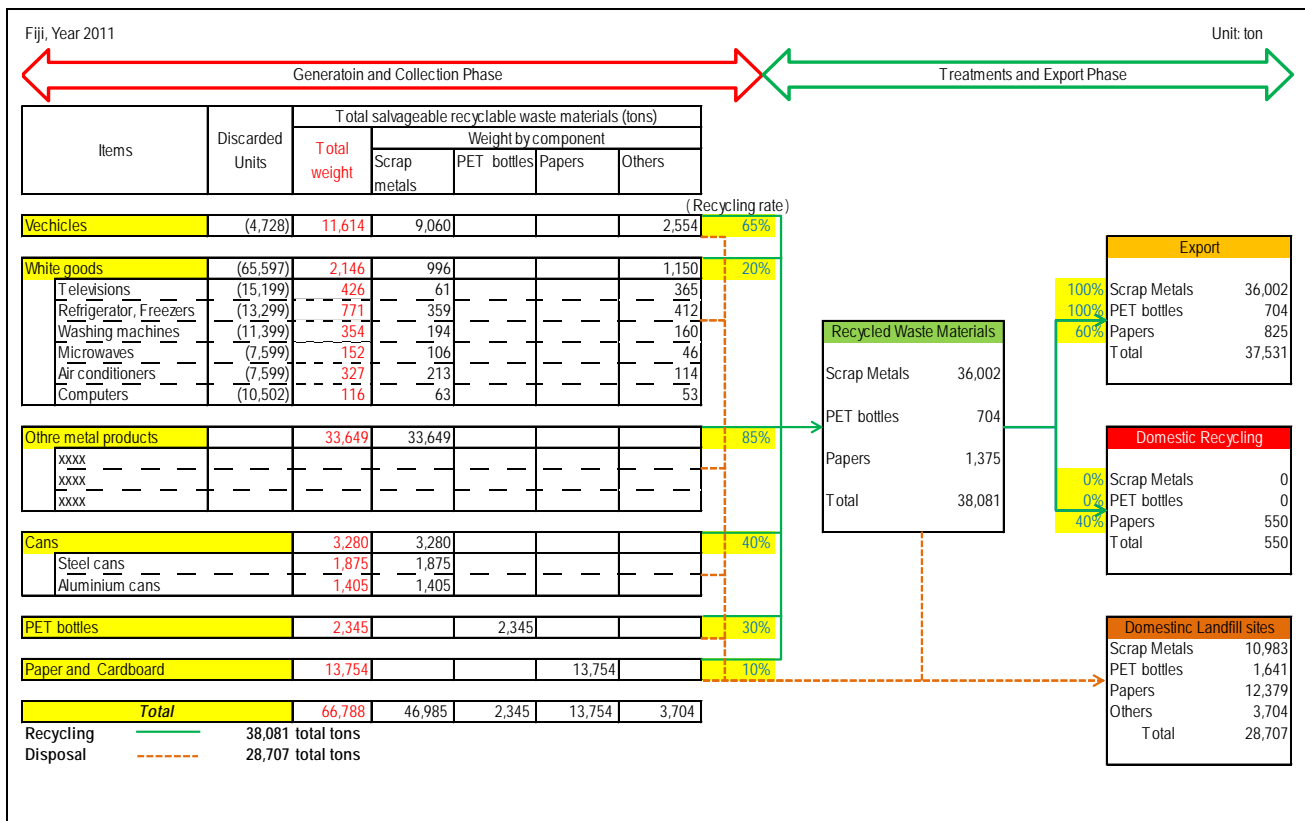


Figure 3-5 Fiji 2011 Recyclable Waste Goods Flow

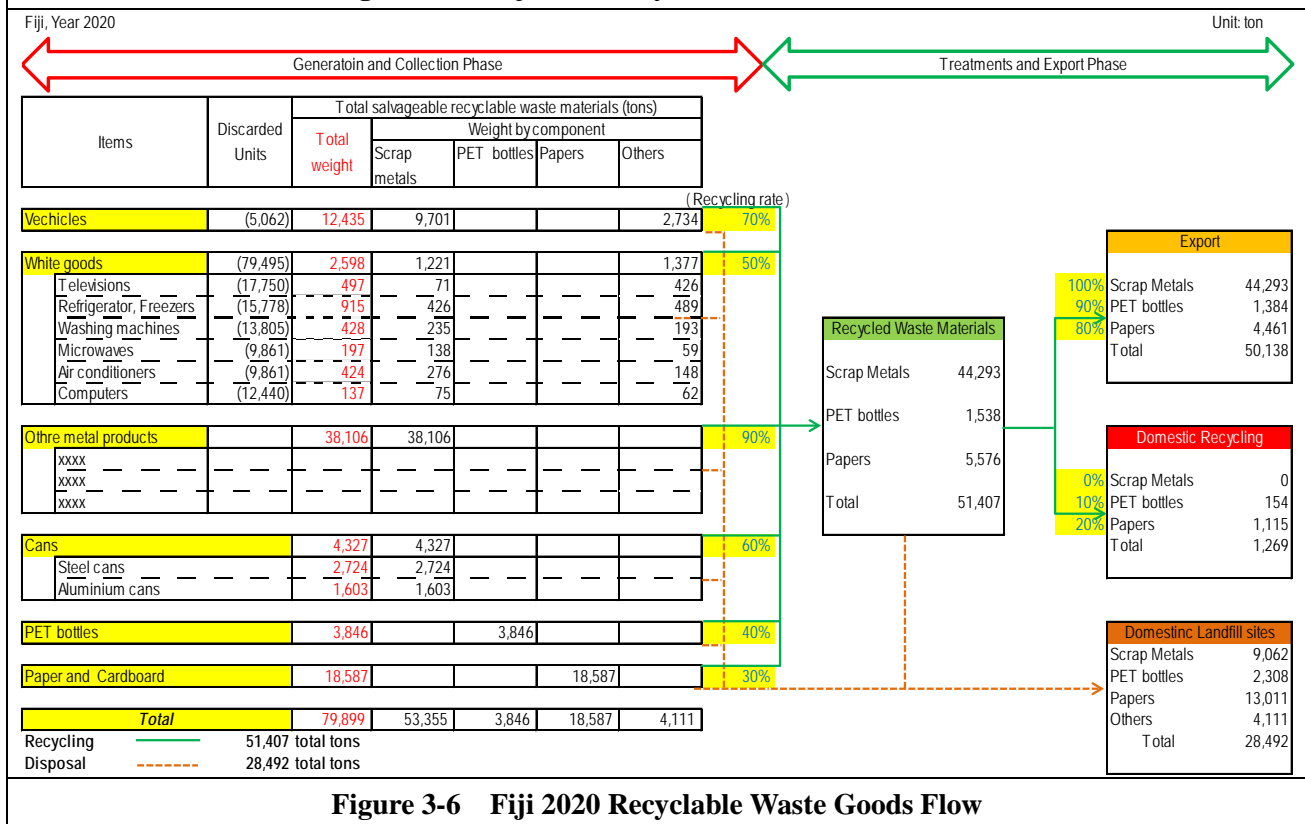
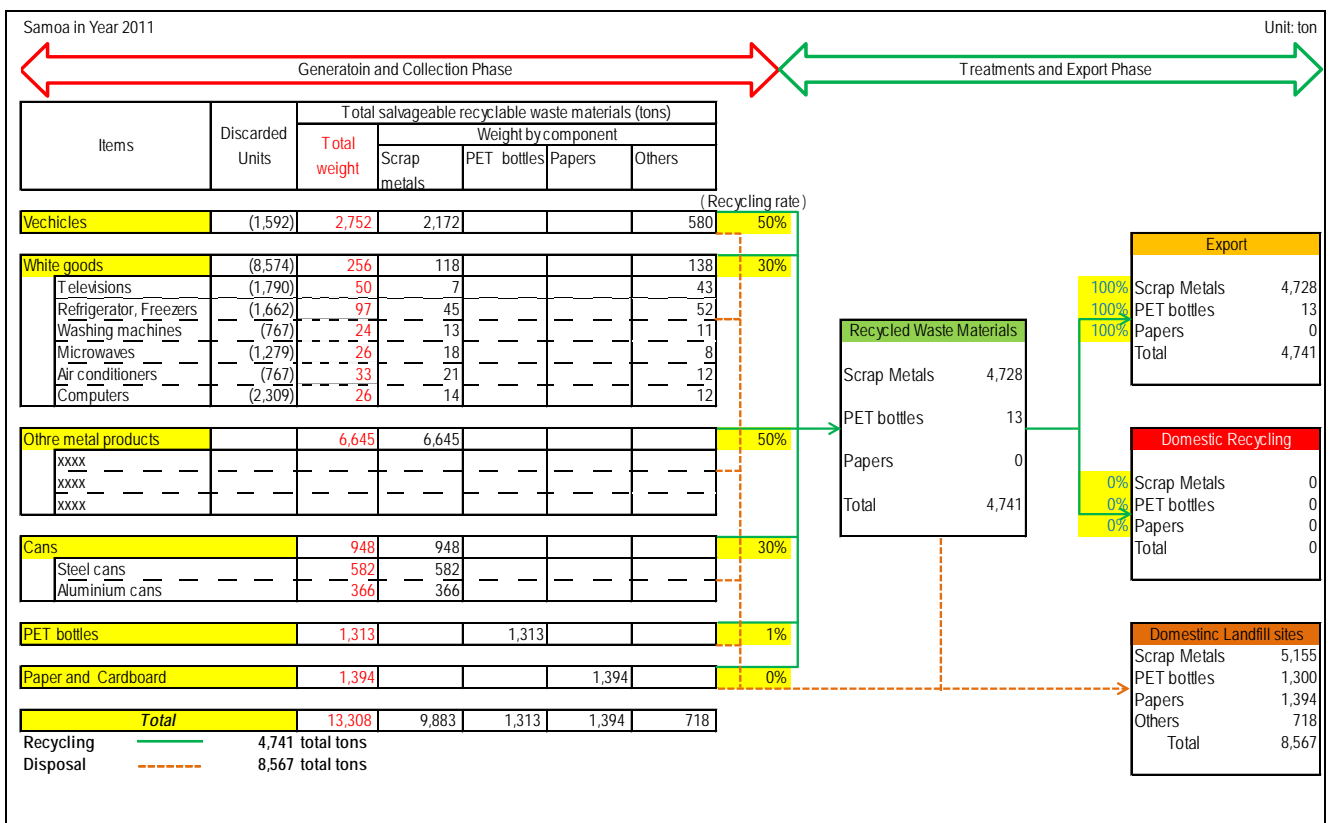
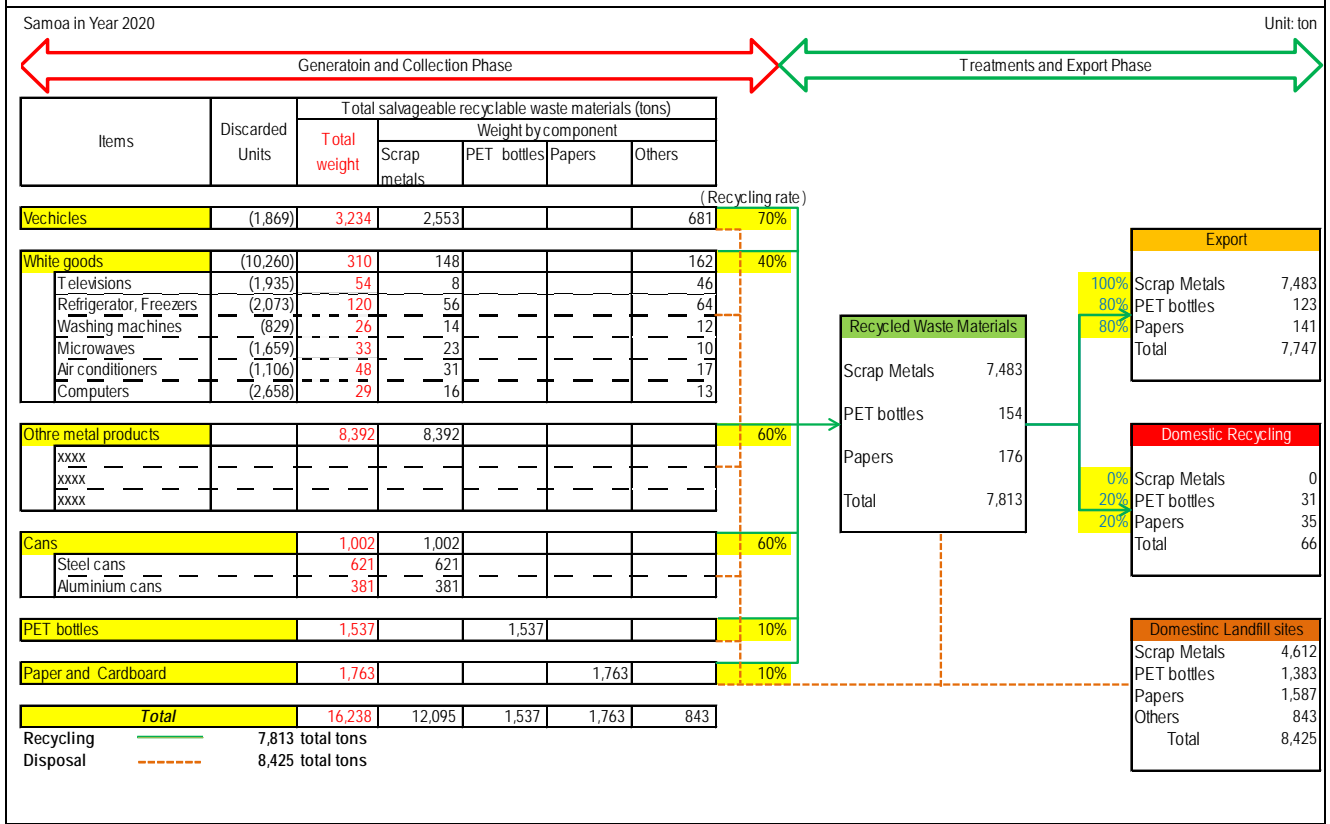


Figure 3-6 Fiji 2020 Recyclable Waste Goods Flow



**Figure 3-7 Samoa 2011 Recyclable Waste Goods Flow**



**Figure 3-8 Samoa 2020 Recyclable Waste Goods Flow**

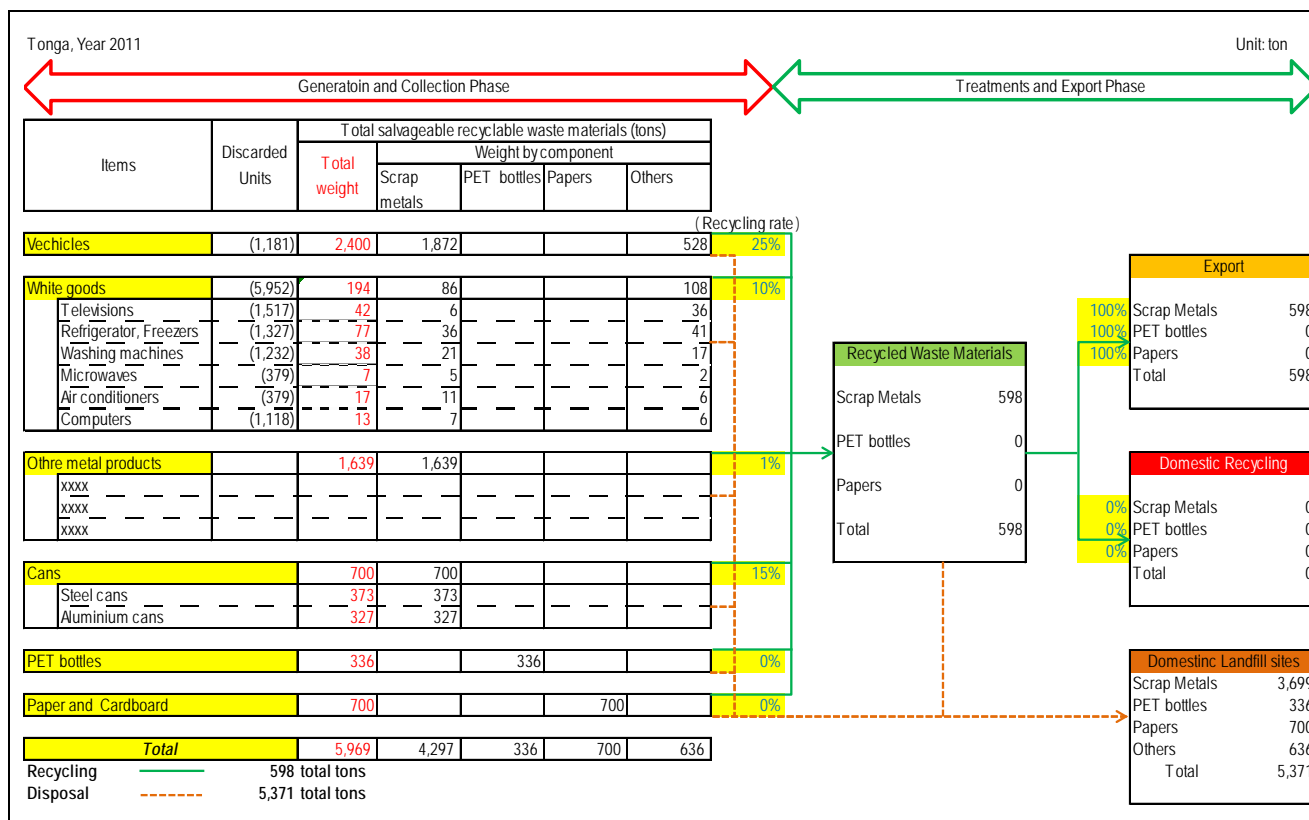


Figure 3-9 Tonga 2011 Recyclable Waste Goods Flow

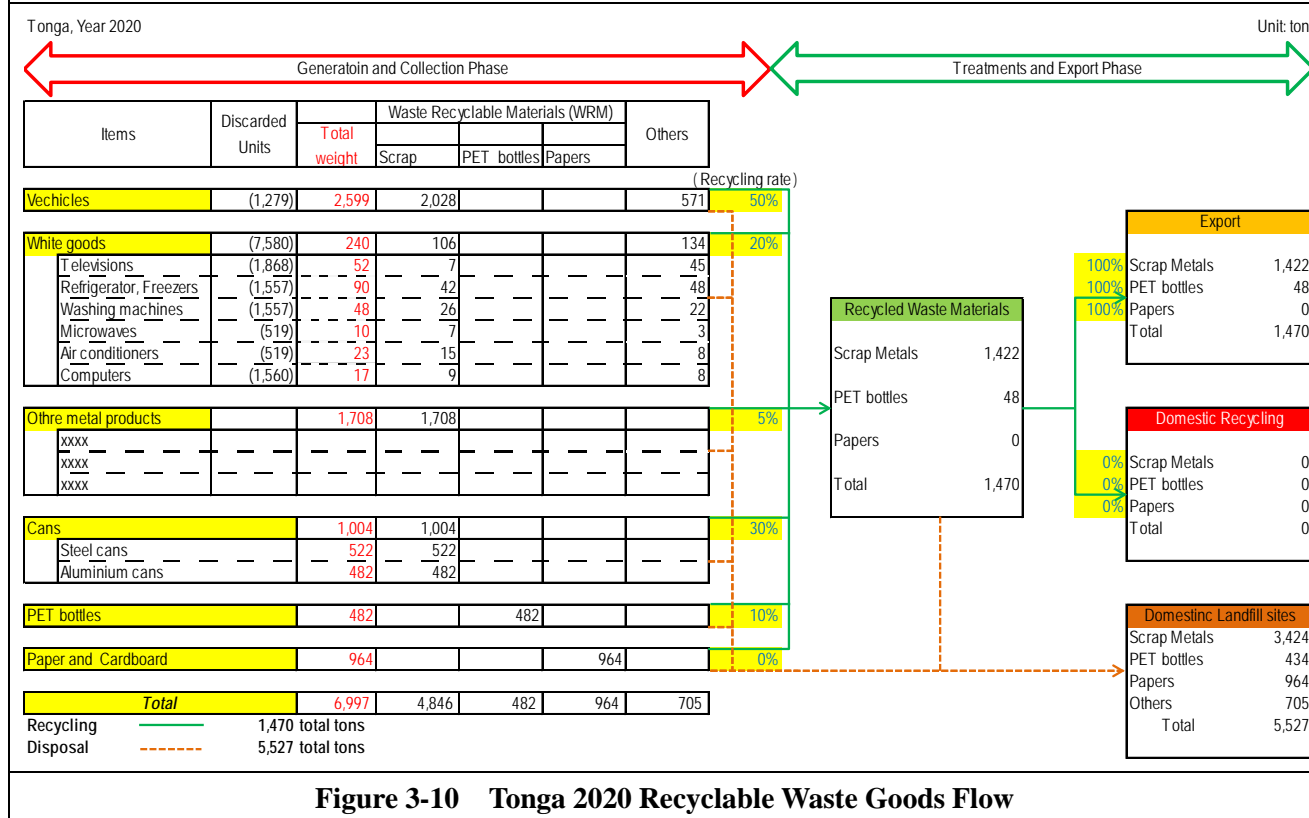


Figure 3-10 Tonga 2020 Recyclable Waste Goods Flow



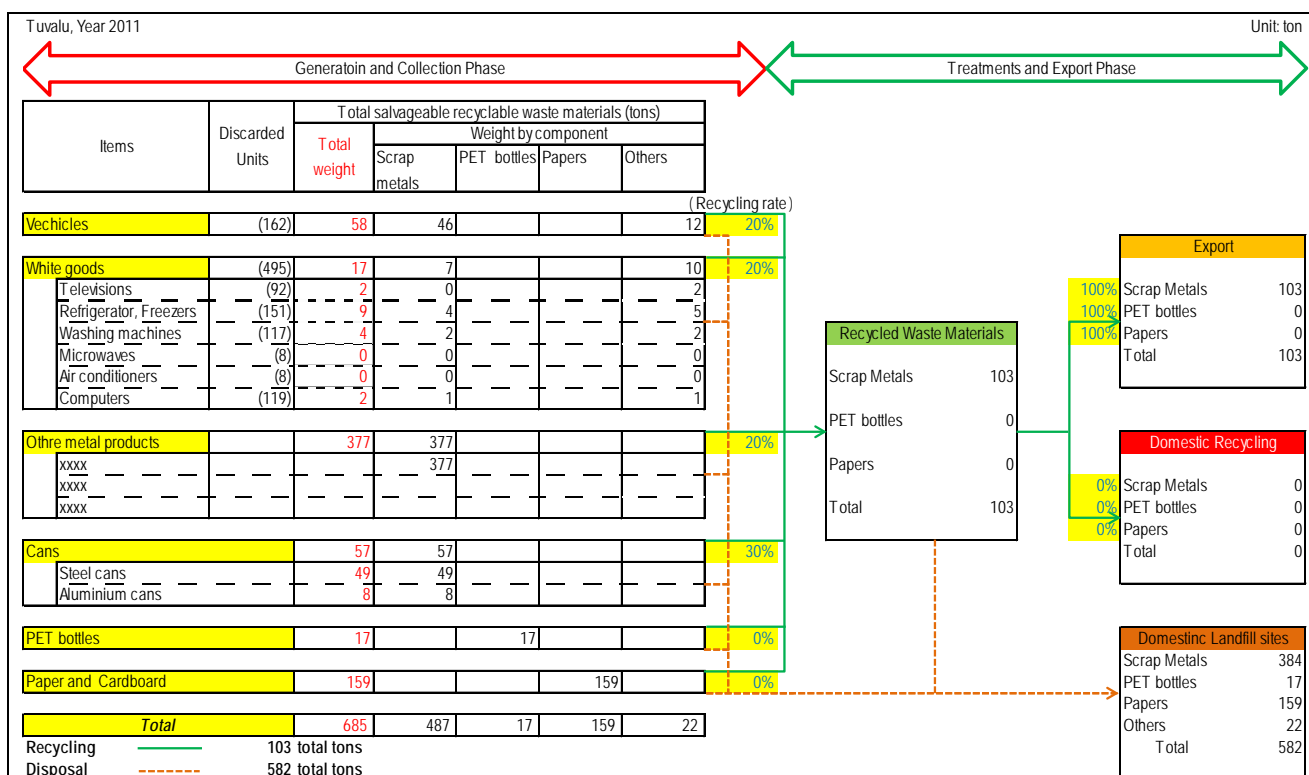


Figure 3-11 Tuvalu 2011 Recyclable Waste Goods Flow

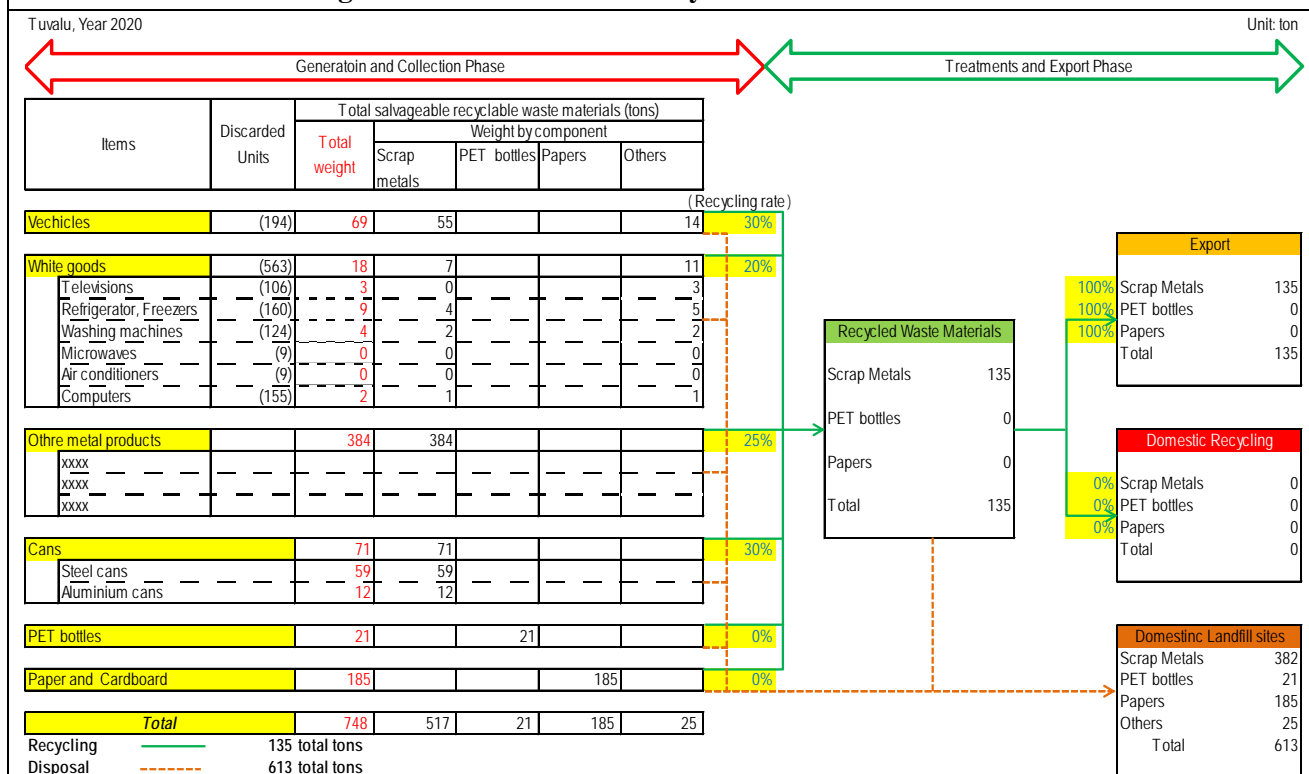


Figure 3-12 Tuvalu 2020 Recyclable Waste Goods Flow

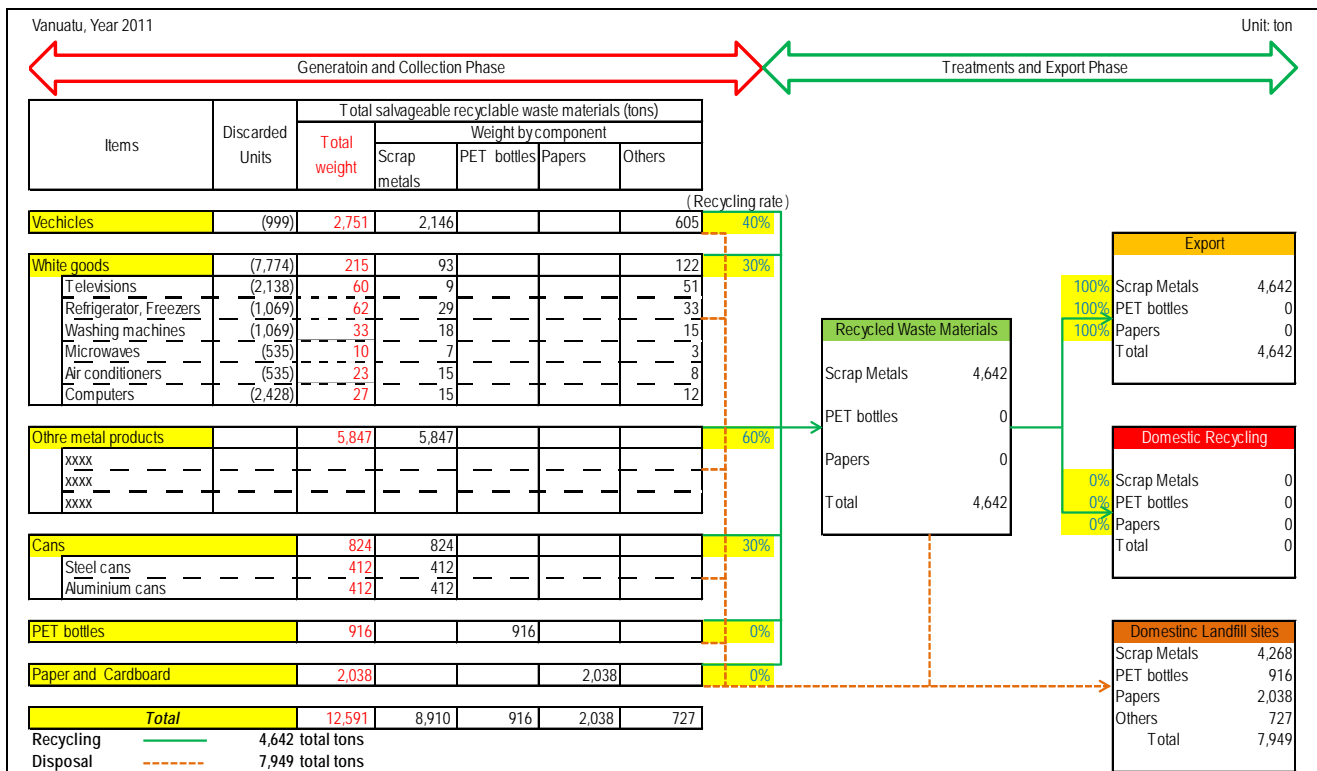


Figure 3-13 Vanuatu 2011 Recyclable Waste Goods Flow

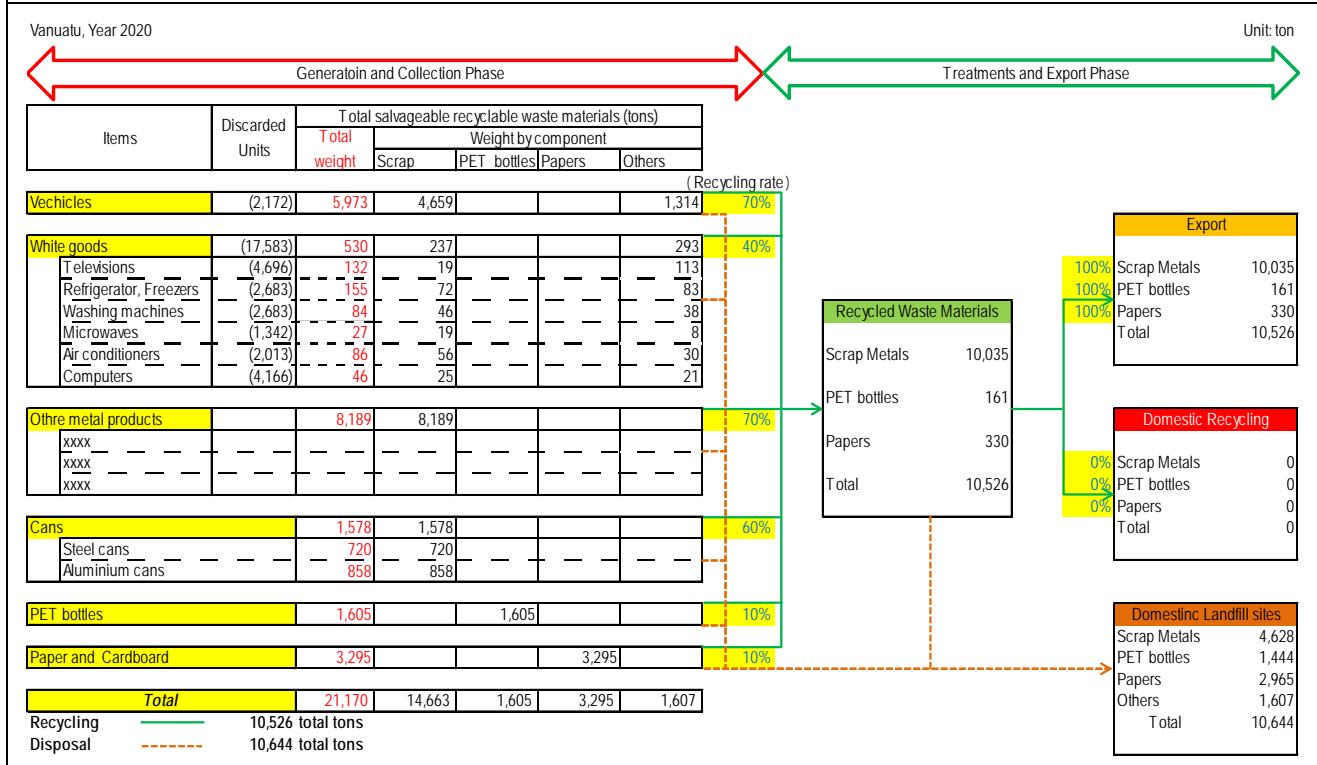
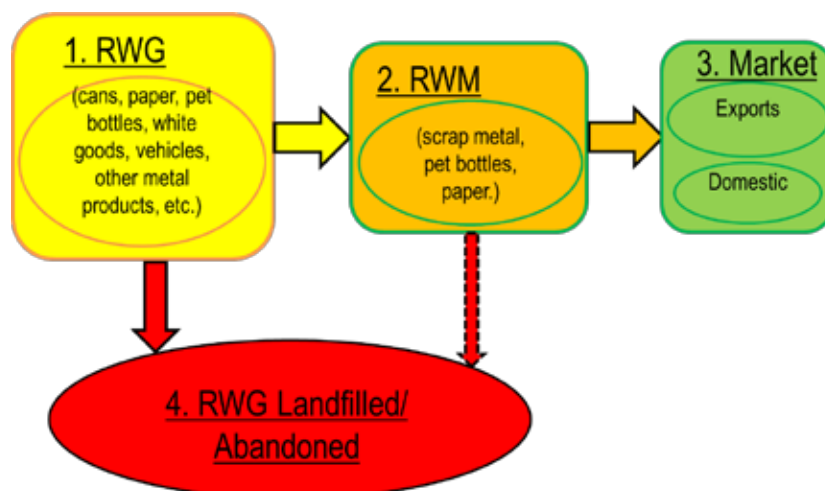


Figure 3-14 Vanuatu 2020 Recyclable Waste Goods Flow

### 3.2.3 Summation Tables

In summary, the present amounts of generated Recyclable Waste Goods, by type of goods, and the actual Recycled Waste Materials for each of the five PICs are shown in Table 3-13. The four phases of the recycling that are described in the Table are schematically shown in Figure 3-15.



**Figure 3-15 Schematic Presentation of the RWM and RWG Flow**

The first item in the table; Recyclable Waste Goods (RWG) shows the potential amount of waste that can be recycled in tons. The main RWG items are waste vehicles, white goods, other metal products, steel cans, aluminum cans, pet bottles and paper and cardboard. The shares of each of these items within the RWG are described in the table.

The second item is the Recycled Waste Materials (RWM). These values reflect the actual waste goods that are salvaged from the RWG above and processed; through cutting, shredding, compacting and baling depending on the material into RWM. The main RWM are scrap metal, pet bottles and paper & cardboard.

The third item describes the Recycled Materials Market; or in other words whether the end-users for the RWM are found domestically or exported to international destinations, as exports.

And finally, the last item shows the amounts of RWG that are not processed into RWM and do not reach the recycling market. These amounts unfortunately remain as waste and are disposed of at the disposal sites, landfills or abandoned some places on the islands.

The highest generation amount of Recyclable Waste Goods is in Fiji, at 66,788 tons in 2011. In terms of Recycled Waste Materials, in Fiji it was possible to recover around 57% of the potential recyclable materials due to the activities of the recycling companies there and most of the recovered materials are exported. The lowest recovery rate was in Tonga, where 90% of the Recyclable Waste Goods end in the landfill or are just abandoned somewhere in the country's islands, because of the lack

of recycling activities there and the goods are not processed into materials. Of the total Recyclable Shares of Paper and Cardboard are quite high and this indicates that more efforts for reducing waste paper and cardboard and recycling them are required. As explained in Chapter 2, there is hardly any domestic recycling as witnessed by the shares of domestic in the recycled material markets for the five countries.

Table 3-13 Recyclable Waste Goods Amounts in 2011

Item	Fiji		Samoa		Tonga		Tuvalu		Vanuatu	
	Amount (ton)	Share (%)	Amount (ton)	Share (%)	Amount (ton)	Share (%)	Amount (ton)	Share (%)	Amount (ton)	Share (%)
1 Recyclable Waste Goods (t/yr)	66,788	100%	13,308	100%	5,969	100%	685	100%	12,591	100%
- Vehicles share of total RWG	11,614	17%	2,752	21%	2,400	40%	58	8%	2,751	22%
- White Goods	2,146	3%	256	2%	194	3%	17	2%	215	2%
- Other Metal Products	33,649	50%	6,645	50%	1,639	28%	377	57%	5,847	47%
- Steel Cans	1,875	3%	582	4%	373	6%	49	7%	412	3%
- Aluminium Cans	1,405	2%	366	3%	327	5%	8	1%	412	3%
- Pet bottles	2,345	4%	1,313	10%	336	6%	17	2%	916	7%
- Paper & Cardboard	13,754	21%	1,394	10%	700	12%	159	23%	2,038	16%
2 Recycled Waste Materials (t/yr)	38,081	57%	4,741	36%	598	10%	103	15%	4,642	37%
- Scrap Metal share of total RWM	36,002	54%	4,728	36%	598	10%	103	15%	4,642	37%
- Pet Bottles	704	1%	13	0%	0	0%	0	0%	0	0%
- Paper & Cardboard	1,375	2%	0	0%	0	0%	0	0%	0	0%
3 Recycled Material Market	38,081	57%	4,741	36%	598	10%	103	15%	4,642	37%
- Export share of total Market	37,531	56%	4,741	36%	598	10%	103	15%	4,642	37%
- Domestic	550	1%	0	0%	0	0%	0	0%	0	0%
4 RWG to Landfill or Abandoned	28,707	43%	8,567	64%	5,371	90%	582	85%	7,949	63%

Source: JICA Study Team

The projected Recyclable Waste Goods and Recycled Waste Materials for 2020 were made as outlined in the estimation process in section 3.1 of this chapter. The recycling rates are projected to increase on the assumption that the recycling companies will increase their activities. Table 3-14 shows the projections for each of the five PICs, for the four phases in the same manner as the previous table for 2011.

In terms of TEU container numbers, the figures for the RWM exports in 2011 and the projected exports in 2020 are shown in Table 3-14. For the five PICs, the RWM exports are projected to increase in 2020 by 1,100 TEU compared to the corresponding figure for 2011, i.e. at an increased rate of about 47%.

**Table 3-14 RWM Export Amounts (TEU)**

	2011RWM Exports ( A )	2020RWM Exports projected ( B )	Increased Amount ( C ) =(B) (A)
Fiji	1,880	2,510	630
Samoa	240	390	150
Tonga	30	70	40
Tuvalu	5	7	2
Vanuatu	230	530	300
Total	2,385	3,507	1,122

Table 3-15 Recyclable Waste Goods Amounts in 2020

Item	Fiji		Samoa		Tonga		Tuvalu		Vanuatu	
	Amount (ton)	Share (%)	Amount (ton)	Share (%)	Amount (ton)	Share (%)	Amount (ton)	Share (%)	Amount (ton)	Share (%)
1 Recyclable Waste Goods (t/yr)	79,899	100%	16,238	100%	6,997	100%	748	100%	21,170	100%
- Vehicles share of total RWG	12,435	16%	3,234	20%	2,599	37%	69	9%	5,973	28%
- White Goods	2,598	3%	310	2%	240	3%	18	2%	530	3%
- Other Metal Products	38,106	48%	8,392	52%	1,708	25%	384	51%	8,189	38%
- Steel Cans	2,724	3%	621	4%	522	7%	59	8%	720	3%
- Aluminium Cans	1,603	2%	381	2%	482	7%	12	2%	858	4%
- Pet bottles	3,846	5%	1,537	9%	482	7%	21	3%	1,605	8%
- Paper & Cardboard	18,587	23%	1,763	11%	964	14%	185	25%	3,295	16%
2 Recycled Waste Materials (t/yr)	51,407	64%	7,813	48%	1,470	21%	135	18%	10,526	50%
- Scrap Metal share of total RWM	44,293	55%	7,483	46%	1,422	20%	135	18%	10,035	47%
- Pet Bottles	1,538	2%	154	1%	48	1%	0	0%	161	1%
- Paper & Cardboard	5,576	7%	176	1%	0	0%	0	0%	330	2%
3 Recycled Material Market	51,407	64%	7,813	48%	1,470	21%	135	18%	10,526	50%
- Export share of total Market	50,138	62%	7,747	48%	1,470	21%	135	18%	10,526	50%
- Domestic share of total Market	1,269	2%	66	0%	0	0%	0	0%	0	0%
4 RWG to Landfill or Abandoned	28,492	36%	8,425	52%	5,527	79%	613	82%	10,644	50%

Source: JICA Study Team

## **Chapter 4. Survey of Water Transport and Ports**

### **4.1 International Maritime Network**

Water transportation is a key factor to circulate recycling material into a global market. International maritime network and domestic maritime network will be examined in this chapter. Before surveying international maritime conditions, the team will grasp the general view of international trade in Pacific countries and world.

#### **4.1.1 Trade Characteristics in PICs**

##### **(1) General view of trade in PICs**

Based on International Trade Statistics 2010, the value of foreign trade in Fiji 2009 is US\$1,437 million in imports and US\$ 629 million in exports which represents 75% of total of the five countries (see Figure 4-1). There is a big imbalance of trade between import and export. This situation is the same as the other four countries. The value of imports in Samoa is US\$ 230.5 million, followed Vanuatu (US\$201.7 million), Tonga (US\$144.6 million) and Tuvalu (US\$26.5 million). The value of exports is very small in each country. PICs' main trading partners are Singapore, Australia and NZ and the Far East countries. Intra trade is small.



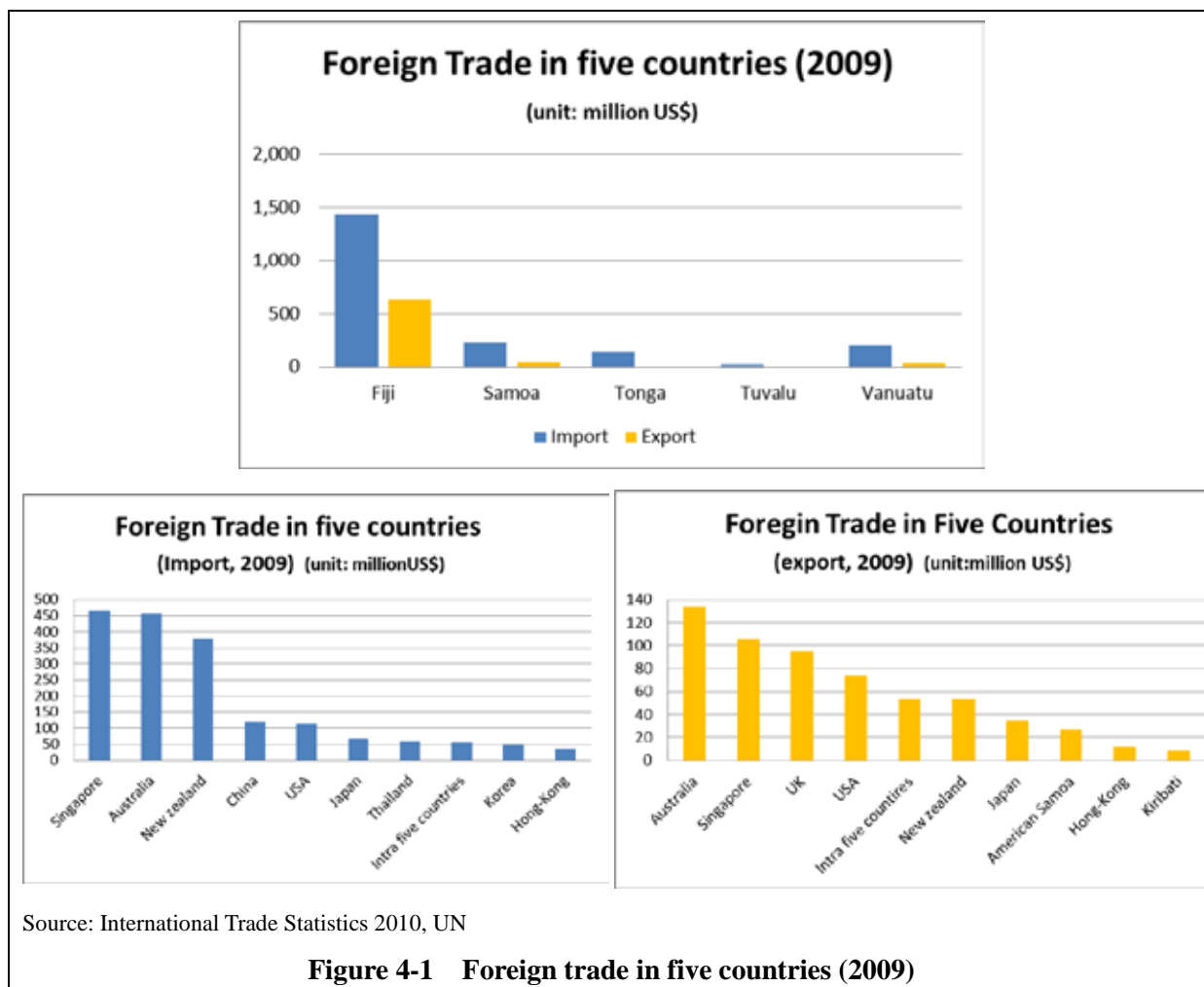


Table 4-1 shows import and export by principal commodities in PICs. As mentioned earlier, there is an imbalance of trade between import and export. For instance, Fiji's value of export is 43% of that of import. The share of export value in the other four countries is 14.8% in Vanuatu, 20% in Samoa, 5.3% in Tonga, and 0 % in Tuvalu, respectively. These figures are much lower than the figure of Fiji. Among import commodities in Fiji, minerals fuels, lubricants and related materials (US\$ 369.4 million) is the largest import commodity, followed by machinery and transport equipment (US\$ 310.2 million), foods and live animals (US\$ 268.9 million). On the other hand, main export commodities are foods and live animals (US\$ 272.2 million), minerals fuels, lubricants and related materials (US\$ 127.0 million). It shows that various kinds of goods such as food, petroleum, manufactured goods, machinery and transport equipment are imported to PICs; on the other hand, first industry commodities such as sugar, fish and copra are the only export items from PICs.

**Table 4-1 Import and export by principal commodities (Unit: US million \$)**

Country	FIJI		SAMOA		TONGA		TUVALU		VANUATU	
	(2009)		(2009)		(2009)		(2008)		(2007)	
Commodity	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT
Total	1,437.0	628.7	230.5	46	144.6	7.8	26.5	0	201.7	29.9
0 Foods and live animals	268.9	272.2	64.9	7.7	40.0	6.6	4.8	0	34.3	8.7
1 Beverages and tobacco	11.5	45.3	3.2	1.0	8.2	0.1	0.8	0	6.6	0.0
2 Crude materials, inedible, except fuels	11.3	25.7	5.7	0.2	2.7	0.3	1.0	0	3.3	5.4
3 Minerals fuels, lubricants and related materials	369.4	127.0	42.8	0.0	29.4	0.0	4.4	0	36.5	0.0
4 Animals and vegetable oils, fats and waxes	14.9	3.8	1.2	1.2	0.0	0.0	0.0	0	1.1	4.9
5 Chemicals and related products, nes	118.2	19.8	13.1	0.0	6.8	0.3	0.4	0	13.7	0.3
6 Manufactured goods classified chiefly by material	205.9	33.6	27.9	0.2	15.0	0.1	1.0	0	32.1	0.5
7 Machinery and transport equipment	310.2	21.5	20.5	31.5	27.2	0.1	2.2	0	49.4	0.9
8 Miscellaneous manufactured articles	120.6	55.0	12.9	0.2	8.7	0.3	0.7	0	19.2	0.8
9 Commodities and transactions not classified elsewhere	6.1	24.8	38.3	4.0	6.6	0.0	11.2	0	5.5	8.3

Source: International Trade Statistics Yearbook 2010, UN

## (2) Base metal flow in PICs

The team briefly surveyed the flow of scrap metal in the world. Scrap metal is the main commodity of the recycling industry. According to international trade statistics, value of total trade (import and export) of scrap metals was US\$ 8,890 million in 2009. In the last five years, the value of total trade of that ranged from US\$ 6,200 to 10,900 million. Turkey (US\$ 7,120 million) is the largest consumer of scrap metal in the world, followed by Korea (US\$ 3,814 million) and China (US\$ 3,006 million). Korea exported scrap metal worth US\$430millions, however balance of import and export shows that Korea is still a major consumer. European countries such as Belgium (US\$ 2,853 million import, US\$ 1,427 million export), Germany (US\$ 2,527 million import, US\$ 4,794million export) and Netherlands (2,088 import, US\$ 3,855 million export) are major importers of scrap metal as well

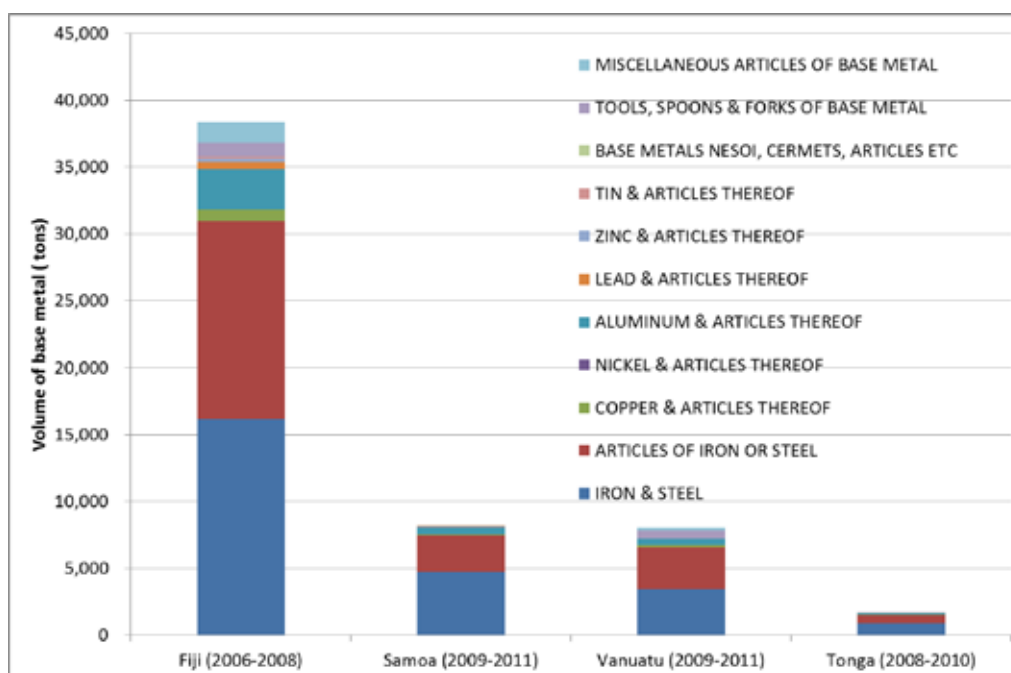
as major exporters of it. United States (US\$1,470 million import, US\$8,385 million export) and Japan (US\$ 611 million import, US\$ 3,295 million export) are major exporters of scrap metal.

**Table 4-2 Import and export of ferrous waste and scrap; remelting scrap ingots of iron or steel  
2009  
(Unit: US million \$)**

	IMPORT		EXPORT	
	Country	Value	Country	Value
1	Turkey	7,120.5	United States	8,385.5
2	Korea	3,814.0	Germany	4,794.2
3	China	3,006.1	Netherlands	3,855.4
4	Belgium	2,853.5	Japan	3,295.7
5	Germany	2,524.7	United Kingdom	3,009.8
6	Spain	2,381.4	France-Monaco	2,742.8
7	Netherlands	2,088.1	Canada	1,512.5
8	Italy	1,857.5	Belgium	1,427.8
9	India	1,745.5	Russian federation	1,118.5
10	United States	1,470.0	Romania	958.7
11	Finland	1,463.1	Denmark	701.2
12	Viet Nam	1,138.2	Czech Republic	678.0
13	Malaysia	964.8	Singapore	663.0
14	France-Monaco	930.9	Australia	650.6
15	Lexemburg	918.9	Sweden	645.0
16	Egypt	669.4	Poland	526.0
17	Indonesia	635.7	Austria	458.6
18	Japan	611.3	South Africa	452.6
19	Pakistan	557.6	Korea	430.7
20	Thailand	518.8	Mexico	428.9
	World	44,939.1	World	43,962.5

Source: International Trade Statistics Yearbook 2010, UN

Next, the team estimated base metals flows in PICs. Figure 4-2 show the last three years average volume of base metals import in each country. According to the trade data collected by the customs authority in each country (Tuvalu's data is not available). The largest base metals importer in PICs is Fiji which imported 38,384 tons of base metals, followed by Samoa (8,181 tons), Vanuatu (7,244tons) and Tonga (1,672tons). Ferrous (Iron& steel, Article of iron or steel) is the largest import commodity, followed by aluminum, copper and lead. These imported base metals will be scrap metals eventually. At present, the study team does not prepare estimation volume of scrap metals generation from the base metals, because these are used various purpose and their life span is varying. Total of 55,482 tons of base metals were imported in PICs, and 11,197 tons of those were exported.



Note: Tuvalu's data is not available. Averaged volumes in the last three years are shown because the volume fluctuated year by year.

**Figure 4-2 Import volume of base metals (Last three years average)**

#### 4.1.2 International Maritime Network in PICs

##### (1) Maritime Network

Recycling materials are usually transported by containers. A bulk cargo ship might be another alternative but it is unlikely to be feasible in PICs. For instance, a person could charter a bulk cargo ship with 500 DWT but he would have to aggregate 500 tons of recycling cargoes. Such a large volume of recycling materials is not expected in the PICs. It would take time to aggregate the recycling materials, meaning that he could only charter a ship until it could be fully loaded or he would have to lease a yard or a warehouse for stocking the recycling materials. This would result in additional costs. On the other hand, a 20 feet container carries about 20 tons of goods. If a recycling company aggregate 20 ton of recycling cargoes, he will pack and ship it right away. Hence, in this survey, the team focuses on accessibility of container service route from PICs in terms of physical accessibility and monetary burden of transport.

Trade data indicated that PICs trading partner were Singapore, Australia, New Zealand, and the Far East countries, but there was a severe trade imbalance between import and export. Furthermore, 1.4 million people are spread across an area of 3.69 million square kilometres in PICs. Since cargoes are dispersed, it would be difficult to transport them efficiently. The imbalance of trade and the dispersed cargo distribution will influence the freight rate and marine network in PICs. Against this

background, the study team will survey present status of shipping networks and deployed ships in the marine network in PICs, interview shipping lines and recycling companies on freight rate for exporting goods, and explore share of marine transportation cost on recycling material selling price.

At first, the team will survey present international shipping network. PICs are far from trunk lines of container ships. Eleven Shipping companies extend their network service routes depending on needs for transportation. However the PICs are directly connected to NZ, Australia and the Far East. In addition, there is a direct route to Singapore and the USA. The study team summarized operators and its shipping route, and deployed ships. Details of each route are described in the following sections.

1) PICs – Australia and NZ Route

Table 4-3 indicates operators and their service between PICs and Australia, NZ. Eight routes are served at present. Pacific Direct Line, Pacific Forum Line, Reef, and Polynesian Shipping Line, Cooltainer and other shipping lines are forming a consortium in order to reduce transportation cost and alleviate operational risks. Voyage duration is from 15 to 30 days. The ships call 156 times in a year. Each international container ship directly calls capital city ports except for Funafuti, Tuvalu. Seven out of the eight routes calls Suva, Fiji. Suva is in fact the hub of the network. Pacific Forum Line was sponsored and established by twelve countries in the Pacific in 1978. NZ is the largest shareholder with 23% of the largest route in PICs.

**Table 4-3 Operators and their service between PICs and Australia, New Zealand**

SERVISE ROUTE (Shipping Company)	VESSEL	VOYAGE DURATION (Number of calls in a year)	PORT OF CALL
AUSTRALIA / FIJI / NEWZEALAND (Pacific Direct Line,Pacific Forum Line, Reef,Swire,Cooltainer )	Capitain Tasuman Forum Fiji	30days (24)	MELBOURNE - PORT KEMBLA - BRISBANE - NOUMEA - SUVA - LAUTOKA - AUKLAND - TAURANGA - NAPIER - MELBOURNE
NEWZEALAND / FIJI / SAMOA / TONGA (Pacific Direct Line,Pacific ForumLine, Reef,Cooltainer, Polynesian Shipping Line)	Southern Lily2	20days (18)	AUKLAND - LAUTOKA - SUVA - APIA - PAGOPAGO - NUKU'ALOFA - AUKLAND
NEWZEALAND / FIJI / SAMOA / TONGA (Pacific Direct Line,Pacific ForumLine, Reef,Cooltainer, Polynesian Shipping Line)	Southern Cross	20days (18)	AUKLAND - SUVA - APIA - NUKU'ALOFA - AUKLAND
NEWZEALAND / FIJI / VANUATU (Pacific Direct Line,Pacific ForumLine, Reef,Cooltainer, Polynesian Shipping Line)	Southern Fleur	15days (24)	AUKLAND - NOUMEA - LAUTOKA - SUVA - PORT VILA - SANTO - TAURANGA - AUKLAND
NEWZEALAND / TONGA (Pacific Direct Line,Pacific ForumLine, Reef,Cooltainer, Polynesian Shipping Line)	Southern Tiare	15days (24)	AUKLAND - NUKU'ALOFA - VAVA'U - NIUE - AUKLAND
FIJI / TUVALU (Pacific Direct Line,Pacific Forum Line, Reef)	Southern Pearl	20days (18)	SUVA - WALLIS - FUNAFUTI - TARAWA - MARSHALL ISLANDS - SUVA
FIJI / NAURU / PAPUA NEW GUINEA (Reef)	Reef Nauru	20days (18)	SUVA - LAUTOKA - NAURU - HONIARA - LAE - PORT MORESBY - SUVA
AUSTRALIA / VANUATU / FIJI (Swire)	Micronesia Pride	30days (12)	MELBOURNE - PORT KEMBLA - GLADSTONE - BRISBANE - PRONY - SANTO - SUVA - TARAWA - MELBOURNE
	Total	(156)	

note:Voyage duration indicates for full circle.

Figure 4-3 illustrates a container shipping route between PICs and Australia and New Zealand. Container ships call each port in PICs but there is particularly heavy traffic between Suva and Auckland. This route is the largest route in PICs.

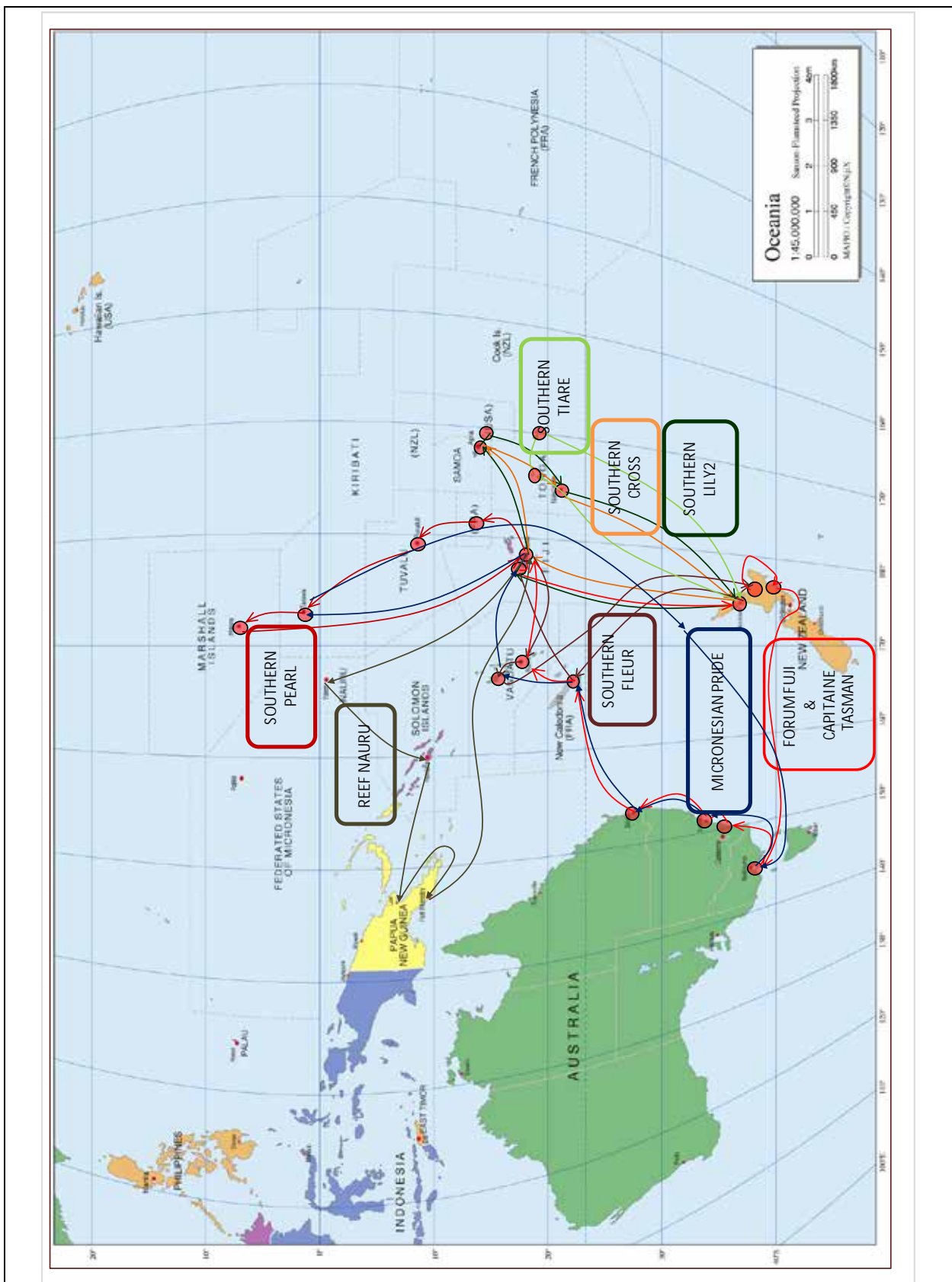




Figure 4-3 Shipping route between PICs and Australia, NZ

Table 4-4 lists specification of deployed ships between PICs and Australia and New Zealand. Eight ships are serving in the route of which gross tonnages of deployed vessels are 1,200 GT to 13,497GT. The container ships capacities are varying from 79 TEUs to 1,280 TEUs. A typical vessel, for instance, MV Forum Fiji, is 145 meters in length, 8.12 meters in draft, 951 TEUs capacity and equipped with two 40-ton cranes. Drafts of these ships are varying from 4.27 meters to 9.22 meters. International ports in PICs are in shallow water and not equipped with container cranes except for Suva port. Therefore, container ships are small and use deck cranes to handle cargoes.

**Table 4-4 Specification of deployed ships between PICs and Australia, NZ**

Forum Fiji			Capitaine Tasman		
	Gross tonnage	9,725t		Gross tonnage	9,725t
	Length	145.93m		Length	145.93m
	Beam	22.6m		Beam	22.6m
	Draft	8.12m		Draft	8.12m
	TEU	951TEU		TEU	951TEU
	Cargo gear	2×40t cranes		Cargo gear	2×40t cranes
	Ramp	none		Ramp	none
Southern Lily 2			Southern Pearl		
	Gross tonnage	13,497t		Gross tonnage	5,234t
	Length	159.53m		Length	109.4m
	Beam	25.0m		Beam	18.2m
	Draft	9.22m		Draft	6.68m
	TEU	1,280TEU		TEU	570TEU
	Cargo gear	2×40t cranes		Cargo gear	2×45t cranes
	Ramp	none		Ramp	none
Southern Cross			Southern Tiare		
	Gross tonnage	6,245t		Gross tonnage	1,185t
	Length	115.43m		Length	62.55m
	Beam	20.8m		Beam	11.4m
	Draft	7.0m		Draft	4.27m
	TEU	688TEU		TEU	79TEU
	Cargo gear	2×45t cranes		Cargo gear	2×20t cranes
	Ramp	none		Ramp	none



Southern Fleur			Reef Nauru		
	Gross tonnage	9,999t		Gross tonnage	2,800t
	Length	142.7m		Length	86.0m
	Beam	22.6m		Beam	15.2m
	Draft	6.68m		Draft	6.68m
	TEU	1,217TEU		TEU	267TEU
	Cargo gear	3×40t cranes		Cargo gear	2×25t cranes
	Ramp	none		Ramp	none

Data of MV Micronesia Pride is not available.

2) PICs – Far East route

Table 4-5 shows the operators and its service between PICs and the Far East. There are three routes. Container ships are calling Lautoka, Suva, Apia, Nuku’alofa, Santo in the PICs, a total 21 times calls a year. Voyage duration is from 60 to 70 days. Greater Bali Hai, Swire and Kyowa Line have formed a consortium. Kyowa Line was established in Tokyo 1974. It carries eight vessels and covers the whole Pacific. Swire is a subsidiary shipping company of China Navigation.

**Table 4-5 Operators and its service between PICs and the Far East**

SERVICE ROUTE (Shipping Company)	VESSEL	VOYAGE DURATION (Number of calls in a year)	PORT OF CALL
KOREA / JAPAN / FIJI / SAMOA / TONGA  (Greater bali hai,Swire,kyouwa shipping,NYK-hinode line)	Coral Islander  Pacific Islander	70days  70days  (10)	KAOHSIUNG-BUSAN-KOBE-NAGOYA-YOKOHAMA-MAJURO-TARAWA-NOUMEA-LAUTOKA-SUVA -APIA-PAGOPAGO-PAPEETE-NUKU'ALOFA-NOUMEA-SANTO-HONIARA-NORO-KAOHSIUNG
KOREA / JAPAN / VANUATU / FIJI / SAMOA  (Greater bali hai,Swire,kyouwa shipping,NYK-hinode line)	Tropical Islander	70days  (5)	KAOHSIUNG-BUSAN-KOBE-NAGOYA-YOKOHAMA-HONIARA-SANTO-PORT VILA-NOUMEA-LAUTOKA-SUVA-APIA-PAGOPAGO-PAPEETE-KAOHSIUNG
KOREA / JAPAN / VANUATU / FIJI / SAMOA  (Greater bali hai,Swire,kyouwa shipping,NYK-hinode line)	South Islander	60days  (6)	KAOHSIUNG-BUSAN-KOBE-NAGOYA-YOKOHAMA-HONIARA-SANTO-PORT VILA-NOUMEA-LAUTOKA-SUVA-APIA-PAGOPAGO-KAOHSIUNG
	Total	(21)	

note:Voyage duber of calls in a year

Figure 4-4 shows the container shipping route between the Far East and PICs. A

multi-port-calling network is formed in the PICs even though major trunk lines in the world form hub-and-spoke network. Limited cargo volume and poor port facilities in each country might be one of the reasons for forming the multi-port-calling network. On the other hand, Kyowa line has a round trip route with a hub port in Busan for its Far East service. Cargoes from/to the Far East are transhipped in Busan, Korea.

A typical deployed vessel, for instance, the Pacific Islander II, is 161 meters in length, 7.6 meters in draft, 912 TEU capacity and equipped with two 40-ton cranes and a ramp for RORO cargo. She can carry containers, break bulk and RORO cargoes such as automobiles and trucks. These have been developed and tailored on port condition of the Pacific Islands with shallower water, few quay cranes on port, less container cargo handling in each port, variety of cargo package. The deployed vessels in the Far East route are relatively larger than those in NZ and Australia route.

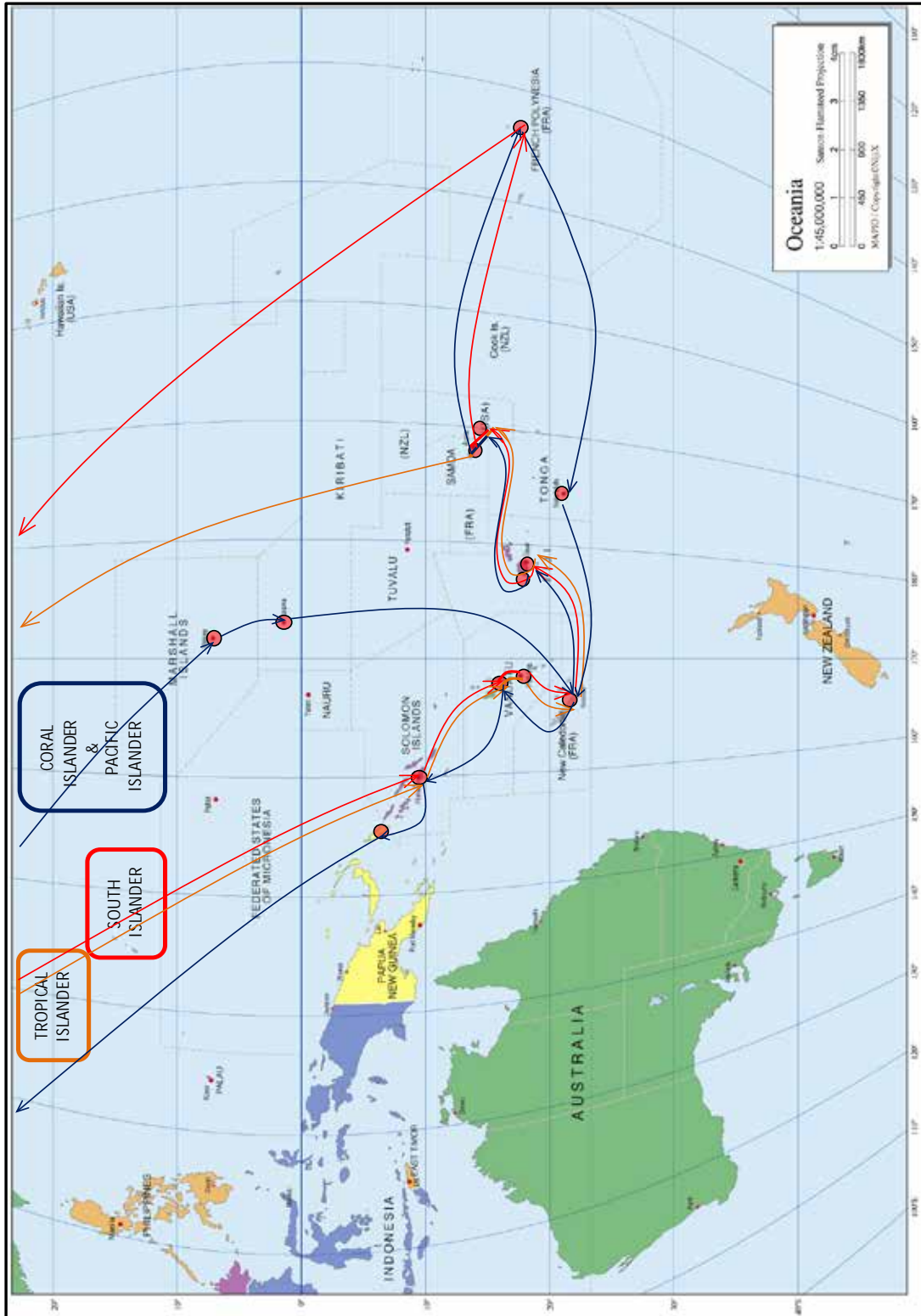




Figure 4-4 Shipping route between PICs and the Far East

**Table 4-6 Specification of deployed ships between PICs and Far East**

Pacific Islander			Tropical Islander		
	Gross tonnage	17,134t		Gross tonnage	18,174t
	Length	161.0m		Length	151.0m
	Beam	25.0m		Beam	25.0m
	Draft	7.6m		Draft	8.0m
	TEU	912TEU		TEU	966TEU
	Cargo gear	2×40t cranes		Cargo gear	2×40t cranes
	Ramp	equipped		Ramp	equipped

South Islander			Coral Islander		
	Gross tonnage	18,174 t		Gross tonnage	17,111 t
	Length	161.0m		Length	161.0m
	Beam	25.0m		Beam	25.0m
	Draft	8.0m		Draft	7.7m
	TEU	966TEU		TEU	914TEU
	Cargo gear	2×40t cranes		Cargo gear	2×40t cranes
	Ramp	equipped		Ramp	equipped

3) PICs – Singapore Route

Table 4-8 and Figure 4-5 shows container shipping route between PICs and Singapore. Swire operates the route and deploys four vessels. Voyage duration is 60 days. The ships call 24 times per year but only call Suva and Lautoka in Fiji among ports in PICs. Suva is in fact a hub port in PICs for Singapore.

**Table 4-7 Operators and its service between PICs and Singapore**

SERVISE ROUTE (Shipping Company)	VESSEL	VOYAGE DURATION (Number of calls in a year)	PORT OF CALL
SINGAPORE / FIJI / NEWZEALAND (Swire)	Pacific Nanigator	60days (24)	JURONG - JAKARTA-PORT MORESBY- NOUMEA-LAUTOKA-SUVA-TAURANGA- AUKLAND - LAE - DAVAO - JURONG
	Tasman Endeavour		
	Ningpo		
	Ninghai		
	Total	(24)	

note:Voyage duration indicates for full circle.

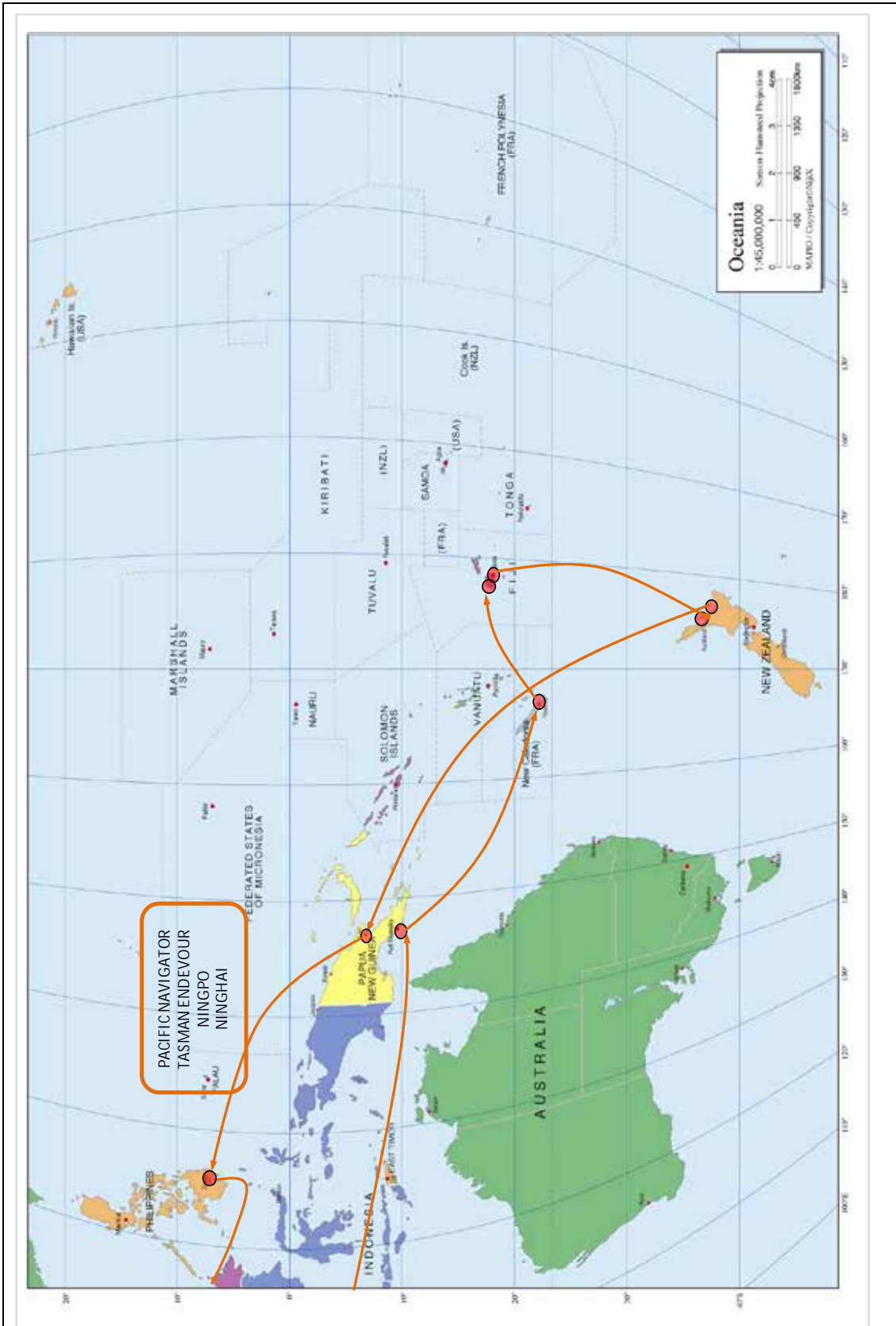






Figure 4-5 Shipping route between PICs and Singapore

Four container ships are serving in the route of which gross tonnages of deployed vessels are 16,175 GT to 18,451 GT. The ships capacities are varying from 1,258 TEUs to 1,728 TEUs. A typical vessel, for instance, MV Tasman Endeavour, is 184.9 meters in length, 10.588 meters in draft, 1,257 TEUs capacity and equipped with two 26 and 35 ton cranes. Drafts of these ships are more than 10 meters in depth.

**Table 4-8 Specification of deployed ships between PICs and Singapore**

Pacific Navigator			Tasman Endeavour		
	Gross tonnage	16,175t		Gross tonnage	18,451t
	Length	184.7m		Length	184.9m
	Beam	25.3m		Beam	27.6m
	Draft	10m		Draft	10.588m
	TEU	1728TEU		TEU	1257TEU
	Cargo gear	3×45t cranes		Cargo gear	3×35t 2×26t
	Ramp	none		Ramp	none
Ningpo			Ninghai		
	Gross tonnage	16,801t		Gross tonnage	16,802t
	Length	183.9m		Length	184.7m
	Beam	25.3m		Beam	25.3m
	Draft	10.0m		Draft	10.0m
	TEU	1,728TEU		TEU	1,728TEU
	Cargo gear	3× 45t cranes		Cargo gear	3× 45t cranes
	Ramp	none		Ramp	none

4) PICs – the USA Route

Figure 4-6 and Table 4-9 shows container shipping routes between PICs and the USA. Hamburg Sud and Hapag Lloyd are operating the routes with six ships. Hamburg Sud operates Hawaii, USA, Samoa, Tonga and USA route with 30 days voyage, and Hapag Lloyd operates Australia, NZ, Fiji and USA route with 60 days voyage respectively. The ships call 36 times in a year. Long Beach and Oakland are base ports on the USA west coast.

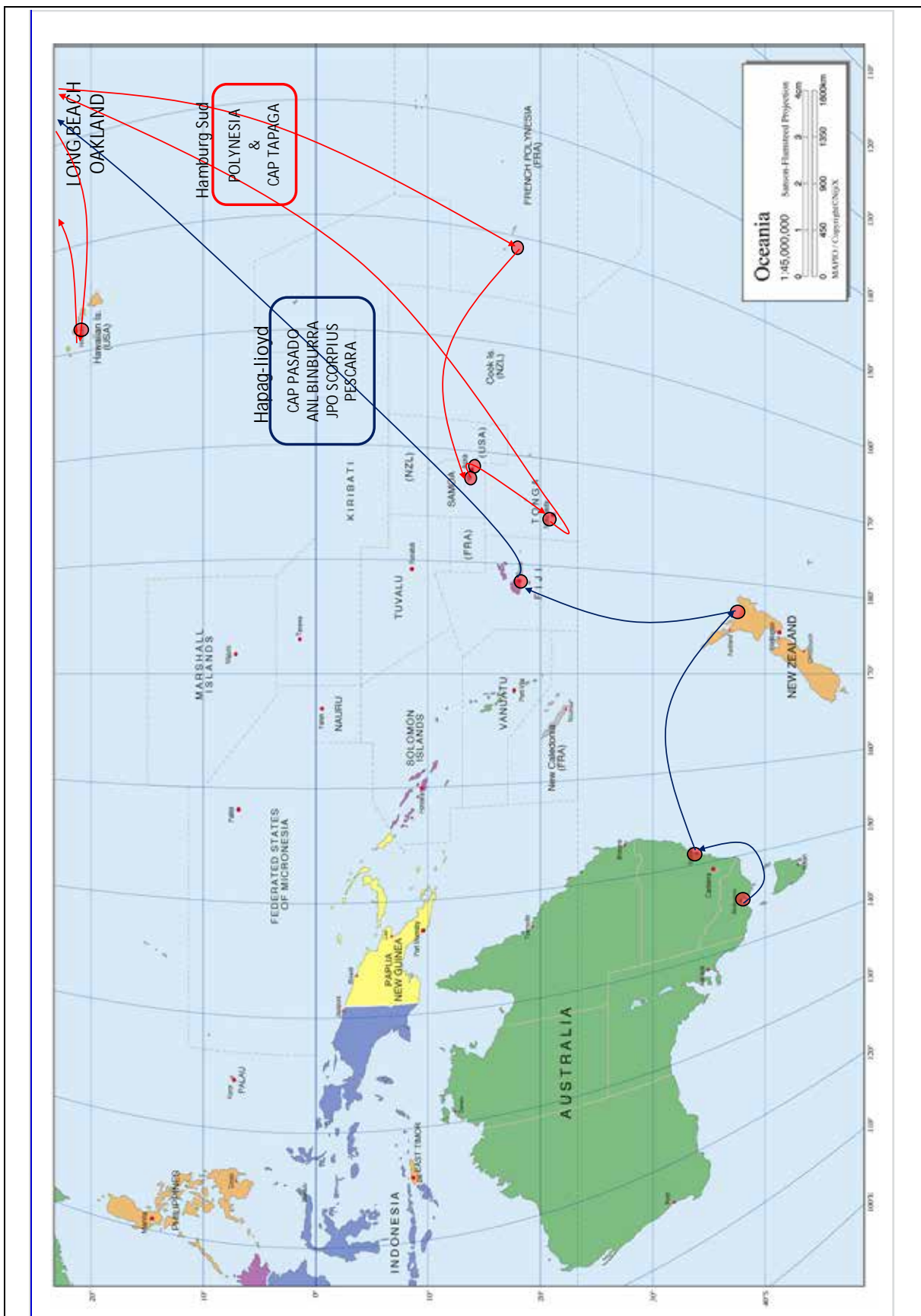


Figure 4-6 Shipping route between PICs and the USA



**Table 4-9 Operators and its service between PICs and the USA**

SERVISE ROUTE (Shipping Company)	VESSEL	VOYAGE DURATION (Number of calls in a year)	PORT OF CALL
HAWAI / USA / SAMOA / TONGA / USA (Hamburg Sud)	Cap Tapaga Polynesia	30days (12)	HONOLULU - SEATTLE - LONG BEACH - OAKLAND - PAPEETE - APIA - PAGO PAGO - NUKU'ALOFA - LONG BEACH - OAKLAND - HONOLULU
AUSTRALIA / NEWZEALAND / FIJI / USA (Hapag-lloyd)	JPO Scorpius Cap Pasada ANL Binburra Pescara	60days (24)	MELBOURNE -SYDNEY- TAURANGA - SUVA - OAKLAND - LONG BEACH - AUCKLAND - MELBOURNE
	Total	(36)	

note:Voyage duration indicates for full circle.

Table 4-10 shows specification of deployed ships between PICs and the USA. Six container ships are serving in the route of which gross tonnages of deployed vessels are 12,029 GT to 28,372 GT. Ships' capacities are varying from 1,122 TEUs to 2,742 TEUs. A typical vessel, for instance, MV Cap Pasado, is 221.6 meters in length, 11.1 meters in draft, 2,742 TEUs capacity and equipped with three 45 ton cranes. Drafts of these ships range from 9m to 12m in depth. Compared to the ships deployed in Australia, New Zealand route, the ship for the USA route is larger. Long voyage requires large ships for navigation.

**Table 4-10 Specification of deployed ships between PICs and the USA**

Polynesia			Cap Tapaga		
	Gross tonnage	15,636t		Gross tonnage	12,029 t
	Length	161.4m		Length	157.1m
	Beam	25.0m		Beam	23.5m
	Draft	9.9m		Draft	9.3m
	TEU	1,304TEU		TEU	1,122TEU
	Cargo gear	2×45t cranes		Cargo gear	2×45t cranes
	Ramp	none		Ramp	none



Cap Pasado			ANL Binburra		
	Gross tonnage	28,372t		Gross tonnage	25,535t
	Length	221.6m		Length	207.4m
	Beam	29.8m		Beam	29.8m
	Draft	11.1m		Draft	11.6m
	TEU	2,742TEU		TEU	2,466TEU
	Cargo gear	3× 45t cranes		Cargo gear	3×45t cranes
	Ramp	none		Ramp	none
JPO Scorpius			Pescara		
	Gross tonnage	26,350t		Gross tonnage	35,697t
	Length	210.0m		Length	231.0m
	Beam	30.1m		Beam	32.2m
	Draft	11.5m		Draft	12.0m
	TEU	2,602TEU		TEU	3,554TEU
	Cargo gear	4×45t cranes		Cargo gear	none
	Ramp	none		Ramp	none

## (2) Maritime Freight

Maritime freight rate is set by private negotiation, and mainly depends on the volume and frequency of cargoes. Furthermore, vessel capacity and cargo demand is a key factor for deciding the freight rate. That is why the freight rate is said to be confidential. The team conducted a survey on the freight rate to shipping agents and shipping companies in PICs. According to the survey, the shipping companies are suffering an imbalance of import/export. The share of import is said to be between 75% and up to over 90% of the total cargoes. They are offering a lower rate on exports to address the imbalance. The freight rates that we obtained from the shipping agents and companies are summarized below. Freight rate per 20ft container from Australia, NZ to PICs is US\$1,000 to US\$3,000. If cargoes are transhipped in Suva, the rate increases to over US\$4,000. On the other hand, freight rate from PICs to Australia and NZ is from US\$650 to US\$2,500. Freight rate per 20ft container from the Far East to PICs is US\$3,000, while that from PICs to the Far East is US\$1,500 to US\$2,000. The freight rate of exports is half to two-thirds that of imports.

**Table 4-11 Freight rate in each route from/ to the PICs (unit: \$US per 20ft container)**

<b>Route</b>	<b>Freight rate in March 2012</b>
Australia,NZ to PICs	1,000 - 3,000
Australia,NZ to PICs (Fiji Tranship)	over 4,000
PICs to Australia,NZ	650 - 2,500
Far East to PICs	3,000
PICs to Far East	1,500 - 2,000
Singapore to PICs	N/A
PICs to Singapore	1,500 - 3,000

Note:(a) Actual freight rate is confidential. The rate is set through private negotiation between a shipping company and shipper and mostly depends on the volume, frequency of shipping cargoes.

(b) BAF(Bunker Adjustment Factor) is included. Terminal handling charges at origin and destination port are not counted.

(c)The JICA study team roughly summarized transportation cost based on shipping company and shipper interviews in five countries.

Next, team compared the freight rate in PICs with that in major routes in the world. Table 4-12 shows freight rate for major trade routes in the world. The freight rate from South China to USWC (US west coast) is US\$2,100, while that from USWC to South China is US\$670. This difference means that more cargoes flow from China to the US than vice versa. The same trend is found in other routes; South China - USEC, South China - UK, UK- USEC. Freight rate per 40ft container is US\$670 to US\$2,760 in the major world routes. The freight rate of a 20ft container is said to be approximately 60 % that of a 40ft container. If this ratio is applied, the freight rate per 20ft container in the major routes would be US\$ 402 to US\$1,656. This value includes terminal handling charges at origin and destination.

On the other hand, freight rate per 20ft container from/ to PICs is US\$650 to US\$3,000 (see Table 4-11). These numbers exclude terminal handling charges at origin and destination ports. This comparison shows that the freight rate in PICs is higher than that in world major routes. Serious imbalance of cargo volume, small volume of cargo, poor port facility and difficulty of formation of hub-spoke network are the causes of the higher freight rate.

**Table 4-12 Freight rate benchmarks (spot market) for major trade routes, “All-in” (US\$ per 40ft containers)**

Route	Freight rate in March 12
South China to USWC	US\$2,100
USWC to South China	US\$670
South China to USEC	US\$3,290
USEC to South China	US\$1,670
South China to UK	US\$2,760
UK to South China	US\$1,280
UK to USEC	US\$2,360
USEC to UK	US\$1,320
Note: All-in rates include base rate, BAF, other surcharges and terminal handling charges at origin and destination	
Source: Drewry Container Freight Rate Insight	

Scrap metal is actually collected and shipped from Vanuatu to Korea now. The team explored the share of marine transportation cost in producing recycling materials (see Table 4-13). Selling price of scrap metal in the global market is said to be US\$350 per ton. If scrapped metal is collected, sorted into a standard size, packed into containers and shipped to the destination, following costs should be counted. Selling price of metal metal is US\$7,000 per 20ft container. On the other hand, its marine transport and terminal handling charges would be US\$2,180 per 20ft container. Even though collecting fee, sorting labor cost, and land transportation cost should be counted, we can assume that share of water transportation cost is at most 31% of producing and shipping scrap metal from PICs to the Far East. On the other hand, selling price of base metal and precious metal are much higher than that of scrap metal (see Table 4-14). Recycling these metals would be more viable assuming collection and sorting fee are the same as scrap metal.

**Table 4-13 Case study of fee (tentative)**

Vanuatu - Far East		Work Fee	Value(US\$/TEU)	Share	
Cost	Collection and Sort	scrap collecting fee	N/A	} 31%	
		sort scrap and pack in container	N/A		
	Transportation cost	Inland freight	N/A		
		water freight (Pacific Islands - Far East)	1,600		
	Terminal handling charge	Port in Pacific Islands (Port Vila)	506		
		Port in Far East (Busan)	74		
		Total	2,180+a		
					<u>US\$ per ton</u>
Income	Scrap metal	Scrap metal	7,000	100%	350
		Note: Selling price of Scrap metal is US\$350 per ton.			

**Table 4-14 Selling price of base metal**

	Selling Price	
	US\$ per ton	US\$ per TEU
Steel	350	7,000
Copper	8,043	160,860
Lead	2,094	41,880
Zinc	1,981	39,620
Nickel	19,815	396,300

Source: Steel: Team interviewed a recycling agent in NZ  
 Copper, Lead, Zinc, Nickel: data from Japan Oil, Gas and Metals National Corporation

Figure 4-7 shows selling price of scrap metal in Tokyo for the last 8 years. In the beginning of 2004, the price of scrap metal was relatively stable, fluctuating between JPY 10,000 to 20,000 per ton. However, in late 2006 the price started to increase and reached JPY 60,000 per ton in July 2008. This huge surge in price was due to a shortage of metal when the Beijing Olympic games were held in August 2008. The price dropped to JPY 4,000 per ton just after the games, and has been ranging between JPY 20,000 to 30,000 per ton recently. This means that the price is changeable depending on world market.



(Source: Sangyo Press, Japan)

**Figure 4-7 Selling price of scrap metal in Tokyo, Japan**

**(3) Quarantine at a destination port**

When importing recycling materials, the materials are subjected to quarantine inspection. A

consignor has to meet quarantine requirements at a destination port. Many recyclable materials tend to be exposed to the elements and thus it will be necessary to remove biosecurity contaminants in the processing stage. Precise information on quarantine regulations is necessary for exporters of recycling materials in PICs.

Quarantine regulations in New Zealand where many of the recycling materials are imported from PICs are as follows. Importing scrap metals are designated as inorganic risk materials (IRMs) in Biosecurity in New Zealand. The import health standard states the minimum legal requirements that must be met at the port of first arrival and at transitional facilities when importing full containers of the IRMs from any country into New Zealand. All containers of the IRMs must be clean and free of regulated biosecurity contaminants and pests (or meet the threshold specified under Table 4-15). Scrap metal for recycling is categorized as IRMs. Table 4-16 shows mandatory treatment and MAF inspection requirement on scrap metal. Furthermore, information relating to IRM consignments must be received by the Ministry of Agriculture and Forestry (MAF) prior to arrival. This includes: (1) Commodity type. (2) Port of origin. (3) Shipment details (for example vessel, consignee, container number, treatment certification (if conducted offshore and prior permission was obtained from MAF).

In addition, consignments of IRMs (less than a container load) inside mixed consignment containers and in/on flat-rack containers, open sided or open top containers and pallets are prohibited from entering NZ. If these consignments arrive at the NZ boarder they will be held, re-shipped to origin or treated unless prior written agreement from MAF was provided permitting importation.

**Table 4-15 Threshold levels for biosecurity contaminants and other contaminants**

Regulated Biosecurity / Other Contaminant Type	Per IRM Consignment
Animal materials or by-products (biosecurity risk materials)	Prohibited
Arthropods & Molluscs – dead (biosecurity risk materials)	Unlimited permitted
Plant Material - dead / desiccated (biosecurity risk materials) <sup>1</sup>	5 pieces(<20cm) are permitted only
Plant Material – fresh / green including seeds (biosecurity risk materials) <sup>1</sup>	Prohibited
Dust/Gravel/film/Sand (including no biosecurity risk material)	Unlimited permitted
Soil (risk material)	20 grams only permitted
Water	Prohibited unless treated on arrival
Wood	Prohibited unless ISPM 15 compliant

1. Includes fruit, leaves, twigs, bark, etc

**Table 4-16 Mandatory treatment and MAF inspection requirements (abstract)**

Category	Treatment	Inspection Requirement at the port of first arrival (POFA) or at transitional facilities (TF)
Scrap metal	Fumigation or heat treatment at POFA within 12 hours of arrival	6-sides inspection at the POFA, then scrap metal inspection within 4 hour of TF unloading.

### **4.1.3 Summary**

There is heavy dependency on the import of consumer goods in the PICs. Various commodities, food, machines, clothes and transportation vehicles are imported but few cargoes, only first industry production, sugar, fish and copra are export commodities. Fiji, the largest exporter of PICs, exports one-fourth of the import value. The ratios of the other countries are less than that of Fiji. It was also found that recycling materials are new export commodities in PICs. Recycling consumers exist in the Pacific region such as Korea, China, Vietnam and Indonesia. Japan still imports scrap metal even though it is major scrap metal export country.

PICs are connected to the developed countries where final recycling consumers are found. There are four major shipping routes. One is from PICs to NZ and Australia. There is a heavy traffic between PICs and NZ, Australia. Second is to the Far East. Kyowa and its partners operate services 21 times per year. They deploy multi-purpose vessels tailored for ports in PICs with shallow water, poor port facilities and a few but various cargoes. The third is to Singapore. SWIRE operated the only direct line to Jurong, Singapore 24 times per year. Deployed vessels are container ship with 1,200 to 1,700 TEU capacities. The fourth is for US. Hamburg Sud and Hapag-Lloyd operate direct connection to the US west coast by container vessels with 1,200 to 2,700 TEU capacities.

Freight rate in PICs is higher than that in the major world route. Shipping companies provide a lower price for export than that for import to encourage export in PICs as they do in the major world routes. After conducting a case study of recycling cost, the team assumes that share of water transportation cost was at most 31% of producing and shipping scrap steel from PICs to the Far East. In addition, selling price of base metal and precious metal are much higher than that of scrap metal. These metals would be more viable. The export of scrap metal is viable under present market conditions as we mentioned before. However, the selling price of scrap metal depends on the global market; in addition, domestic freight rate will be added to the selling price when it is transported from local islands. Accordingly, future prospects are not known.

Recycling materials are subjected to quarantine inspection in importing ports. A consignor has to meet quarantine requirements at a destination port. Many recyclable materials tend to be exposed to the elements and thus it will be necessary to remove biosecurity contaminants in the processing stage. Precise information on quarantine regulations is necessary for exporters of recycling materials in PICs.

## **4.2 Domestic maritime network**

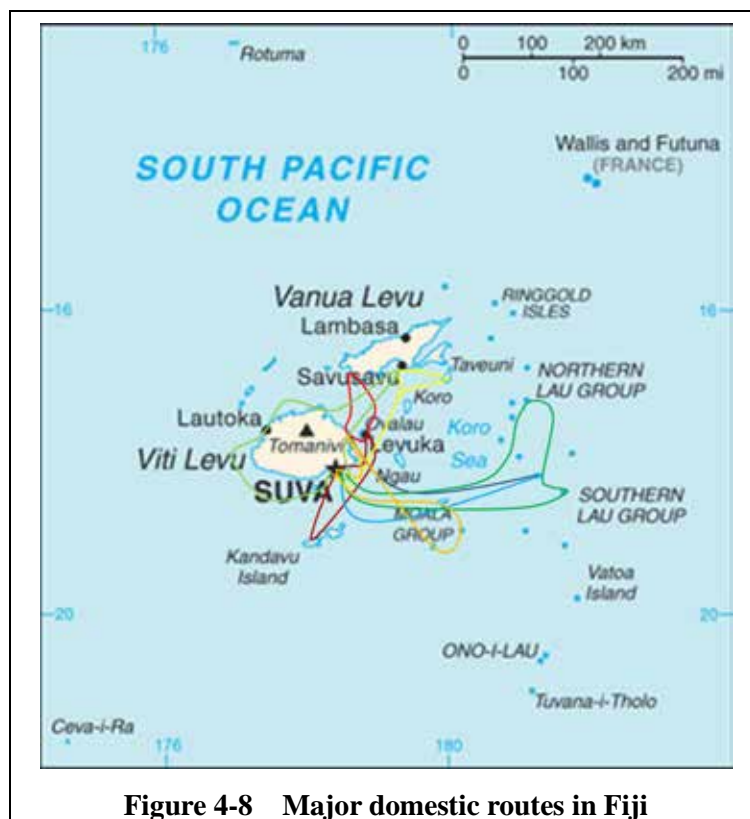
Each PICs consists of many islands, and some of them are far away from the mainland. The dispersed and distant islands make it difficult to collect and transport recycling materials. In this section, we will examine the domestic shipping network, freight rate and port conditions and present recycling materials transport in PICs.

#### 4.2.1 Fiji

Fiji consists of 322 islands, of which 106 are inhabited. Total population is 860,000. There are two major islands; Viti Levu and Vanua Levu, which together account for approximately three-quarters of the total land area of the country. Other islands and island groups include Taveuni and Kandavu (the third and fourth largest islands respectively), the Lomaiviti Group, off Suva, and the remote Lau Group. Viti Levu hosts the capital city of Suva, and nearly three quarters of the population live here.

##### (1) Ships and routes for domestic transport

Viti Levu is the mainland of Fiji, hosting two international ports; port of Suva and port of Lautoka and a domestic port of Natovi. Second largest island, Vanua Levu has two major domestic ports; Savusavu and Nabouwalu. Fiji's domestic shipping routes are extending to remote islands and groups from Viti Levu and Vanua Levu. Major private companies are providing the following routes as illustrated below (see Figure 4-8).



**Figure 4-8 Major domestic routes in Fiji**

A total of 647 RORO vessels called Fiji Ports in 2010. RORO vessels transported 1,162,880 GRT while the total domestic volume is 1,555,927 GRT. This shows that the RORO vessels play an important role in marine domestic transportation.

**Table 4-17 Vessel in Fiji ports (2010)**

Vessel type	Number	GRT
Foreign vessel	1,516	12,456,706
RORO/passenger	647	1,162,880
Conventional/passenger	556	126,770
Fishing/Others	2,848	266,277
Local sub-total	4,051	1,555,927
Total	5,567	14,012,633

Source: Fiji Ports Corporation

Government Shipping Service (GSS) which is belong to Ministry of Works, Transport and Public Utilities and nine private shipping companies are operating cargo transportation in Fiji as listed below (See Table 4-18).

**Table 4-18 Shipping company and its service routes**

Shipping company	Route	Ship
Patterson Brothers Shipping	Natovi - Nabouwalu - Levuka	Ferry
Venu Shipping Ltd	Suva - Kadavu - Levuka	RORO
Gounder Shipping	Suva - Savusavu - Taveuni	N/A
Bligh Water Shipping	Lautoca - Suva - Natovi - Savusavu	N/A
Kelton Group	Natovi - Nayau	N/A
Lau Shipping	Suva - Lau group ( Lakeba - Nayau - Vanua Balavu - Cicia - Vanua Vatu )	N/A
Seaview Shipping	Suva - Lomaiviti group (Gau - Bakiraki - Naviti - Moala - Totoya - Matuku - Levuka - Natovi)	N/A
Cruz Holding	Suva - Taveuni - Savusavu	N/A
Consort Shipping	Suva - Savusavu - Taveuni	Ferry
	Suva-Gau	Ferry
	Suva - Naitaba - Mago, gourps	Barge
Government Shipping Services	Suva-small islands and groups	Ferry/Barge

(Hearing from Shipping companies in Fiji)

RORO ships are very popular for marine transportation in Fiji Suva. Natovi, Levuka, Kadavu and Savusavu are major domestic ports which can accommodate RORO ships.(see Figure 4-9 and Figure 4-10). However, barges are used in small islands and island groups where deep draft ships cannot enter. Information on direct RORO ship entry ports was not obtained in the survey.

GSS owns a RORO ship and four general cargo vessels. They are serving remote and less populated island routes where large revenues cannot be expected and thus receive government financial support. GSS transported 2,882 tons of cargoes outward and 144 tons of cargoes inward in 2009. According to a representative of GSS, recycling material cargo has not been transported.





**Figure 4-9 A ferry boat accommodating containers, automobiles, trucks and passengers (domestic terminal in Suva)**



**Figure 4-10 A truck boarding a RORO ship (domestic terminal in Suva)**

**(2) Ports**

The Ministry of Works, Transport and Public Utilities holds jurisdiction over ports, and marine transport, while the Fiji Ports Corporation operates six ports (Suva, Lautoka, Malau, Levuka, Wairiki and Rotuma). The total volume of trading is 2,005,072 tons for import and 1,439,115 tons for export, totaling 3,444,187 tons in 2010. Within this volume, the container volume is 1,748,326 tons or 86,863 TEU while include 959,557 tons for import and 788,769 tons for export.

**Table 4-19 Fiji's container trading volume**

	2007	2008	2009	2010
Import	962,157 t	1,004,013 t	898,347 t	959,557 t
Export	788,687 t	745,382 t	642,109 t	788,769 t
Total	1,750,844 t	1,749,395 t	1,540,456 t	1,748,326 t

(ton)

(Source: Fiji Ports Corporation)

Note: Fiji exported 8,663 tons (equivalent to 433 TEU) of recycled materials in 2011 according to customs statistics. According to the interview survey with recycling contractors, they export 20 TEU of recycled materials per month (240 TEU or 4,800 tons per year).

The current status of the Port of Suva and Port of Lautoka, which are international ports of Viti Levu Island, and major ports of the neighboring islands Vanua Levu and Kadavu are described below.

- 1) Port of Suva
  - a) **Outline of Port of Suva**



Figure 4-11 Entire view of Port of Suva

**b) Port of Suva Container Terminal**

The quay layout of the Suva Terminal is shown in Fig. 4-14. The total length of the quay is 845 m, including 495 m for Kings wharf, 165 m for Princes wharf, and 185 m for Walu Bay wharf. The depth is 11 m for all of them. The total area of the terminal is 8.0 ha. The cargo of container vessels is mainly handled in the 330 m long section of Kings Central and Kings North.

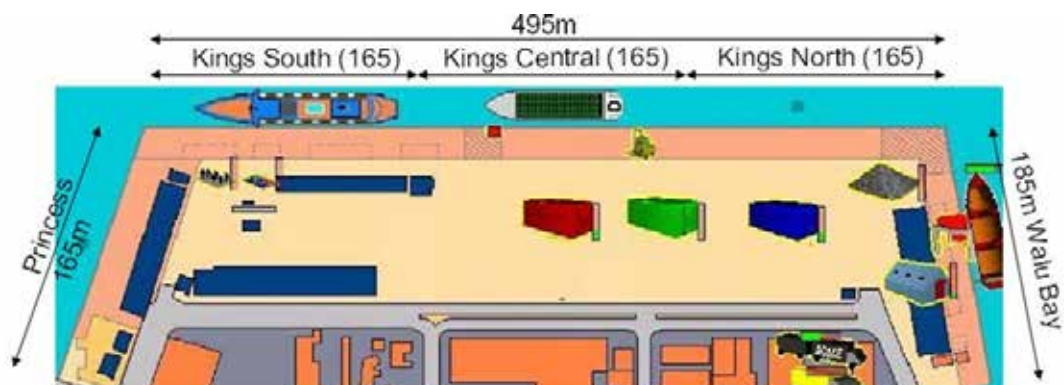


Figure 4-12 Layout of Suva Container Terminal

**Table 4-20 Major port facilities of Suva Container Terminal**

Port facility	Length(m)	Depth(m)
Kings wharf	495m	11m
Princes wharf	165m	11m
Walu Bay wharf	185m	11m

Terminal area	8.0ha
Container yard area	2.5 ha
Capacity	2,500TEU

The container yard covers an area of 2.5 ha. The cargo handling equipment includes two 100-ton tire type wharf cranes, two 32-ton trip lifters, and four 25-ton trip lifters. Because there are no straddle carriers, trailers are used to transport cargo within the yard.

**Table 4-21 Major cargo handling equipment at Suva Container Terminal**

Major cargo handling equipment	Number
Mobile crane(100 tone)	2
Top lifter(32 tone)	2
Top lifter(25 tone)	6
Fork-lift(20 tone)	2
Yard tractor(40 feet)	3
Yard tractor(20 feet)	3

As shown in Figure 4-13, the yard layout of Suva container terminal has two mobile cranes, Amigo and Mika, at the front of the wharf, and yard tractor cranes operate clockwise on a one-way route. The slot layout is six slots by two or three rows and ten slots by two to four rows.



**Figure 4-13 Yard layout of Suva Container Terminal**

The annual number of container handled in 2011 was 52,254 TEU. The breakdown is 35,340 20-ft containers and 7,957 40-ft containers, and 80% of the total volume was occupied by 20-ft containers. Imports are far greater than exports with 28,409 TEU for imports and 17,823 TEU for exports. The port also handles transshipment cargo, which was 5,022 TEU in 2011.

**Table 4-22 Container trading volume at Suva Container Terminal in 2011**

2011	20 feet ( box )	40 feet(box )	TEU
Import	18,461	4,974	28,409
Export	12,839	2,492	17,823
Tranship(Import)	1,639	214	2,067
Tranship(Export)	2,401	277	2,955
<b>TOTAL</b>	<b>35,340</b>	<b>7,957</b>	<b>52,254</b>

The total number of vessels that called at this port in 2011 was 277 including 261 container vessels, 2 car ferries, and 14 bulk cargo vessels. The terminal operation company said the Port of Suva was congested since there are only two container berths actually available.

**Table 4-23 Vessels berthed at Suva Container Terminal in 2011**




Number of ship visits 2011	
Container	261
Car carrier	2
Bulk carrier	14

**c) Survey on the current status of the cargo handling capability of Suva Container Terminal**

The status of cargo handling at Suva Container Terminal was investigated by visual observation of four container vessels and counting the number of containers handled per hour. The survey was conducted in three days, Sept. 22, 23 and 28 in 2012.

**i) Visual observation result**

Container handling is conducted round-the-clock by three teams in three shifts from 0:00 to 8:00, 8:00 to 16:00, and 16:00 to 24:00. Work is cancelled when it rains. The results of visual observation are summarized in Fig. 4-14, 4-15, and 4-16.

		
<p><b>Figure 4-14 Shipboard crane handling 20-ft containers</b></p>	<p><b>Figure 4-15 Handling of 40-ft containers on the deck</b></p>	<p><b>Figure 4-16 Cargo handling with a wharf crane</b></p>
<p>20-ft containers are handled with ship gear (shipboard crane) and a spreader. This procedure is poor in container stability during loading and unloading and is also time-consuming.</p>	<p>Containers handled only with ship gear with no spreader. This work lacks stability and is time-consuming. When handling filled 40-ft containers, the vessel itself can greatly careen because of the moment of the containers.</p>	<p>Cargo handled with two shore cranes. This procedure ensures greater efficiency than use of ship gear but is said to only be capable of handling up to about 20 containers per hour. One of them was out of order.</p>

ii) Results of cargo handling capacity survey

The number of containers handled per hour was counted for four container vessels. Changes in the number of containers handled per hour for the containers surveyed are shown in Figs. 4-19, 4-20, 4-21 and 4-22. The number of containers handled and the specifications of the container vessel are shown in Tables 4-25 to 4-28. Two cranes handled the cargo of all vessels.

Every survey shows a wide variety in the number of containers handled per hour, which means cargo handling was not stable. The average number of containers handled per hour is 6.8 for Scelde Trader, 14.8 for South Islander, 8.4 for ANL BinBura, and 11.3 for Reef Samoa, and the total average is 10.3. The maximum number of containers handled is 11 for Scelde trader, 24 for South Islander, 17 for ANL BinBura, and 19 for Reef Samoa, and the total average is 17.8. When cargo is handled with a deck crane, cargo is hoisted with a single wire, not in a four-point hoisting style, and therefore the container itself greatly swings during hoisting. Thus, a lot of time is spent on the loading and unloading of these containers. Container vessels that call in the port are not particularly large. Given their size, these vessels sway and roll more while containers placed on the quay are being stacked aboard with a shipboard crane. Excessive motion of a ship creates various risks; the safety of cargo handling workers may be compromised, container casings may be damaged due to the containers bumping into each other, or the cargo inside containers may be damaged. The terminal operator pointed out insufficiency in maintenance of cargo handling machinery claiming that shore cranes are more efficient than shipboard cranes but cannot perform to their full potential because of frequent failures or because spreaders, which are designed to ensure stability of crane hoisting in a single-point suspension, often fail.

The general understanding about the cargo handling efficiency of a tire-type crane is that one crane can handle about 20 containers per hour. Now that two cranes have been installed, there should be more room for efficiency improvement considering the present cargo handling results. It is also necessary to improve the operating rate of shore cranes and spreaders. Improvement in maintenance skills for cargo handling machinery is also required. The hinterland of the port is occupied by management offices and warehouses. If a processing facility and /or dedicated yard for recyclable materials is set up in the port area in the future, appropriate measures should be taken accordingly such as revision of the terminal layout and improvement of the cargo storage capacity.

Vessel: Scelde Trader; survey date: Sept. 22, 2012

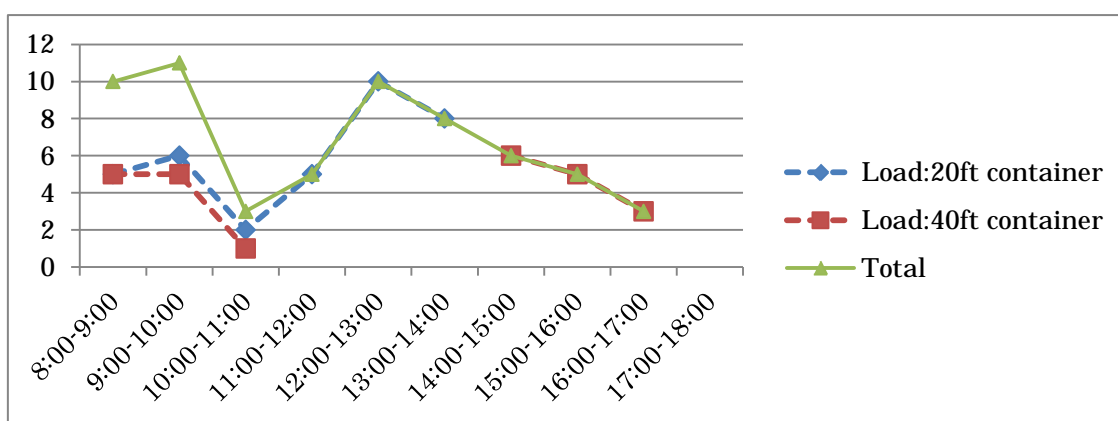
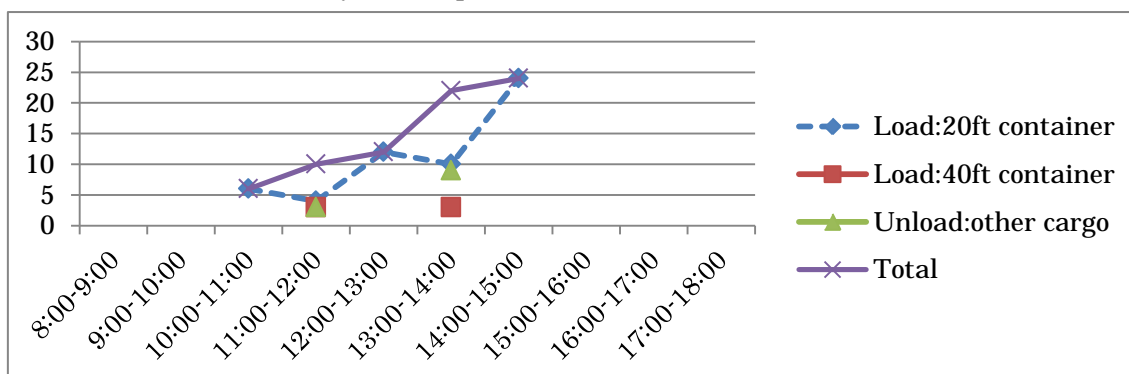


Figure 4-17 Changes over time in the number of containers handled (Scelde Trader)

Table 4-24 Handled container survey results and container vessel specification (Scelde Trader)

Total handling number	61 box	Vessel	Scelde Trader
Average handling number	6.8 box per hour	Length	132.60m
The maximum handling number	11 box per hour	Draft	7.20m
The minimum handling number	3 box per hour	TEU	660 TEU
The number of cranes	2 ship crane	Cargo gear	2×50t cranes

Vessel: South Islander; survey date: Sept. 23, 2012

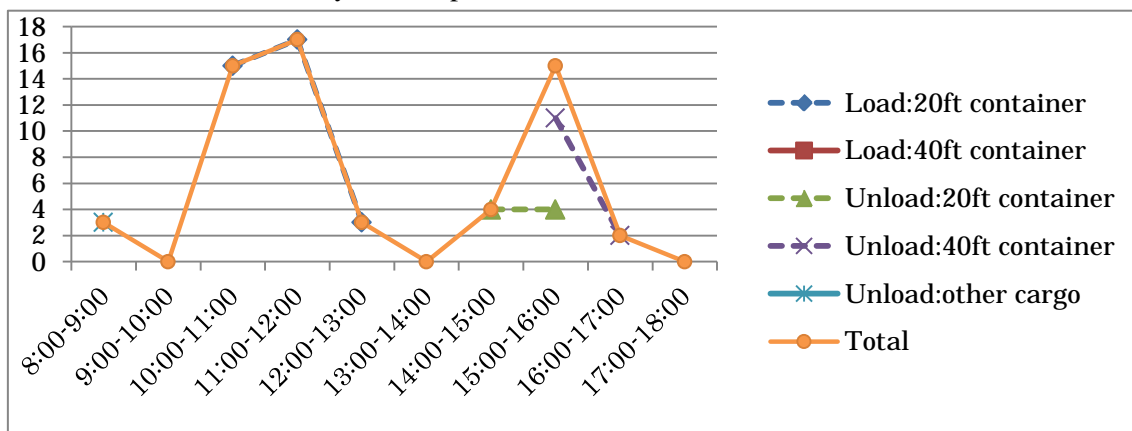


**Figure 4-18 Changes over time in the number of containers handled (South Islander)**

**Table 4-25 Handled container survey results and container vessel specification (South Islander)**

Total handling number	74 box	Vessel	South Islander
Average handling number	14.8 box per hour	Length	161.0m
The maximum handling number	24 box per hour	Draft	8.0 m
The minimum handling number	6 box per hour	TEU	966 TEU
The number of cranes	2 ship crane	Cargo gear	2×40t cranes

Vessel: ANL BinBura; survey date: Sept. 28, 2012



**Figure 4-19 Changes over time in the number of containers handled (ANL BinBura)**

**Table 4-26 Handled container survey results and container vessel specification (ANL BinBura)**

Total handling number	59 box	Vessel	ANL BinBura
Average handling number	8.4 box per hour	Length	207.4m
The maximum handling number	17 box per hour	Draft	11.6 m
The minimum handling number	2 box per hour	TEU	2,466TEU
The number of cranes	1 ship crane + 1 mobile crane	Cargo gear	3×45t cranes

Vessel: Reef Samoa; survey date: Sept. 28, 2012

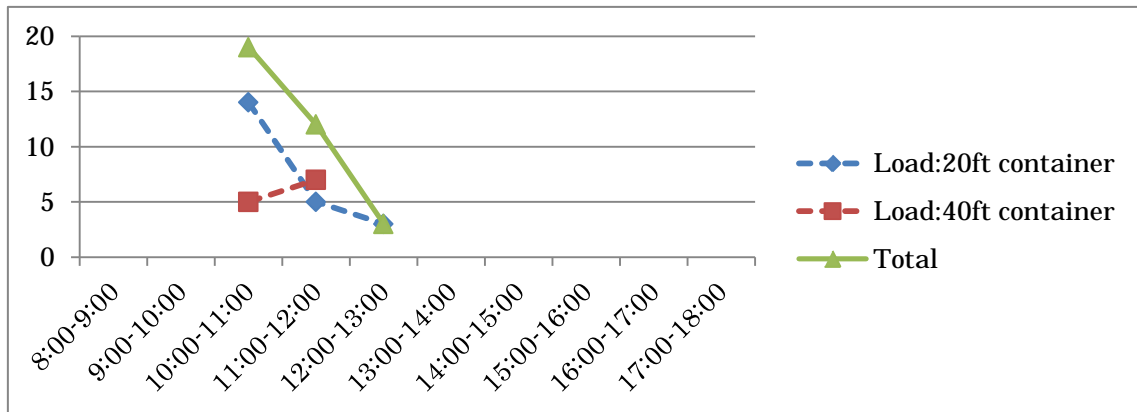


Figure 4-20 Changes over time in the number of containers handled (Reef Samoa)

Table 4-27 Handled container survey results and container vessel specification (Reef Samoa)

Total handling number	34 box	Vessel	Reef Samoa
Average handling number	11.3 box per hour	Length	109.4 m
The maximum handling number	19 box per hour	Draft	5.8 m
The minimum handling number	3 box per hour	TEU	519TEU
The number of cranes	2 ship cranes	Cargo gear	2×40t cranes

## 2) Port of Lautoka

Like the Port of Suva, the Port of Lautoka is also located in Viti Levu Island and is Fiji's second largest container port. The major quay specifications are 299 m in total length and 11 m in depth, while the domestic port's quay specifications are 78 m in total length and 7 m in depth. Behind the port are located many factories including a sugar manufacturing factory and chip factory.



Figure 4-21 Entire view of Port of Lautoka



**Table 4-28 Specifications of major port facilities of Port of Lautoka**

Port	Wharf	Length(m )	Depth(m)	Remarks
Lautoka	International	299	11	
	Domestic	78	7	

(Source: Fiji Ports Corporation)

### 3) Ports on Neighboring Islands (Vanua Levu)

Covering an area of about 5,587 km<sup>2</sup> and having a population of about 130,000, Vanua Levu Island is Fiji's second largest island after Viti Levu, where Fiji's capital is located. The largest city on this island is Labasa, which has a population of about 27,000 and is the country's second largest sugar producing town. The second largest city is SavuSavu, a tourist spot.

An integrated marine and land intermodal transport is fully established between Labasa, the central city of Vanua Levu, and Suva in Viti Levu. That is to say, one can travel between Suva and Labasa on an express bus. The route of this service is as follows:

4:30 am: Departure from Suva bus terminal

6:30 - 7:00 am: Departure from Natovi Jetty, northeastern part of Viti Levu, on a ferry

11:00 - 11:30 am: Departure from Nabouwalu Jetty, southwestern part of Vanua Levu, again on a bus by land





3:30 - 4:00 pm: Arrival at Labasa

This land route is also connected to the bus route to the island's second largest town SavuSavu. Express bus service is also available from Labasa to Suva, with a bus departing from Labasa at 6:30. The express bus service is operated once per day from Monday to Saturday (no service on Sundays). The major transportation operators are all private companies, namely Patterson Brothers Shipping, which operates the ferry service, and Seaboard, which operates the express bus service.

There are three ports on Vanua Levu, the Ports of Nabouwalu, SavuSavu and Labasa. These ports are managed by the Maritime Safety Agency of Fiji, an organization under the Ministry of Works, Transport and Public Utilities. Natovi Jetty, which is located in the main island of Fiji, and jetties of Nabouwalu, SavuSavu and Labasa in Vanua Levu island are explained below.

#### Natovi Jetty

A Ro-Ro ramp and a small landing craft ramp are developed on both sides of the jetty. This jetty is located in a place susceptible to waves as no breakwater is constructed off the port. Although some parts of the road from Suva to Natovi Jetty are unpaved, the trunk road connects these two points, a trip which takes about two hours by express bus.

	
<p><b>Figure 4-22 Natovi Jetty before arrival of a ferry</b></p>	<p><b>Figure 4-23 Natovi jetty when a ferry arrived</b></p>
<p>The jetty is 40 m long and 4 m wide. Ferryboats are moored to the front ramp and tires are used instead of fenders.</p>	<p>This ferry, named the Spirit of Harmony, is a used ferry from Japan. It was previously known as Ferry Sazan.</p>
	
<p><b>Figure 4-24 Express bus connecting Suva and SavuSavu</b></p>	<p><b>Figure 4-25 Mooring of the ferry to Natovi Jetty</b></p>
<p>This bus is bound for Labasa, the central city of Vanua Levu, and it connects to another bus bound for SavuSavu along the way to Labasa.</p>	<p>The ferry is longer than the mooring facility, so the concrete mooring post at the tip of the jetty plays an important role.</p>

**Nabouwalu Jetty**

This jetty is about 100 m in total length and about 10 to 20 m in width. No breakwater is constructed, but the flow of water is gentle. The facility is managed by the local office of the Maritime Safety Authority of Fiji (MSAF) on Vanua Levu Island. Although there is direct access from Nabouwalu Jetty by express bus on a ferry to the island's central city Labasa, about half the route is unpaved, and it takes about four hours.



**Figure 4-26 Entire view of Nabouwalu Jetty**

Seen on the ferry deck are many express buses, which directly head for Suva, as well as many cars and passengers. This ferry service mainly carries passengers.



**Figure 4-27 Ferry arrived at Nabouwalu Jetty**

The mooring system used here is longitudinal mooring that connects the rear part of the ferry to the jetty and uses an anchor only to fix the front of the boat.

#### SavuSavu Jetty

This jetty is located in the southern central part of Vanua Levu. It has a Ro-Ro ramp and a recently improved mooring jetty. Ro-Ro ship (carrying a mixture of vehicles and passengers) service connecting to the Port of Suva is operated four times a week by two private shipping companies. Metal Scrap metals are shipped out in the open box of a truck four or five times a week.



**Figure 4-28 Ramp of SavuSavu Jetty to which Ro-Ro boats are moored (longitudinal mooring)**



**Figure 4-29 Newly constructed mooring jetty at SavuSavu Jetty**

#### Labasa Jetty

There is a small jetty along a river flowing through the island's central city Labasa. The jetty is located in the compound of the MSAF that operates the jetty. No large ships such as Ro-Ro ships use the jetty. It is only used to moor small ships and service boats. In the neighborhood are sugar factories and fertilizer factories, and Labasa Jetty is dedicated to the shipping of products from those factories. But we were told that a plan to construct a jetty for international trade at Labasa is under consideration.



**Figure 4-30 Entire view of Labasa Jetty**



**Figure 4-31 Office building of MSAF**

4) Ports on Neighboring Islands: Kadavu Island

Kadavu Island, the third largest island of Fiji after Viti Levu and Vanua Levu, has a population of 10,167 and covers an area of about 411 km<sup>2</sup> (compare to Awaji Island with a population of 140,000 and an area of 592 km<sup>2</sup>). Although there are about 250 settlements scattered across the island, there is no concentration of population in the form of a town or village. The administration office and hospital are located at a place called Vunisea. Kadavu is situated about 90 km south of Suva.

Venu Shipping operates a seaway line that leaves Suva and returns to Suva after visiting Kabulelevu-I-Ra, Vunisea and Kavala on Kadavu Island. The ship leaves Narains Wharf, Walu Bay, Suva, for Kadavu every Tuesday for a sailing time of 24 hours.



**Figure 4-32 Mooring to the buoy (Kabukelevu-I-Ra area)**



**Figure 4-33 Vunisea Jetty**






**Figure 4-34 Kavala Jetty**

There is no quay. Ships are moored to a buoy in the water, and cargo is reloaded onto a small boat for transport to land. A boat is lifted off of the ship, and the personnel on the boat connect the mooring cable to the buoy.

Although the jetty was newly constructed by the government, it is subject to oceanic waves. Therefore, cargo handling is difficult when there are waves. In addition, the jetty suffers scouring.

It is a good port facing an estuary. There are no access roads or warehouses.

		
<p><b>Figure 4-35 Cargo and passenger during landing at Kavukelevu-I-Ra area</b></p>	<p><b>Figure 4-36 Mooring at Vunisa Jetty</b></p>	<p><b>Figure 4-37 Mooring at Kavala Jetty</b></p>
<p>The jetty has no quay. Ships anchor offshore, and cargo and passengers are reloaded for disembarking or embarking. Cargo handling work is prevented when waves occur due to the tidal current. Vessels call to this port once a month.</p>	<p>Cargo is transported on trucks to local settlements after being unloaded from the vessel. This jetty was relocated to the mouth of the bay, where reefs are distributed in the nearby waters. Since there are no navigation signs, vessels are forced to take this dangerous seaway.</p>	<p>No access roads are properly developed. Manual labor is used for loading and unloading.</p>

Sinu-I-Wasa (ferry-cum-freighter) operated by Venu Shipping is a 1,481 GT (1,053 DWT) vessel. Cargo handled by the vessel mainly includes bulk loads such as building materials, foodstuffs (canned foods, grains and edible oil), and fuel consumed in the island. Unit loads such as containers or pallets are not yet transported. According to the captain of this vessel, there are a few problems with Narains Wharf, a domestic vessel terminal of Suva: there is a ship that sank in the water ahead of the wharf, the water area for turning around, a necessity for vessels to dock, is too small, and nighttime navigation signs are not sufficiently installed.

		
<p><b>Figure 4-38 Cargo stored in the vessel (1)</b></p>	<p><b>Figure 4-39 Cargo stored in the vessel (2)</b></p>	<p><b>Figure 4-40 Kava, one of the major exports of the island</b></p>
<p>Cargo inside the vessel is stored</p>	<p>Trucks and heavy machines were</p>	<p>Kava is a valuable agricultural</p>

in cardboard boxes or plastic bags; there is no unit-loading arrangement.	also included in the cargo to the island, but these trucks were not the kinds used for land transport business in the island.	export item.
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### (3) Freight rate

In Fiji, the Prices and Incomes Board (PIB) sets a ceiling rate on freight transportation. Under the rate, a private liner can set its rate for individual shippers depending on the volume and frequency of the cargoes. The PIB rate that the team collected is listed in the table. For instance, freight rate from Suva to Savusavu is F\$80 in PIB rate, however the actual rate is less than F\$80. According to interview with domestic liners, the PIB rate has not been changed for the last two decades even though bunker rate increased dramatically.

Major shipping companies don't receive any subsidies from the government, however some lines providing service for less populated groups are said to receive a subsidy because of lower economic performance.

**Table 4-29 Major routes' freight rate in Fiji**

Route	Freight rate		
	PIB rate	20 feet container in F\$	20 feet container in US\$
Suva-Koro	F\$78/ton	1,560	839
Suva-Savusavu	F\$80/ton	1,600	861
Suva-Labasa (including land transportation cost)	F\$88/ton	1,760	947
Suva-Kasavu	F\$54.05/ton	1,081	581
Natovi-Nabouwalu	F\$1,00/(7-9 ton truck)	2,500	1,345
Natovi-Odalau	F\$900/(7-9 ton truck)	2,250	1,210

Source: Prices and Incomes Board

### (4) Recyclable materials transport

According to Fiji custom, 8,663 tons of scrap metal was exported in 2011. Recycling company says that ferrous, non-ferrous, plastics and paper are collected and most of them are exported. Table 4-30 shows an example of local recycling company's recyclable material export. In addition to local recycling companies, Korean recycling companies are also collecting and exporting scrap metals to Korea. On the other hand, actual cargo handling volume of recyclable materials is not reported to Fiji Ports Authority. There is neither regulation nor limitation for exporting recycling materials at present in ports. Biosecurity Authority Fiji administers a procedure of custom invoice but does not conduct any inspection on exporting recyclable material.

**Table 4-30 Recyclable materials volume and export destination (a case of a recycling company in Fiji)**

Recyclable materials	Volume of exports	Destination
Plastics(including PET)	2 TEUs per three months	Hong Kong
Paper	5 – 8 TEUs per month	Australia
Cardboard	2 TEUs per month	Australia
Ferrous	10 TEUs per month	Indonesia
Non Ferrous	2 TEUs per month	Australia and NZ

Hearing from a recycling company in Fiji

Recycling material is expected to be a new export commodity. Recyclable materials are collected not only in the mainland, Viti Levu, but also on local islands. Scrap metals are transported from local islands to Viti Levu. These are transported in an open truck from Lambasa, Vanua Levu to Suva, and are put in a container before being shipped abroad. As far as our team survey findings, no recycling material is transported by ship except scrap metals from Lambasa at present. The imbalance of cargo volume still remains in domestic transportation. Many of the domestic liners carry consumer commodities from Suva and Natovi in Viti Levu Island to other local islands. On the other hand, a few export cargoes including timber, copra fish and taro, are generated from the local islands. Additional export cargoes are required in local islands.

#### 4.2.2 Samoa

Samoa consists of Upolu Island, Savai'i Island and seven small islands. Total population is 180,000.

##### (1) Ships and routes for domestic transport

Samoa Shipping Corporation (SSC) is the only domestic shipping line in Samoa. The SSC owns six domestic vessels. The SSC was funded by the government but does not receive any operational subsidy from the government. Specifications of its ships are listed below. The ships have limited drafts with around 1.4 to 2.4 meters for entering shallow water in ports. MV Lady Samoa III is 42 meters in length, 2.35 meters in draft. She is deployed in the main route between Upolu island and Savai'i island.

**Table 4-31 Specifications of ships of Samoa Shipping Corporation**

Name	Type	Loa(m)	Draft (m)	GT (tons)	Remarks
MV Lady Samoa III	Passenger/Vehicle Ferry	42.0	2.35	1,045	Japan grant
MV Lady Naomi	Passenger/Vehicle Ferry	46.5	2.40	993	
MV Lady Samoa II	Passenger/Vehicle Ferry	43.3	2.35	867	Japan grant

MV Fotu-O-Samoa II	Cargo Barge-Ramp Type	39	2.5	299	
MV Samoa Express	Cargo Barge-Bow Ramp	42.0	2.18	340	
MV Lady Filifilia	Passenger	23.76	1.4	60	

Source: Samoa Shipping Corporation website



**Figure 4-41** A passenger / vehicle ferry MV Lady Samoa III.(source: SSC website)

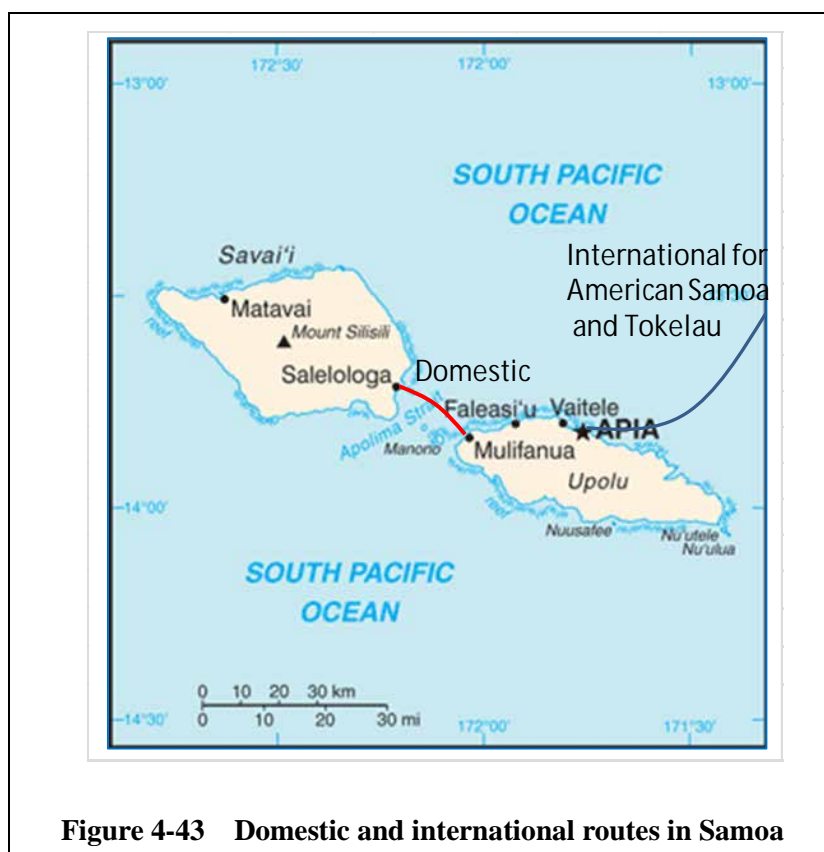


**Figure 4-42** Cargo barge-ramp type ship MV Fotu-O-Samoa II (at Apia port)

The main route is Upolu Island and Savai'i Island. MV Lady Samoa III and MV Fotu-O-Samoa II connect Mulifanua port in Upolu and Salelologa port in Savai'i. They serve 4 or 6 times per day from Monday to Saturday and 2 times per day on Sunday. It takes about 70 to 90 minutes.

In addition, SSC provides an international route service to American Samoa as well as Tokelau islands (NZ territory) which are located north of Samoa.





**(2) Ports**

Samoa Port Authority (SPA) manages and operates ports in Samoa. The Port of Apia is a major port of Upolu Island; it has two international berths that are 11 m deep. The average volume of cargo handled per year over the past eight years is about 400,000 ton. Other major ports include the Port of Salelologa, the gateway to Savai'i Island, and the Port of Mulifanua, a domestic port of Upolu Island. Of the two quays of Apia Port, the main quay is 187 m in length and 11 to 12 m in depth. The new quay is 165 m in length and 11 to 12 m in depth. Apia Port also has two berths for domestic transport. The Port of Salelologa has a 5-m deep international quay and a 4- to 5-m deep domestic quay. The Port of Mulifanua in Upolu Island has two quays that are both 3 m deep.

**Table 4-32 Cargo handled by ports in Samoa**

2011	Total cargo throughput (unit:1,000 tonnes)	Container cargo throughput (unit:1,000 tonnes)	Container cargo throughput ( unit:TEU ) ( ) :Number of empty containers
Import	382	377	12,205 (748)
Export	100	103	12,284 (9,070)
Total	482	480	24,489 (9,818)

(Source: Samoa Port Authority)

Note: The amount of base metals exported to foreign countries in 2011 was 720 tons (equivalent to 36 TEU) according to customs statistics. According to the interview with the recycling contractors, a total of 1,206 tons (equivalent to 60 TEU) were exported, including 885 tons of iron, 110 tons of automotive parts, 92 tons of aluminum, 82 tons of batteries, and 37 tons of electric motors.

The international container terminal of Apia Port has an area of 12,700 m<sup>2</sup>, and the land area behind the terminal is occupied by management offices and warehouses. Because of the lack of land space, SPA plans to expand the container terminal and repair the existing quays. If a processing facility and/or dedicated yard for recyclable materials is set up in the port area in the future, appropriate measures should be taken accordingly such as revision of the terminal layout for improvement of the cargo storage capacity.

Since the port faces the open sea, it is susceptible to sea swells, which often prevents smooth berthing and cargo handling at this port. Given this condition, shipping companies expressed their desire for improvement of port facilities.

**Table 4-33 Specifications of major ports in Samoa**

Port	Wharf	Length(m )	Depth(m)	Remarks
Apia	International			Container yard: 120,000 square meter
	Main Wharf	187	11	
	New Wharf	165	11 - 12	
	Domestic	-	-	2 berths
Salelologa	International	-	5	1 berth
	Domestic	-	4 - 5	1 berth
Mulifanua	Domestic	-	3	2 berths

(Source: Samoa Port Authority)



**Figure 4-44 Entire view of Apia Port**



**Figure 4-45 Entire view of Mulifanua Port**

The white building at center is the passenger terminal. The typical mooring position of a ferry is the yellow part seen on the right of the building and the ramp behind it.



**Figure 4-46 Entire view of Salelologa Port**

The white building at center is the passenger terminal. To the left of the building is the ferry mooring quay. A stand-by ship, Lady Samoa II (supplied by Japan) is moored farther to the right of the picture.

### (3) Freight Rate

Freight rate between port of Mulifanua and port of Salelologa is shown below. The freight rate is applied to length of Vehicle. A 20 feet container will be charged at SAT\$700 (US\$300).

**Table 4-34 Freight rate between Mulifanua port and Salelologa port (abstract)**

Length of Vehicle	Freights	
	SAT\$	US\$
9ft-12ft	80	34
12ft-15ft	95	40
15ft-18ft	100	42
18ft-21ft	110	46
Heavy truck, bus, all other machinery equipment	SAT\$35 (US\$15) per ton	

Source: Samoa Shipping Corporation

In addition, international freight rate between Apia, Fiji and Pago Pago, American Samoa, is shown below. A 20 feet container will be charged at SAT\$ 3,600 (US\$ 1,520).

**Table 4-35 Freight rate between Apia, Fiji and Pago Pago, American Samoa**

Type of Cargo	One Way		Round trip	
	SAT\$	US\$	SAT\$	US\$
Sacks (Taro, Copra, Coconuts, Bananas, Taamu) / Repacks, Bundle	25	11	50	21
Fine mats – max weight 50 lbs. (min charge SAT\$10.0)				
Pallets (1 cubic meter – up to 600 lbs.)	120	50	160	67
General Cargo up to 1 ton or 2,000 lbs.	180	76	235	99

Source: Samoa Shipping Corporation

#### (4) Recycling Materials Transport

Custom data indicates that 720 tons of base metals were exported abroad in 2011. According to a local recycling company, 885 tons of ferrous, 110 tons of automobile parts, 92 tons of aluminum, 82 tons of batteries and 37 tons of electric motors were exported in 2011. Plastics are not exported at present. These two figures are not equal, but ferrous is a main commodity for export. According to Samoa Shipping Corporation (SSC), recyclable materials do not seem to be transported from outside the mainland. There is no recycling company operating outside the mainland. At present, port authority does not impose any regulation on exporting recyclable materials.

If the recyclable material were to be transported, following domestic maritime conditions would be considered. Major cargoes between the two ports are food, fuel and construction materials. These are transported by containers or open trucks. Transportation volume is listed below. 23,850 vehicles weighing 76,523 tons were transported from Mulifanau to Salelologa, and 24,967 vehicles weighing 63,216 tons were transported from Salelologa to Mulifanau. These data are based on the number of trucks, not based on cargo items. However, recycling materials are not considered to be transported on the domestic route in Samoa, although a recycling company is operating in Upolu.

**Table 4-36 Number of vehicles with tonnage between Mulifanau and Salelologa (July 2009 to June 2010)**

Destination Origin	Mulifanau	Salelologa
Mulifanau		76,523 (23,850)
Salelologa	63,216 (24,967)	

Note: ( ) shows the number of vehicles.

Source: Samoa Ports Authority

Furthermore, there is a regional international network among Samoa, American Samoa (USA) and Tokelau (NZ). The volume of transportation between Apia and Pago Pago, and Apia and Tokelau is listed below respectively. 679 tons of cargoes were transported from Apia to Pago Pago. 218 tons of cargoes were transported from Pago Pago to Apia. Volume of export from Apia is two or three times

larger than that from Pago Pago and Takelau. Some recycling materials are transported by MV Fatu-O-Samoa, but this is in American Samoa's territory. 5,306 tons of cargoes were transported from Apia to Tokelau, on the other hand, 1,339 tons of cargoes were transported from Tokelau to Apia. Waste materials such as timbers and base metals generated in Manau islands, west of American Samoa, are transported to Pago Pago, center of America Samoa, by MV Fatu-O-Samoa when requested by American Samoa (usually every two or three months).

**Table 4-37 Volume of Inter-Island Shipping (July 2009 to June 2010)**

Destination	Apia	PagoPago	Destination	Apia	Tokelau
Origin			Origin		
Apia, Fiji		679 tons	Apia, Fiji		5,306 tons
PagoPago, American Samoa	218 tons		Tokelau, NZ	1,339 tons	

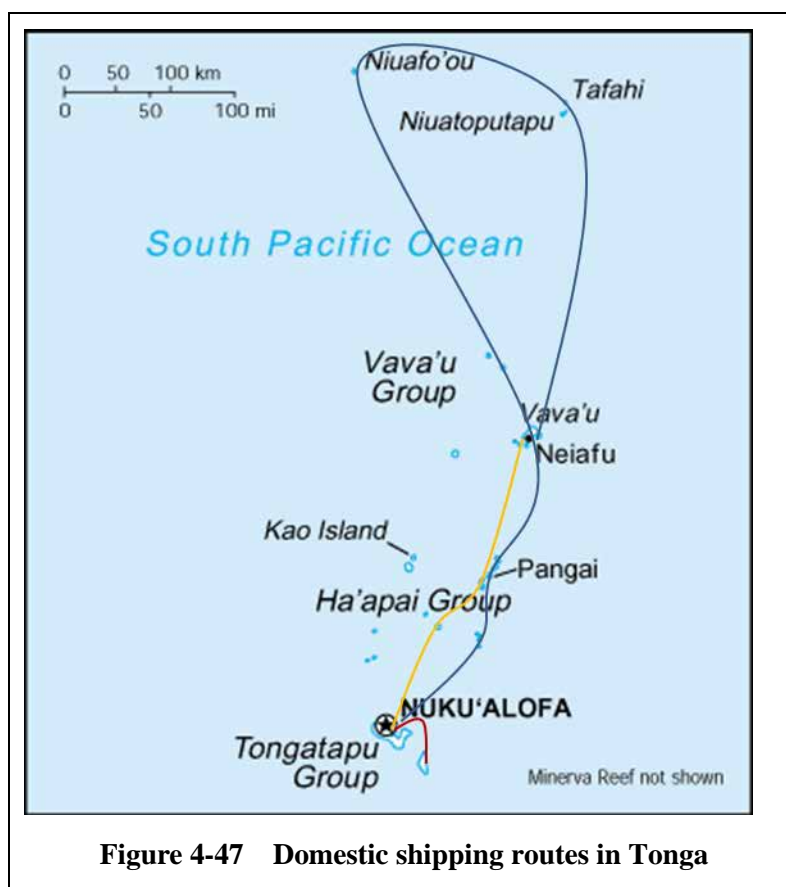
Source: Samoa Ports Authority

### 4.2.3 Tonga

Tonga consists of 170 islands and group islands with a population of 103,000. Tongatapu island is the largest in Tonga and the capital city Muku'alofa is located there. Major group islands are Ha'apai group located 150 kilometer north of Tongatapu, Vava'u group 400 km from Tongatapu and Niua group 600 km north east of Tongatapu respectively.

#### (1) Ships and lines for domestic transport

Four domestic shipping lines cover domestic service routes in Tonga. Their operating routes are illustrated and listed below. Friendly Islands Shipping Agency (FISA) has the largest network among the four. FISA is operating a RORO ship MV Otuanga'ofa (1534GT) that was granted to Tonga from Japan. Her weekly service route is Nuku'alofa – Nomuka – Tungua - Haafeva Is – Lifuka – Vava'u. She also calls Vava'u – Niuafo'ou - Niua Toputapu once every four or six months. The only ports she can enter are Nuku'alofa and Vava'u. A surfboat is essential for berthing in the other ports. Originally a government shipping company served domestic main routes. After a marine accident in 2008, it was dissolved and the FISA succeeded its operation.



Besides FISA, there are three private companies operating domestic routes. Uata Shipping Lines is providing a weekly service with a RORO ship MV. Pulpaki; from Nuku’alofa - Ha’apai Group - Vava’u Group. It takes about 18 hours from Nuku’alofa to Vava’u. It is also serving a route from Vava’u to Niua Group in one or two-month interval. This route is subsidized by the government because of the long distance and relatively small volume of cargoes.

Tofa Landsea Shipping is operating a ferry MV ALAIMOANA (160GT) from Nuku’alofa to Eua islands. South Sea Shipping Ltd. is operating a general cargo ship MV SITKA (289GT) between Nukas – Hapai – Vava’u – Niua.

**Table 4-38 Domestic shipping companies and their service routes in Tonga**

Shipping company	Ship type	Route
Friendly Islands Shipping Agency	RORO,container multi-purpose (1)	Nukualofa – Nomuka – Tungua - Ha’afeva Is – Lifuka – Vava’u (weekly service).
		Vava’u – Niufo’ou - Niua Toputapu (every four or six months). The ship can enter ports in Nulualofa and Vava’u
Uata Shipping lines	RORO(1)	Nukualofa - Ha’afeva - Ha’apai - Vava’u
	General cargo ship (1)	Nukualofa - Eua
Tofa Landsea Shipping	Ferry (1)	Nukualofa - Eua
South Sea Shipping Ltd.	RORO (1)	Nukualofa - Ha’apai - Vava’u - Niua

Figure 4-19 shows a handy container being discharged from MV Otuanga’ofa at Nukua’lofa port. MV Otuanga’ofa is 53 meters in length, 3.0 meters in draft, equipped with two 5-ton cranes and aft ramp door. Originally a handy size open container was used in the domestic route in Tonga.

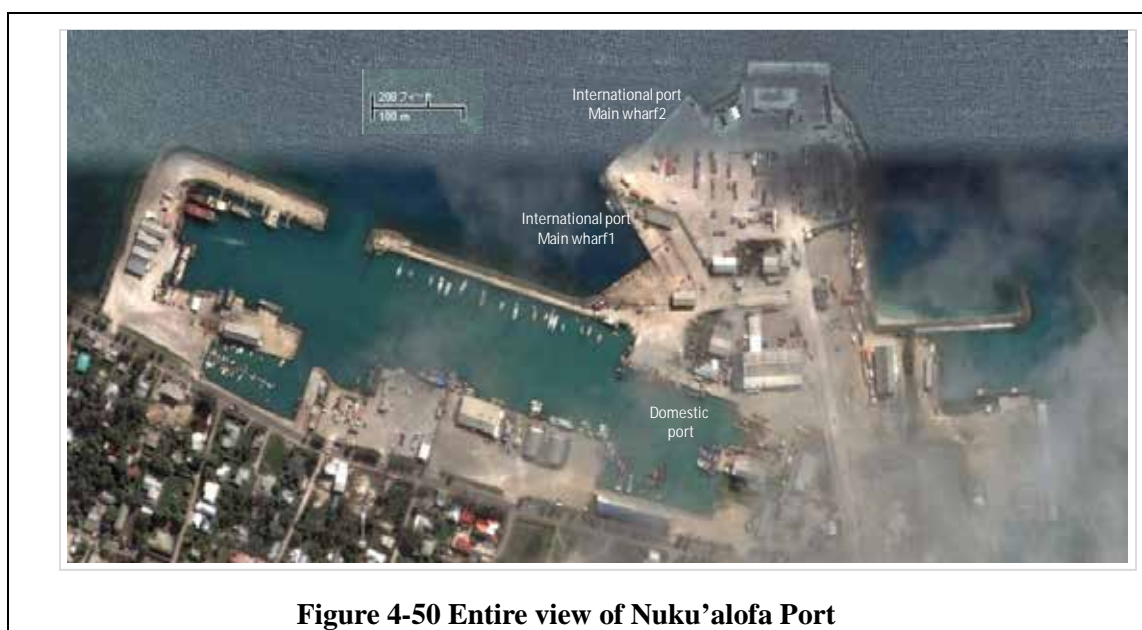
However, the open container would get wet during rainy weather and theft was also a concern. The new handy container was introduced. Specification of the new handy container is 2.438 meters (8 feet) in width, 1.829 meters (6 feet) in depth and 2.0 meters in height. Tare is 1 ton and gross weight is 6 tons which can be handled by folk lifts in local ports. 54 dry containers and 8 reefer containers are used at present. This container is suitable for small cargo in local ports.

Figure 4-20 shows MV Pulupaki of Uata Shipping Lines berthing at Nuku’alofa port. The ship is 675 GT and has a draft of 3.7 meters. It was originally operated in Japan.

<p><b>Figure 4-48 Handy containers being discharged from MV Otuanga’ofa (FISA) at Nuku’alofa port.</b></p>	<p><b>Figure 4-49 MV Pulupaki of Uata Shipping Lines berthing at Nuku’alofa port.</b></p>

**(2) Ports**

Port Authority of Tonga is in charge of port of Nukualofa. Dept. of Marine & Ports, Ministry of Transport administers mariners and the other ports in Tonga. Port of Nuku’alofa is the main port of Tonga with two international wharves and a domestic RORO wharf. The total wharves area is approximately 300 meter in width and 200 meter in length. The port is equipped with mobile cranes but the yard is not paved. Most of the land is unutilized. A warehouse with quarantine office was granted by EU.



**Figure 4-50 Entire view of Nuku'alofa Port**

Port of Nuku'alofa has two international wharves; Main wharf 1 is 105 meters in length, 13 meter in depth, and Main wharf 2 is 114 meters in length, 10 to 11 meters in depth. In addition, the domestic wharf is 100 meters length, 5 to 7 meter in depth.

**Table 4-39 Port facilities in ports in Nuku'alofa port**

Port	Wharf	Length(m)	Depth(m)	remarks
Nuku'alofa	International			
	Main Wharf 1	105	13	
	Main Wharf 2	114	10-11	
	Domestic	100	5-7	

Source: Port Authority of Tonga

Port of Nuku'alofa handled a total of 8,530 TEUs containers (2,635 TEUs of import, and 5,895 TEUs of export) in 2011. However the total of container handling volume has been stagnant for the last four years.

**Table 4-40 Cargo handling in Nuku'alofa port**

	(TEU)			
	2008	2009	2010	2011
Import	6,073	5,615	5,341	2,635
Export	5,865	5,599	4,962	5,895
Total	11,938	11,214	10,303	8,530

Source: Port Authority of Tonga

The port authority is now planning rehabilitation of the two existing wharves and the construction of additional new wharf. If a recycling process facility or a designated yard for recycling



materials will be introduced in the terminal area in the future, re-allocation of terminal use and improvement of cargo handling capacity in the terminal will be required.

### (3) Freight Rate

FISA's freight rates are prepared by general cargo, livestock, construction material, hazardous and container. The freight rate for container is listed below. MV Otuanga'ofa is carrying a handy container designed for a local small volume of cargo. She can carry 54 dry containers and 8 liquid containers at one time. The container can accommodate 6 tons of cargoes or about 20% of the volume of a twenty-foot container.

**Table 4-41 Freight rate between of MV Otuanga'ofa (abstract)**

					(Upper:T\$)	
					(Lower:US\$)	
Type & Load of container	NUK/PNG	NUK/VAV	NUK/NTT	PNG/VAV	PNG/NTT	VAN/NTT
FISA full load	134	165	345	109	281	265
	56	69	145	46	118	111
FISA half load	86	102	194	74	162	152
	36	43	82	31	68	64
20 feet laden	618	751	2,403	482	2,100	1,792
	260	316	1,010	203	883	754
20 feet empty	1,098	1,299	2,403	780	2,100	1,792
	462	546	1,010	328	883	754

Note: NUK: Nuku'alofa, PNG: Pangal, VAV: Vava'u, NTT: Niuatoputapu

Source: FISA Website

### (4) Recycle Material Transport

According to a foreign trade report for 2010, published by Tonga statistics department, 381 tons of ferrous and 45 tons of non-ferrous were exported abroad. Almost all of the ferrous are exported to NZ, and the Non-ferrous are to Taiwan respectively. The customs office and the quarantine office do not impose any regulation on exporting recyclable materials because these materials were not hazardous.

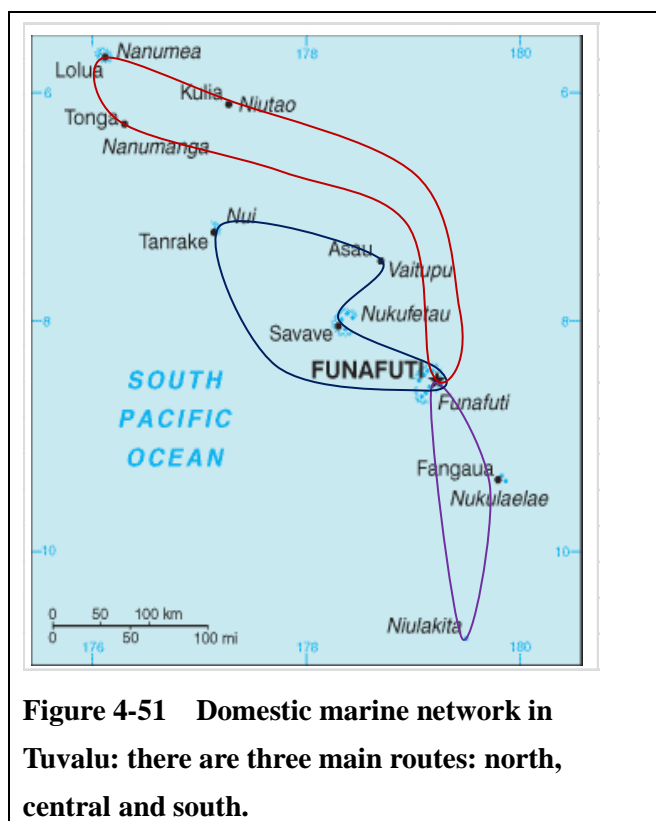
There is one recycling company is operating in Tonga at present. It ships recycling material not only from the mainland Tongatapu, but also from Ha'apai and Vava'u. Containers from Ha'apai are transported to Nuku'alofa. These are transhipped at Nuku'alofa to NZ. Furthermore, recycling materials from Vava'u are shipped from Vava'u to NZ directly.

#### 4.2.4 Tuvalu

Eight thousand people dwell in Tuvalu, the least populated among the five survey countries. Small Islands are scattered across a length of 700 kilometers from north to south, encompassing a vast area of 280 thousands square kilometers.

##### (1) Ships and Routes for Domestic Transport

The domestic network in Tuvalu is mainly served by two general cargo ships; MV NINAGA II (1,042GT) and MV MANUFOLAU (580GT). They are owned and operated by Department of marine & Port Service, Ministry of Communication & Transport of Tuval. They voyaged thirty six (36) and forty eight (48) times respectively in 2010. They connect Funafuti with the other 8 islands and atolls in Tuvalu; Nanumea, Nanumanga, Niutao, Nui, Vaitupu, Nukufetau, Nukulaelae, Niulakita. All the ports in Tuvalu except Funafuti have only slopes for surfboats. That is why the ships can handle only small break bulk cargoes, and not containers. Recycling materials, such as scrap metals, PETs and e-wastes, are usually transported as containers because of their handling difficulties. A unit load system needs to be developed if recycling materials are to be shipped from the remote islands.



Total volume of domestic cargo transported 7,689 tons (6,753 tons by MV NIVAGA II and 936 tons by MV MANI FOLAU) in 2011. The total cargo volume has increased in the last four years.

**Table 4-42 Volume of domestic cargo transportation from 2007 to 2012**

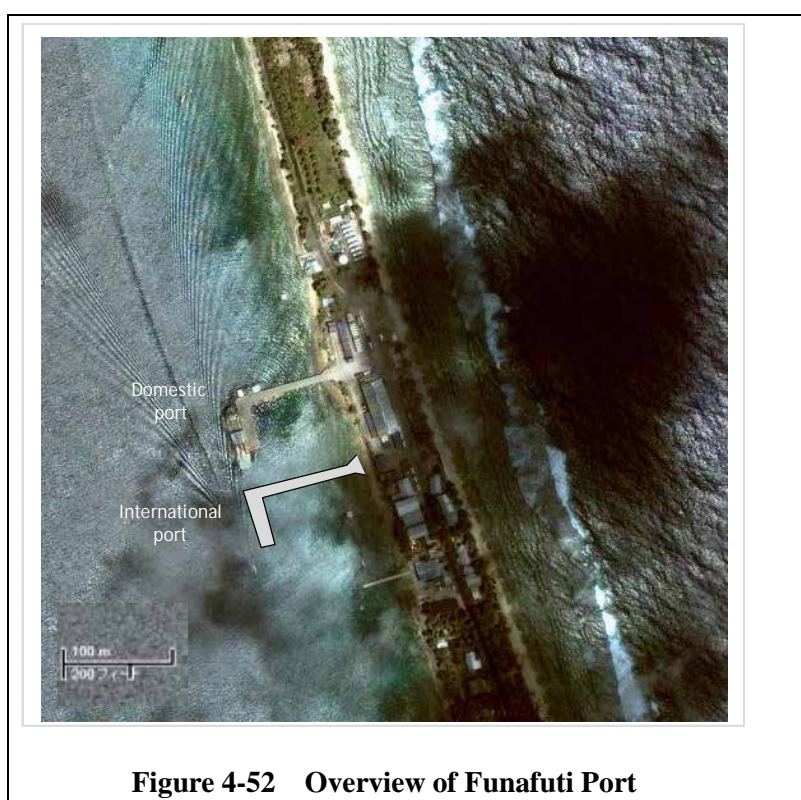
Year	2007	2008	2009	2010	(Unit:Cubic meter)	
					2011	2012 (by the end of March)
Nivaga	2,550	3,441	5,148	5,342	6,753	430
Manu Folau	830	900	946	986	936	83
<b>Total</b>	<b>3,380</b>	<b>4,341</b>	<b>6,094</b>	<b>6,328</b>	<b>7,689</b>	<b>513</b>

Source: Tuvalu marine office

**(2) Ports**

Department of Marine & Port Services, Ministry of Transport & Communications is in charge of port operation and management in Tuvalu. Port of Funafuti is the main gate of Tuvalu. The port has an international wharf and a domestic wharf. These are eight meters depth each. The international wharf was granted by Japan in 2009.

The port has a warehouse and mobile cranes but yard is not paved. There is little room for expansion in the terminal area. If a recycling process facility or a designated yard for recycling materials will be introduced in the terminal area in the future, re-allocation of terminal use and improvement of cargo handling capacity in the terminal will be required.



**Figure 4-52 Overview of Funafuti Port**

**Table 4-43 Port facilities in ports in Funafuti port**

Port	Wharf	Length(m)	Depth(m)	remarks
Funafuti	Interenational			
	Main Wharf	50	8	Japan grant
	Domesic	46	8	

Source: Tuvalu marine office

Funafuti port handled a total of 1,107 TEUs container (564 TEUs of imports and 543 TEUs of exports) in 2011. The number of empty containers is counted. According to Tuvalu Marine office, there are few export cargoes from Tuvalu.

**Table 4-44 Cargo handling in Funafuti port**

			(TEU)
	2010	2011	2012
Import	429	564	218
Export	464	543	191
Total	893	1,107	409

Source: Tuvalu marine office

Figure 4-24 shows views of MV NIVANGA berthing at Funafuti port. Figure 4-25 shows surfboats carrying passengers and light commodities to shore in a remote island while mother ship is anchoring off the port. A 20 feet container cannot be accommodate at local ports in Tuvalu.



**Figure 4-53 MV NIVANGA II (1,042GT) and its surfboat; berthing at Funafuti port**



Source: Tuvalu Cooperative Society

**Figure 4-54 Surfboats carrying passengers and light commodities to shore in a remote island.**

**(3) Freight rate**

Domestic freight rate is shown below. For instance, the freight rate for private ships from Funafuti and Nanumea, which is the farthest island from Funafuti, is AUS\$85.00\* per ton/cubic meter.

(\*: AUS\$85.00/ton = Freight \$66.50/ton + Wharfage \$8.50/ton + Handling \$10.00/ton.)

**Table 4-45 MV NIVAGA II & MANIFOLAU Freight table - 1995**

(unit: AU\$)

(Private)

Naumea	25.00	32.50	45.50	54.00	56.00	66.50	79.50	89.00
33.75	Naumaga	29.50	32.50	48.50	49.50	60.50	72.50	81.50
43.88	39.83	Niutao	31.50	40.00	43.50	54.00	66.00	77.50

61.43	43.88	42.53	Nui	35.50	35.00	47.00	58.00	67.00
72.90	65.48	54.00	47.93	Vaitupu	24.50	32.00	41.50	57.00
75.60	66.83	58.73	47.25	33.08	Nukufetau	30.00	41.00	52.50
89.78	81.68	72.90	63.45	43.20	40.50	Funafuti	31.00	44.50
107.33	97.88	89.10	78.30	56.03	55.35	41.85	Nukulae	34.00
120.15	110.03	104.63	90.45	76.95	70.88	60.08	45.90	Niulakita
(Government and Private organization)								
Private			wharfage=\$8.50 per ton/cubic metre			Handling=\$10.00per ton/cubic metre		
Government/Corporation/Organizations								
			wharfage=\$11.48 per ton			Handling=\$13.50per ton		
Freight Suva-Funafuti==\$62.00 per ton								

Source: Tuvalu marine office

#### (4) Recycling Materials Transport

A one-man enterprise is the only recycling business being operated in Funafuti, Tuvalu. Five containers of ferrous metal and one container of non-ferrous metal were shipped to NZ in 2010. These are the only export commodities from Tuvalu. Obviously, the business is still in the embryonic stage. The owner has limited capital resources and thus he collects scrap metals in the island, and cuts them with his hands. There is neither metal cutting equipment nor truck for transportation.

In addition, there are no recycling materials shipped from the remote islands. When shipping commodities from Nanumea Island to NZ, first the cargo is transported to Funafuti as break bulk, and then it is put into a container, sent to Suva, and transhipped to NZ. It will be charged both domestic and international freight rates. There are no specific regulations for transporting recycling materials in Tuvalu.

#### 4.2.5 Vanuatu

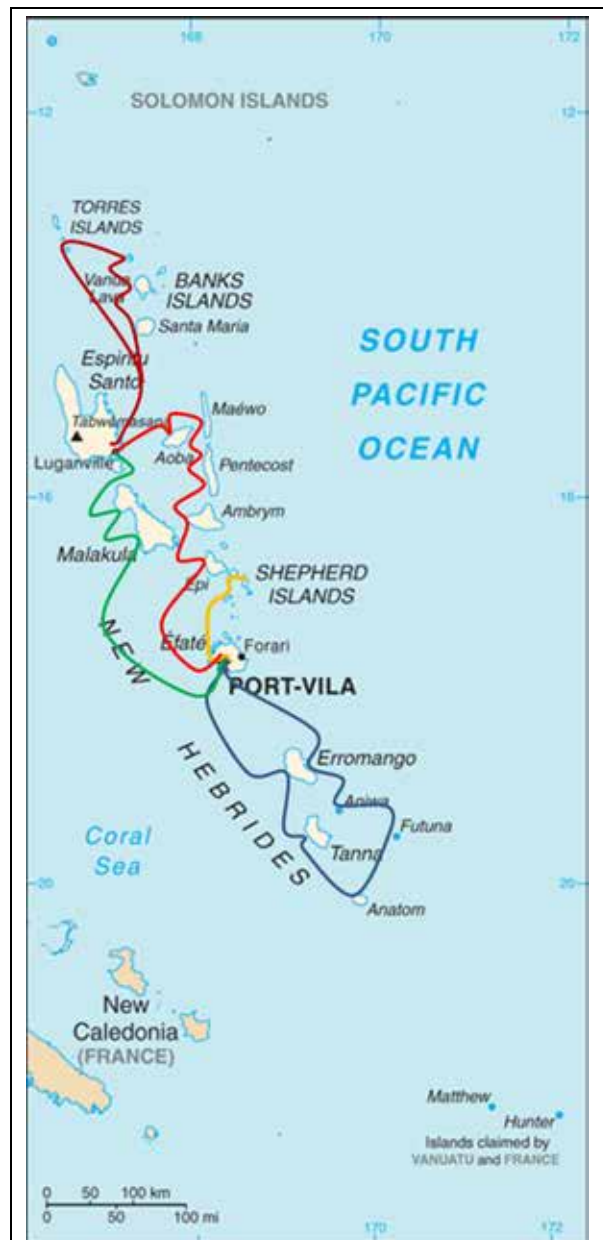
The country is composed of 83 islands scattered across a length of 1,200 kilometers from north to south in the South Pacific Ocean. People are dwelling in twelve islands out of the 83 islands

##### (1) Ships and routes for domestic transport

There are three major domestic routes. The north route connects Luganville, the Torres islands and Banks Islands. The central routes connect Luganville and Port-Vila via Pentecost, Ambrym and Malakula. The south route connects Port-Vila and Tafea province.

In 1999, Vanuatu government deregulated domestic marine routes and allowed foreign registered vessels to provide service on domestic routes in order to increase the frequency of service.

At present, In Vanuatu, forty two (42) private ships are serving on the domestic routes, but most of these ships are small and old. Table 4-37 shows that around three fourths of operational ships are less than 150 GT and more than 20 years of age. Most of ships can transport both cargo and passenger while a few of them are land craft type boat(which means a small RORO boat).



**Figure 4-55 Major domestic marine network in Vanuatu: There are three main routes; north, central and south.**

**Table 4-46 Ships serving domestic network in Vanuatu**

Name of ship	GT	Route
Marata	30	Malekula-Santo
LC Tina 1	192	Santo-Amoaie-Pentecost-Ambym-Epi-PortVila
Lady Sabrina	43	Santo-Ambae-Maewo-Santo
Makila	92	Santo-Amoaie-Pntecost-Ambym-Epi-PortVila
Kawale	115	Santo-Torba Province
Keidi	114	Santo-Torba Province
Sowides	63	Santo-Torba Province
Aurora	103	Santo-Malukla
Havutu	99	Santo-Ambae-Maewo-Pntecost-Malekula-Santo
LC Brisk	104	Santo-Ambae-Pentecost-Ambym-Epiport-Malekula-Santo
Jadams	45	Santo-Malekula
H. Tino	38	Santo-Malekula
Big Sista	33	PortVila-epi-Paama-malekula-Santo
Epi Dream	17	PortVila-Epi
Touaraken	264	PortVila-Tafea Province
Efate Queen	118	Santo-Ambae-Pentecost-Ambrym-PortVila
LC Kalyara	120	Portvila-Tanna
Santo Queen	94	Portvila-Malekula-Santo
Elkemar II	291	Santo-Ambae-Ambrym-Epi-Malekula-Santo

Source: Department of port and marine

**Table 4-47 Number of ships by size and built year**

Gross Ton.	year	~ 1969	1970 ~ 1989	1990 ~ 2010	Total
0 ~ less than 50		3	7	1	11
50 ~ less than 100		4	5	1	10
100 ~ less than 150		1	8	1	10
150 ~ less than 200		-	4	1	5
250 ~ less than 300		-	2	1	3
350 ~ less than 400		-	1	-	1
450 ~ less than 500		-	-	2	2
Total		5	27	7	42

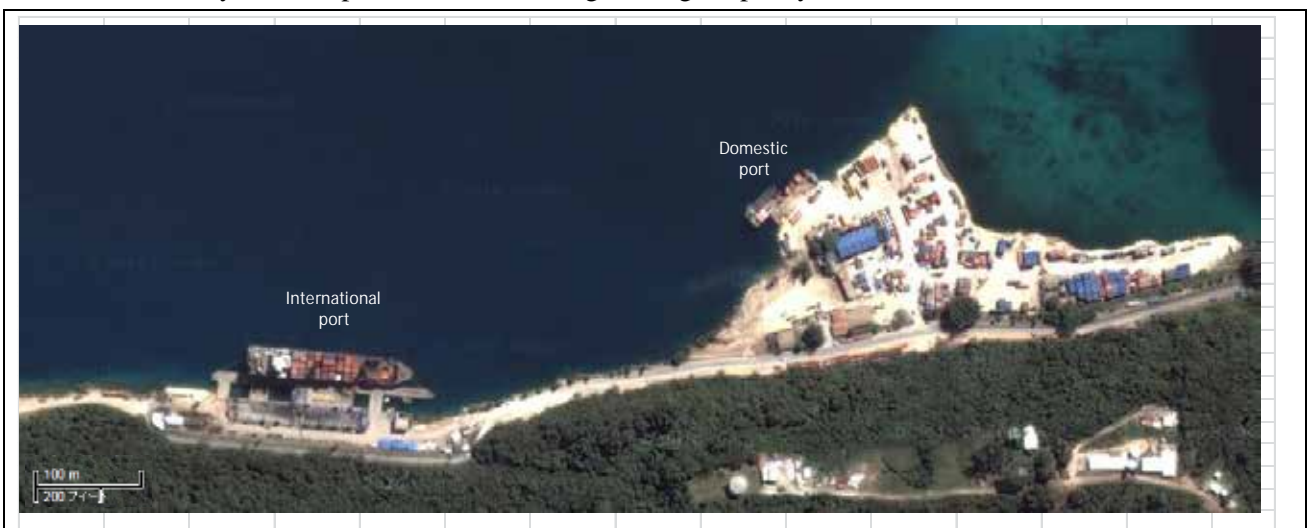
Source: Port & Marine Department, Vanuatu

## (2) Ports

Ports in Vanuatu are managed and operated by the Department of Port and Marine. Vanuatu has two international ports, the Port of Port-Vila in Efate Island and the Port of Luganville in Espiritu Santo Island. The following outlines the present status of major ports including the Port of Port-Vila, Port of Luganville, and others in neighboring islands.

1) Port of Port-Vila

The Port of Port-Vila is the gateway to Vanuatu. It has an international quay and a domestic quay, both 10.7 m in depth. The container terminal of the port is operated by Ifra Port Development Service, a private company, under contract with the port authority. Container vessels and passenger vessels use the 250 m long international quay. The Department of Port and Marine plans to construct a new international terminal at the present site of the domestic quay to improve the quay performance. There is little land available for port development as it immediately adjoins the mountains. The port has warehouses and movable cranes. The yard is not paved. There is almost no land available for expansion of the terminal. If a processing facility and/or a dedicated yard for recyclable materials is set up in the port area in the future, appropriate measures should be taken accordingly such as revision of the terminal layout or improvement of the cargo storage capacity.



**Figure 4-56 Entire view of Port of Port-Vila**

Figure 4-57 shows the domestic terminal of Port of Port-Vila. The domestic quay is 100 m long and 8.0 m deep and is capable of mooring 5 or 6 ships at the same time. The quay capacity has almost reached its upper limit. Piles and girders are seriously damaged.



**Figure 4-57 Internal quay of Port of Port-Vila (Star Wharf)**



**Table 4-48 Port facilities in ports in Vanuatu**

Port	Wharf	Length(m)	Depth(m)	remarks
Port-Vila	International			
	Main Wharf	250	10.7	
	Domestic	50	8	
Luganville (Santo)	International/Domestic	200	13	
	Main Wharf			

(Source: Department of port and marine)

Vanuatu handled 16,274 TEU of foreign cargo in total in 2010. This breaks down to the Port of Port-Vila handling 12,426 TEU (6,084 TEU of imports and 6,342 TEU of exports including empty containers), and the Port of Luganville handling 3,484 TEU (1,752 TEU of imports and 2,096 TEU of exports including empty containers). There is almost no export cargo shipped from Vanuatu.

**Table 4-49 Cargo handling in ports of Vanuatu**

Vanuatu		2010	remarks
Port-Vila	Import	6,084	
	Export	6,342	
Luganville	Import	1,752	Estimation value
	Export	2,096	
Total		16,274	

(Source: Department of port and marine)

Note: 4,158 tons (208 TEU) and 133 tons (7 TEU) of metal scraps were exported in 2011 and 2010 respectively according to the customs statistics of Vanuatu. 95% of these are metal scraps. According to the interview with Vanuatu recycling contractors, 587 TEU (11,740 ton) were exported in 2011.

## 2) Ports in Neighboring islands: Malekula Island

Located at the center of the island nation, Malekula Island is Vanuatu's second largest island and a part of Malampa Province. Composed of three major islands, Malampa Province has a population of 36,100 and an area of 2,770 km<sup>2</sup>. The central island of the province, Malekula, has a population of about 30,000 and has the provincial capital Lalatoro. This island has a few small-scale mooring facilities for small vessels. These facilities are managed by the provincial government.

### Lits Lits Wharf

Lits Lits Wharf is located near the capital Lalatoro. The wharf is about 40 m long and about 8 m wide, with a T-shaped pier and a 100-m long approach road. South of this approach is a temporary ramp. According to the survey, this temporary ramp was constructed to serve banana boats coming from Noumea about once a month.

This area is included in one of the local port development projects launched with the assistance

of the Asian Development Bank and New Zealand. The plan is to extend the area south of the approach road and construct a mooring facility and a yard.



**Figure 4-58 Entire view of Lits Lits Wharf (T-shaped pier)**



**Figure 4-59 Approach road and ramp of Lits Lits Wharf**

#### PRV facilities

Located north of Norsup, PRV or Plantation Rusel Vanuatu is a private enterprise engaged in export of copra and cacao. This company owns a small pier for their own use. The structure of this pier is about 50 m long, 3 m wide and about 1.4 m deep. About half of the structure is located on the landside. Gabions are installed beside the structure so as to allow mooring of a ramp-way type barge. This barge vessel owned by PRV is fully loaded with four or five cars. It is used to carry copra, cacao and cows to Luganville on Espiritu Santo Island.



**Figure 4-60 Entire view of the privately owned port facility (PRV)**



**Figure 4-61 A vehicle being loaded onto the barge**

### 3) Ports on Neighboring Islands: Tanna Island

Tanna Island is part of Vanuatu's southernmost province Tafea. Some 27,000 people live in Tafea Province covering an area of 1,627 km<sup>2</sup>. The provincial capital of Isangel is located in Tanna Island. A volcanic island, Tanna is about 40 km from north to south, about 19 km from east to west, and has an area of about 550 km<sup>2</sup>. It is reported that some 8,000 people live on this island

### Lenakel Wharf

Lenakel Wharf is the only mooring facility on Tanna. It was first constructed in the 1980s and was repaired in 1999. With a jetty sticking into the sea through the approach road, the mooring facility faces the open sea and is therefore easily subject to oceanographic phenomena. It is hard for the wharf to keep calmness of waters. Stevedoring is conducted by a local contractor. They have no cargo handling equipment; all work is done manually.

Lenakel Wharf is used by a total of three liner services operated by three shipping companies each operating a liner once a week. But the wharf is often affected by meteorological conditions. Hence no clearly scheduled timetables are provided. When the western part of the island is affected by the bad condition, ships take shelter in the tranquil waters on the eastern part of the island, namely Waisisi Bay or Port Resolution. Daily commodities are transported once a month to other neighboring islands of Tafea Province. No recyclable waste is transported out from Tanna.



**Figure 4-62 A regular liner moored at Lenakel Wharf**



**Figure 4-63 Approach road to Lenakel Wharf**

#### 4) Ports on Neighboring Islands: Espiritu Santo Island

Part of Sanma Province located in the northern part of the island nation, Espiritu Santo Island is the largest among the New Hebrides. The island covers an area of about 4,000 km<sup>2</sup>. The core city is Luganville, Vanuatu's second largest city with a population of about 10,000. The Port of Luganville is also an international port that serves regular oceangoing vessels. The Port of Luganville has an international terminal, Main Wharf, and two domestic wharfs, Samanson and Melcoffe.

### Main Wharf

It consists of the old quay, about 100 m long, and the new quay, about 115 m long. These wharves are consecutive and depth ranges from 15 to 18 m. It is a terminal wharf serving about ten regular services a month. The terminal is operated by a local terminal operations company, Northern Island Stevedoring Co. Ltd. (NISCOL). Cargo handling equipment is also owned by NISCOL. Until the early part of this year, RWMs were exported in a monthly amount of about 10 to 15 TEU in containers. But

since last May when the government placed a tax on recycling-related items, export of scrap metals drastically dropped. There have been only one to two TEU of scrap metals exported per month over the past couple of months.



**Figure 4-64 New quay of the Main Wharf of Port of Luganville**



**Figure 4-65 Cargo handling equipment owned by NISCOL, the operator of Port of Luganville**

#### Samanson Wharf and Melcoffe Wharf

Samanson Wharf is located to the east of the Main Wharf, while Melcoffe Wharf is located in the west end of Lugan Ville town. Many small vessels were observed to moor at those quays. Samanson Wharf has a stockyard located for scrap metal at a corner of the Wharf. Not set aside for this purpose initially, the stock yard receives scraps gathered by a recycling company and temporarily stores them before they are put in containers for shipment from the Main Wharf. It is reported that there are no problems related to port management.



**Figure 4-66 Domestic vessels seen at Samanson Wharf of Port of Luganville**



**Figure 4-67 Domestic vessel moored at Melcoffe Wharf of Port of Luganville**

### (3) Freight Rate

Domestic freight rate is about 8,000 to 9,000 vatu per cubic meter, depending on the ship owner

The Government does not control the freight.

**(4) Recycling Materials Transport**

A local recycling company and Korean recycling companies are operating their businesses in Vanuatu. Vanuatu customs indicated that 4,158 tons of scrap metal were exported in 2011, 133 tons in 2010. 95% of them are scrap metals.

At present recycling materials are collected in both Efate island and Espritu-Santo island. The collected materials are put into containers in each island and shipped abroad directly from Port-Vila and Luganville ports respectively. No domestic transport of recycling cargo is reported at present. Local collector and Korean collectors are operating collecting activities. Local ships collected recyclable materials to NZ and Korean ship to Korea respectively. Figure 4-28 shows the actual collection and sorting process conducted by a local company in Luganville, Espritu-Santo. Collected materials are sorted into a standard size and packed into containers. The floor and walls inside the container are protected with wood panels.



**Figure 4-68 Process of sorting scrapped metals in Luganville, Espritu-Santo**

**4.2.6 Summary**

AT present, recycling activity is operated in the mainland in each country, and gradually spreading to local islands. Provided that recyclable material collection activity is well developed, domestic shipping would be key to collect and aggregate recycling materials from rural islands to the mainland.

**(1) Ships and routes for domestic transport**

Reviewing maritime transport in PICs, several characteristics are identified. First is ownership of marine transport. The domestic network is covered by local shipping companies in PICs. However, ownership of the domestic shipping company depends on the country’s policy. Nine private shipping

companies and one government owned company are serving routes in Fiji. Private ships are serving the domestic network in Vanuatu. On the other hand, a shipping corporation in Samoa and a shipping agency supported by the government of Tonga are serving the domestic route. A government owned general cargo ship is operating in Tuvalu. This means that privatization in maritime business has been introduced in populated countries, but government assistance is essential in less populated countries.

Second, transportation system is tailored and developed to meet PICs conditions. Even though RORO/Ferry ships are deployed in each country except Tuvalu, many of the RORO ships are equipped with surf boats and cranes. A surf boat is essential to carry commodities to small islands where a mother ship cannot enter. Another finding is that 6-ton capacity containers have been introduced to transport small cargoes in Tonga where port facilities cannot accommodate larger containers.

### (2) Freight rate

Freight rates in each country are sampled in Table 4-39. These amounts of freight rate are to be added to international freight rate when a recycling company plans to export abroad recyclable materials collected in local islands via the mainland. International freight rate between PICs and the Far East is said to be US\$1,500 to US\$2,000 per TEU. Compared the international the freight rate and the domestic rates, the domestic rates are relatively low.

**Table 4-50 Domestic freight rate in PICs**

Country	Route	Freight (per 20ft container)	Remarks
Fiji	Suva – Lambasa	US\$947	Including land transportation cost
Samoa	Manifanua – Salelologa	US\$300	Heavy truck (US\$15 per ton)
Tonga	Nuku’alfa – Vava’u	US\$546	
Tuvalu	Funafuti – Nanumea	US\$1,600	
Vanuatu	-	N/A	

### (3) Port facilities

To facilitate circulation of recyclable material collection throughout the region, RORO system is essential. RORO ships that enable container transport have been introduced in PICs but they cannot enter all ports. Table 4-51 shows provincial population distribution in each country. Distribution of population is quite uneven in PICs. For instance, seventy-nine percent of Fijian total population is found in the province of Viti Levu where the capital city is located. On the other hand thirty-four percent of Vanuatu’s population is found in Shefa, where the mainland is located, while the share of other provinces ranging from 13 to 20 percent (with exception of Torba). This means that Vanuatu has a more dispersed population distribution than Fiji does. Tuvalu, the least populated country, has the most dispersed population distribution among the five. When examining the development of new

RORO facilities, features of the population distribution should be considered.

**Table 4-51 Provincial population and RORO port in PICs**

Country	Province	Population	Population Share	International Port	Domestic Port		Source
					RoRo	Non-RoRo	
Fiji	VITILEVU	661,997	79%	Suva, Lautoka	Suva, Lautoka, Natovi	Natovi, Elington, Denarau and Ysawa i Rara	2007 Population Census of Fiji
	VANUALEVU	135,961	16%	Malau, Galoa, Wairiki and Savusavu	Nabouwalu, Malau, Savusavu, Taveuni	Natuvu	
	LOMAIVITI	16,461	2%		Levuka, Koro, Muanivanua, Buresala, Gau (Nawaikama & Qarani)	Rakiraki, Naviti, Tovulalai	
	LAU	10,683	1%		N/A	Moala, Toyota, Matuku, Lakeba, Naitauba, Nayau, Vanua Balavu, Cicia, Vanua Vatu, Nasaqalau	
	KADAVU	10,167	1%		Vunisea	Vunisea, Mano	
	ROTUMA	2,002	0%		Oinafa		
	<b>TOTAL</b>	<b>837,271</b>	<b>100%</b>				
Vanuatu	TORBA	9,359	4%		N/A	Torba Province	2009 National Population and Housing Census
	SANMA	45,855	20%	Santo	Santo		
	PENAMA	30,819	13%		N/A	Ambae, Maewo, Pentecost	
	MALAMPA	36,727	16%		N/A	Ambrym, Malekula, Paama	
	SHEFA	78,723	34%	Port Vila	Port Vila	Epi	
	TAFEA	32,540	14%			Tanna, Tafea Province	
	<b>TOTAL</b>	<b>234,023</b>	<b>100%</b>				
Samoa	UPOLU	137,599	76%	Apia	Apia, Mulifanua		Population and Housing Census 2006
	SAVAII	43,142	24%		Salologa		
	<b>TOTAL</b>	<b>180,741</b>	<b>100%</b>				
Tonga	TONGATAPU	72,045	71%	Nuku'alofa	Nuku'alofa, Lifuka		Tonga 2006 Census of Population and Housing
	VAVA'U	15,505	15%	Vava'u	Vava'u	Neiafu	
	HA'APAI	7,570	7%			Pangai, Ha'afeva Is, Nomuka, Tungua, Pangai	
	EU'A	5,206	5%			E'ia	
	NIUA	1,665	2%			Niuaotupu, Niuafo'ou	
	<b>TOTAL</b>	<b>101,991</b>	<b>100%</b>				
Tuvalu	FUNAFUTI	4,492	47%	Funafuti	Funafuti		Tuvalu 2002 Population and Housing Census
	NANUMEA	664	7%			Nanumea	
	NANUMAGA	589	6%			Nanumanga	
	NIUTAO	663	7%			Niutao	
	NUI	548	6%			Nui	
	VAITUPU	1,591	17%			Vaitupu	
	NUKUFETAU	586	6%			Nukufetau	
	NUKULAEAE	393	4%			Nukulaelae	
	NIULAKITA	35	0%			Niulakita	
	<b>TOTAL</b>	<b>9,561</b>	<b>100%</b>				

#### (4) Recycling material transport

Recycling business has been operating in the main land of each PIC. The volumes of export per year are varying from 8,663 tons in Fiji to five containers (approx. 100 tons) in Tuvalu. Furthermore, businesses have also started in local islands in Fiji, Vanuatu and Tonga. Container transport or truck transport is used in each case. No regulation is applied for domestic recycling materials transport as long as these are neither hazardous nor explosive. Precise data on recycling material domestic transport cannot be collected in each country at present. In order to formulate a policy and a plan related to recycling business, comprehensive data collection system is required.

## Chapter 5. **Review Issues in Transport and Storage of Recycled Waste Materials under Reverse Logistics**

### **5.1 Issues on Reverse Logistics**

#### **5.1.1 Issues on Bulky Waste Recycling**

As described in the earlier chapters of this report private recycling companies have emerged in each of the 5 countries, in varying capability (manpower, amounts of RWMs, equipment used, etc.) levels. Based on their performance and discussions with the concerned officials the following issues are identified.

##### **(1) Collection coverage of RWG**

The following issues on the collection coverage of RWG were identified;

- There is hardly any source separation of the RWGs
- There is no fixed system of collection of the RWGs, and these are collected by “collection contractors” or in some instances directly by the recycling companies
- The collection of RWGs in the outer and remote islands is very limited

In Fiji, many recycling companies reported that many of the collection contractors do not keep their commitments and sell the RWG to the highest bidders. While in three of the PICs, the populations are very largely concentrated in the main cities and islands, in Vanuatu and Tuvalu the population is more evenly disbursed over a larger number of islands and more efforts are needed to improve domestic shipping to extend collection over a wider region of the country.

Public awareness is required to gradually introduce source separation. In addition the need for a format to enhance more coordination between the collection contractors and recycling companies may be considered.

##### **(2) Requirement to improve working standards and conditions at Recycling Companies**

The Study Team had the opportunity to visit a number of yards operated by the recycling yards. The general impression was that:

- The yards are limited in size with little space to improve stockpiling conditions and provide more space for processing work



- Salvage rates of RWG are around 50 - 60% for vehicles and white goods, as the Recycler Companies mainly concentrate on metal while other components such as tires, glass, plastics and rare earth minerals are mostly sent to the landfill.
- In many of the yards the workers process the RWGs under difficult working conditions, lacking sufficient protective gears and equipment
- The general impression was that the recycling companies do not inject sufficient investments in their operations to improve the quality of the work and that there may not be a long-term commitment by them to this work. This is a significant issue in the case of the recycling companies formed in association with foreign companies.

The comparatively large number of private recycling companies that emerged in Fiji during the last few years is very welcome, but it is clear that there are issues related to their operations which need to be improved. Better separation of the scrap metals by category is expected to lead to increased foreign demand. In addition balanced monitoring by the concerned government authorities and government policies would encourage recycling companies to invest more in equipment and improved working conditions.

### **(3) Strengthening the International Demand for RWMs and Promoting the local Demand**

The Study estimated that about 60% of the RWGs are salvaged and processed into RWMs in Fiji and the rates are less than 40% in the other four PICs studied. This situation may be due to the following issues;

- There is hardly any domestic demand of the RWGs
- There is none or little international demand for paper and cardboard and pet bottles
- The recycling companies do not meet the requirements of potential international buyers for proper separation of the RWMs
- There is little government support to promote international markets for RWMs originating from the PICs.

The domestic demand for waste paper and vehicle batteries was observed only in Fiji. The Study Team confirmed from three beverages manufacturing plants in Fiji and Samoa that the materials used to make bottles and cans by these plants are imported. While these plants have introduced systems to collect used pet bottles and cans, these are processed and shipped overseas for producing the metal sheets and resins that are then exported back to the plants for making the packaging. There is a need to seriously study the feasibility to manufacture the cans and pet bottles in the PICs to increase domestic

demand, and develop regional and domestic markets for such waste items as paper that are not in demand in the international market.

#### **(4) Identification of Government responsibility**

With the private sector taking the initiative in the bulky waste recycling sector, the extent that the government should intervene in this sector should be cautiously considered. Will more government intervention increase the recycling amounts or will it create obstacles and hinder the business? Some of the issues that the Government may help resolve are listed below:

- Lack of proper monitoring of operations and working conditions and collection of data to analyse the extent of the recycling operations
- Small number of private sector companies participating in the recycling industry
- No obligation on the part of dealers of vehicles and white goods to participate in operating collection systems for the discarded units
- Sudden introduction of official actions, such as excessive taxes on recycling business, new deposit systems and imports of RWM, without sufficient discussions with the stakeholders

Some of the recycling companies in Fiji complained that there is no level field in terms of the recycling companies meeting the requirements of the DOE; which creates the situation where some companies spend more on improving operations to meet the requirements while others spend much less. In Fiji, the OE is contemplating introduction of Container Deposit Legislation which is opposed by some recycling companies. In Vanuatu the government is not actively supporting Port Villa city's welcome effort to introduce the chargeable bag system. An active recycling company in Vanuatu has considered suspending operations after the government there suddenly set a tax on the recycling activity.

Governments should be encouraged to develop policies, strategies and action plans for bulky wastes recycling to encourage wider participation by the private sector. And the permitting systems provided to recycling companies need to provide for monitoring of the companies' activities in order to improve the working conditions and ensure that the companies are upgrading their processing skills.

## **5.2 Issues on Water Transport and ports for handling RWG and RWM**

Recycling material has already been shipped from PICs. When circulating recycling materials, collecting, processing and packing recyclable materials are the main issues rather than transporting at present. However several issues on transporting and stocking the recycling materials in ports are identified based on our site survey. Furthermore, our survey revealed that recycling material exports

will reach 2,800 TEUs in Fiji, 380 TEUs in Samoa, 90 TEUs in Tonga, 10 TEUs in Tuvalu and 400 TEUs in Vanuatu in 2020 respectively. Total volume in 2020 is 40 percent larger than that in 2011. First, to achieve this, the participation of government and private sectors for recycling activity in each country will be required. Second, improving transport should only be done when it is justified by the generated volume of recycling materials.

**(1) Collection system over a wide area is not formed in PICs**

Present collection system does not serve outer and sparsely inhabited islands. 1.4 million people are spread across an area of 3.69 million square kilometres. Since recyclable materials are dispersed, it would be hard to aggregate and process materials without effective transportation. International container routes for developed countries from PICs are multi-port-calling networks, though major trunk lines form hub-and-spoke networks. The multi-port-calling networks are preferable for collecting recycling materials in dispersed regions. Even though further study of generation of recycling materials, allocation of processing points and capacity of recycling agents is required, linkage between international network and domestic network in each country should be explored to achieve effective collection of recycling materials.

**(2) Difficulty of domestic recycling materials transport**

RORO system is essential to facilitate collection of recyclable material throughout PICs. RORO ships that enable container transport have been introduced in PICs but they cannot enter all ports. It is not feasible to construct a RORO terminal in each island and atoll. Transportation system is traditionally tailored and developed to meet PICs conditions. Even though RORO/Ferry ships are deployed in PICs, many of the RORO ships are equipped with surf boats and cranes. A surf boat allows commodities to be carried from/to small islands where a mother ship cannot enter. Small unit containers, less than 20 feet containers, have been introduced to handle small cargoes. Transport and cargo handling technology should be continuously improved. In addition, the relationship between population distribution and RORO terminal needs to be examined further as it will indicate where priority on port improvement should be placed.

**(3) Ocean freight rate is added on recycling cost**

The extent of the burden of freight rates on transport of recyclable waste materials should be considered. For instance, major scrap material exporters are US, JAPAN and other European developed countries that are located in densely populated areas. They generate a huge volume of recycling materials and this can take advantage of economy of scale. PICs cannot expect this advantage. Scrap metal market including selling prices is dominated by these large generators and consumers.

On the other hand, PICs have to export the materials over a long distance. Freight rate in PICs is higher than that in the major world routes. A case study of recycling cost showed that share of water transportation cost was at most 31% of the cost of producing and shipping scrap steel from PICs to the Far East, even though shipping companies provide a lower price for export than for import to encourage export in PICs. Furthermore, domestic freight rates are to be added to the international freight rate when a recycling agent plans to export abroad recyclable materials collected in local islands via the mainland. The export of scrap metal is viable under present market conditions, but future prospects are not known. In order to alleviate the impact of freight cost on exporting recycling materials, various kinds of efforts will be expected such as improvement of cargo handling operation in ports, volume increment of cargo handling including recycling goods in ports, shipping company's cooperation, and government assistance for export.

**(4) Recycling companies' lack of information on quarantine regulation at destination port**

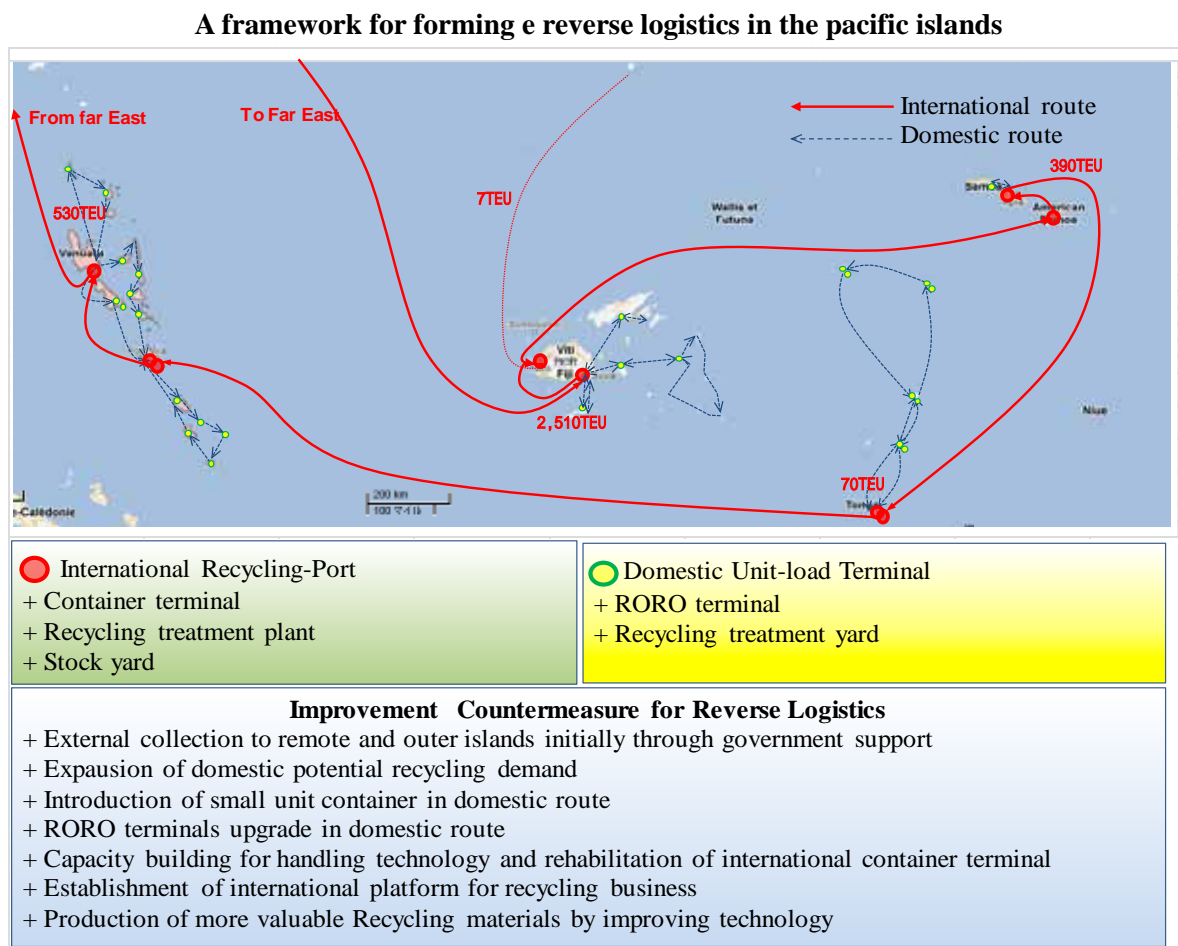
There are cases where recycled materials shipments were rejected at importing ports because of not satisfying standards. For instance, biosecurity authority of NZ is preparing mandatory treatment and inspection requirements for scrap metal. Plant materials, soil, water, wood and other biosecurity items are regulated. Many of the recyclable materials tend to be exposed to the elements and thus, it will be necessary to clean biosecurity contaminants in the processing stage. Precise information on quarantine regulation is necessary for exporters of recycling materials in PICs.

## Chapter 6. Forming reverse logistics in the pacific islands

### 6.1 A regional framework of reverse logistics in the pacific islands

#### 6.1.1 Concept of reverse logistic system

A regional framework of reverse logistics system in the pacific islands is shown below. RWGs generated in local islands are expected to be collected and transported to an international port in the main island by domestic shipping. The accumulated RWGs are cleaned, selected, and sorted as commercial commodities and then, stocked in the international port or its vicinity until finally being exported by international shipping.



**Figure 6-1 Regional framework of reverse logistics in the pacific islands**

Within the regional reverse logistics network, there will be individual reverse logistic network in each country. The following figure shows the example of such domestic reverse logistic network. In order to materialize formation of the reverse logistics network and to promote recycling business in

the Pacific Islands, RWG collecting system that is being now conducted in cities in main islands should be expanded to the whole of the main island as well as local islands. At present in main islands, a recycling company collects RWGs generated in the island, processes them in its workshop, and then exports them to foreign markets from an international port. On the other hand, public sector support may be needed if RWGs in local islands will be collected and stocked in a recycling agent's premises or port. Since the volume of RWGs in local islands is relatively lower than that in the main island. For example, when the volume of stocked RWGs will reach a certain level in a local island, the RWGs would be packed into a container, and transported from a local port to an international port, and then processed as a commercial commodity, and finally exported to the foreign market. A processing facility for the RWGs from local islands will be prepared in the international port or its vicinity if necessary.

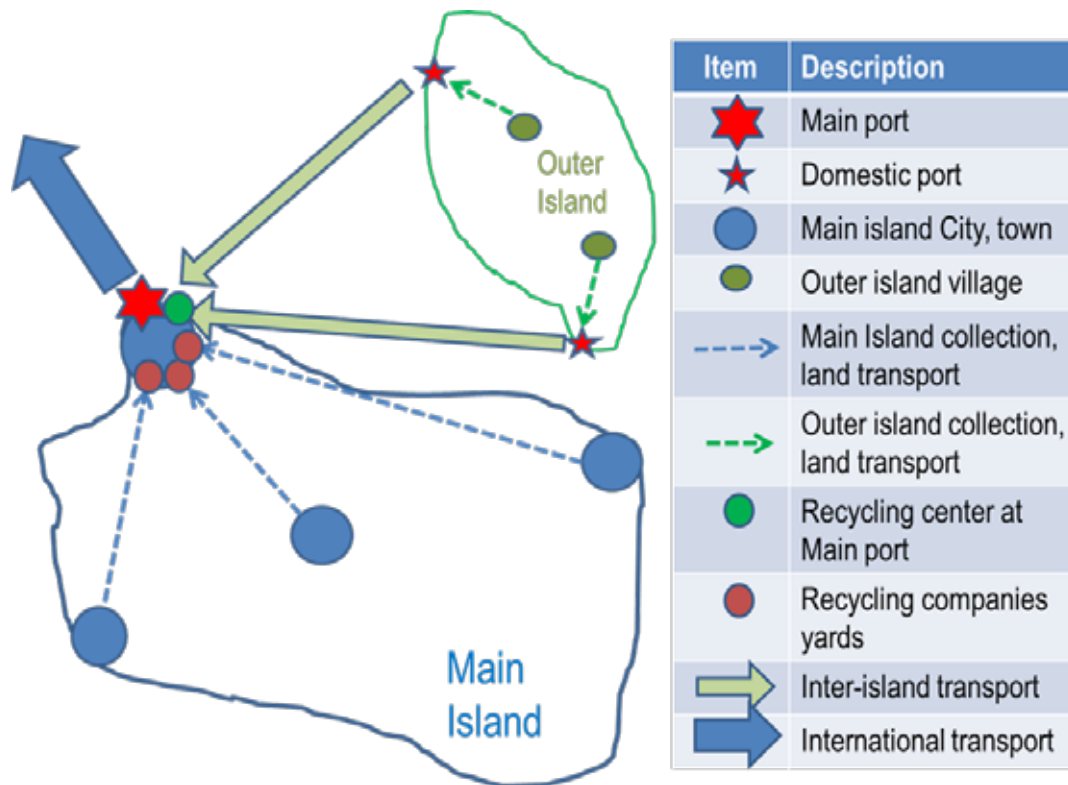


Figure 6-2 Domestic reverse logistic network between a main island and local islands.

### 6.1.2 Activity and flows of reverse logistics

The next figure shows RWGs' processing flow in each region. Each activity is listed in each RWGs processing stage from RWGs collecting stage to exporting and selling stage. Region is divided into three based on accessibility to the global market.

The recycling business has been conducted in main cities which have an international port. It would be desirable for the business to cover the whole country or a region to improve environment in the Pacific Islands. However the business would not be viable due to inefficient transport conditions

resulting from the remote and dispersed islands and limited amount of RWGs generation in the island.

In this survey, the team will propose three regional categories; a city in a main island which has an international port (International Port City), the other local cities in the main islands which have an international port (Inland cities in islands with international port), and remote islands (Outer Islands). The team will examine the viability of reverse logistics in each category. In addition, the problems in each stage such as RWG collection, packaging, domestic transportation (land and marine), processing, international transportation, and export and marketing will be identified, and countermeasures for the problem in each stage will be proposed.

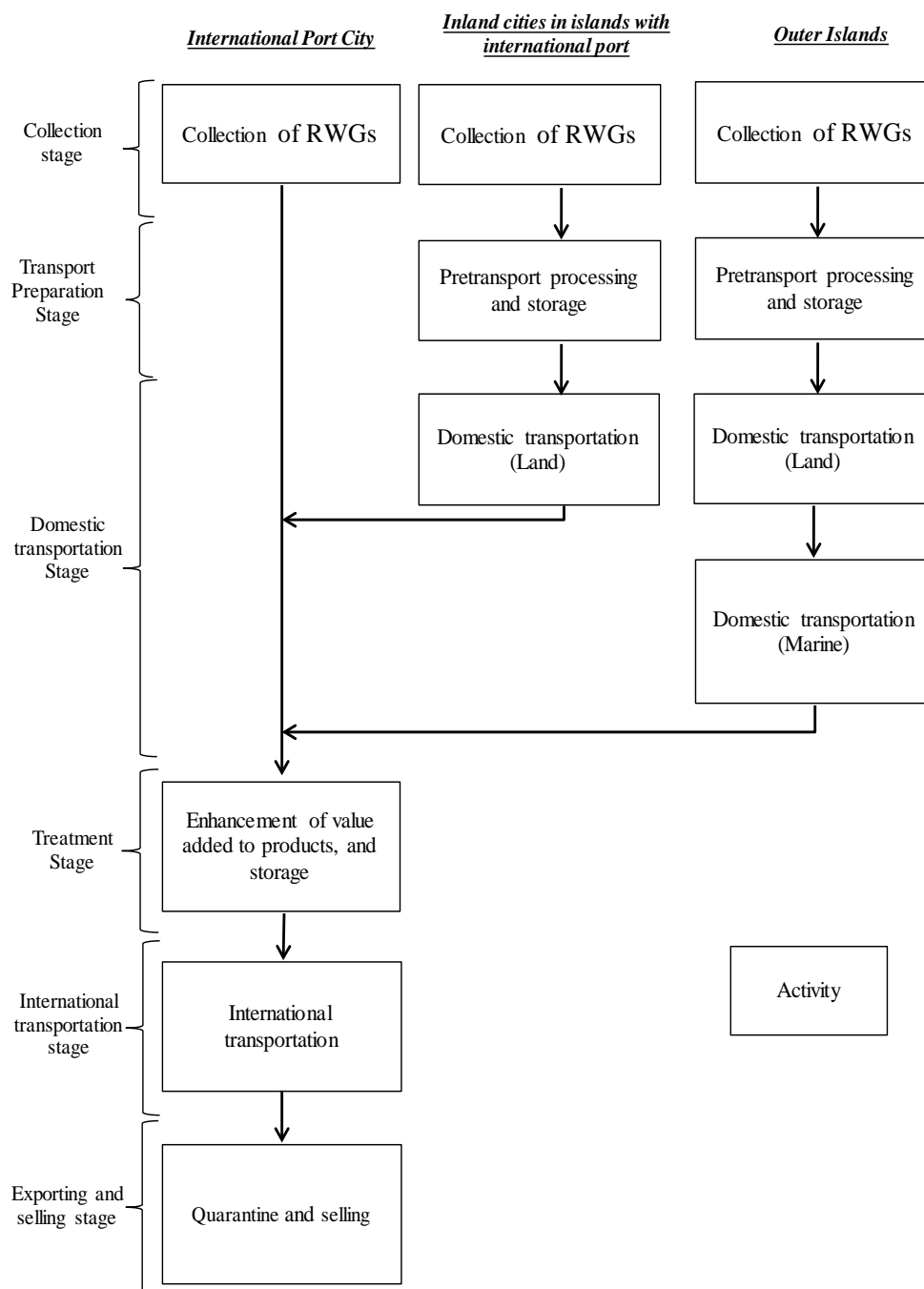


Figure 6-3 RWGs' processing flow and activity in each region.

### 6.1.3 Categorization and future prospects in five countries

The five countries are divided into three categories based on the development of reverse logistics. At first, the team focused on the activities of recycling companies in each country. In Tuvalu, a one-man enterprise is currently the only recycling business being operated. If he stops his business, the reverse logistic in Tuvalu will be terminated. There is only one company in Tonga; however it is undertaking this business actively. There are a number of recycling companies operating in the other three countries. Stable recycling businesses are expected in these four countries. In Fiji, a registration system for recycling operators has already been introduced to prevent unqualified entities from entering the recycling business. In addition, recycling companies are handling not only scrap metal but also other recycling items and some of RWG is reused in the country of origin.

From a marine transport perspective, the team assessed the five countries to determine whether they can access international network directly or not. The network enables the countries to connect to the final consumer destination of the RWM in the pacific countries. Four countries except Tuvalu connect abroad directly. Tuvalu is outside the multi-calling international network and relies on transshipment from Suva, Fiji. Next, the team examined the present status of domestic marine transport for RWGs. Domestic marine transport for RWGs is operated in Fiji and Tonga but has not yet been introduced in the other three countries.

Based on the review of recycling activity and RWG's transport in PICs, the team categorized Fiji as category I, Samoa, Tonga and Vanuatu as category II, and Tuvalu as category III respectively. The team defined each category and proposed countermeasures for improving the situation.

Category I: Private recycling companies maximize the items and volume of RWG and improve the collection ratio of RWG to further develop reverse logistics system. Public sector supports their businesses, if necessary.

Category II: Public sector leads and works together with private recycling companies to improve reverse logistics system. The focus will initially be on economically feasible RWGs including scrap metal. Support should be made available to private companies until a stable business environment is created.

Category III: Public sector should play a main role and involve private sector to establish reverse logistics system in the country.

**Table 6-1 Categorization in five countries**

		Category I	Category II			Category III
Countries		Fiji	Samoa	Vanuatu	Tonga	Tuvalu
Present status of recycling in each country and categorization	Population(2011)	854,120	184,864	251,500	103,036	9,531
	Registration system for recycling company		○	○	○	—
	Number of recycling company	Around 15	Around 3	Around 5	1	1(one man operation)



Present status of recycling in each countries and categorization	Volume of recycling in 2011(tonnage)	38,218	4,133	4,601	584	113
	Volume of recycled scrap(tonnage)	35,895	4,116	4,601	584	113
	Volume of recycled plastic including pet(tonnage)	702	17	0	0	0
	Volume of paper recycled(tonnage)	1,621	0	0	0	0
	Recycled items for domestic use	Paper, lead battery, used oil	—	—	—	—
	Accessibility of RWG recycling to international market(Direct International route)	○	○	○	○	— (Suva transship)
	Availability of RWG domestic transportation(existing domestic route)	○	—	—	○	—

#### 6.1.4 Targeted Recycling Rate and Recyclable Waste Goods

Measures to be taken by each Category to improve recycling by type of RWG are as described below.

Category I, as it has on-going recycling activities for all the RWGs, targets to increase the collection amount shall be set. It shall also enhance the recycling of paper within its country.

Category II shall enhance the existing recycling activities of scrap metals from vehicles and white goods, as well as improve the recycling activities of other RWG items such as paper and PET bottles. In addition, paper recycling in Fiji shall also be determined.

Category III shall first establish a recycling system centering on the scrap metals from cans and white goods. The possibility of recycling other RWG items shall also be explored.

**Table 6-2 Targeted RWG Items and Measures to be taken by Category**

Items	Category I Fiji	Category II Samoa, Vanuatu, Tonga	Category III Tuvalu
Vehicles, White Goods, Heavy Equipment, Cans (Scrap Metals)	ž Maximization of international export	ž Maximization of international export	ž Establishment of intra-regional and international export of RWG
PET Bottles	ž Improvement of export, ž Examination of domestic recycling business	ž Establishment of a collection and export system	ž Determination of recycling

Items	Category I Fiji	Category II Samoa, Vanuatu, Tonga	Category III Tuvalu
Paper, Cardboard	<ul style="list-style-type: none"> <li>ž Maximization of domestic recycling business,</li> <li>ž Improvement of international export</li> </ul>	<ul style="list-style-type: none"> <li>ž Establishment of a collection system,</li> <li>ž Establishment of intra-regional and international export</li> </ul>	<ul style="list-style-type: none"> <li>ž Determination of recycling</li> </ul>

Based on the considerations described so far the recycling targets for each of the three categories were set.

In countries of Category I the recycling activities are already progressing, and therefore a modest increase rate of 5% to 10% has been set. Countries of Category II have low recycling rates at present, and the rates are actually very low when compared to that of Fiji. Therefore there is significant room for improvement and accordingly more ambitious improvement rates for recycling in 2020 of more than 10% of the present rates have been set. In the case of Category III countries, it is first necessary to develop the basic infrastructure to support the reverse logistics, and therefore a low improvement rate of only a few percentage points in 2020 has been targeted.

Accordingly Table 6-3 shows the target improved recycling rates set by category (country) in this Project.

**Table 6-3 Target Recycling Rate by Category (Country)**

Recycling Rate	Category I Fiji	Category II			Category III Tuvalu
		Samoa	Vanuatu	Tonga	
Recycling Rate as of 2011	57%	36%	37%	10%	15%
Target value for 2020 (Targeted rate)	+ 5% ~ 10% ( 64% )	+ 10% or more			+ a few percent (18% )
		( 48% )	( 50% )	( 21% )	

The effects of achieving the targeted recycling rates described in Table 6-3 are shown in Table 6-3. If we consider the case of Fiji the amount of RWMs in 2020 when compared to the figure of 2011 would grow by about 13,000 tons. This growth would in turn increase the number of containers to be imported by 630 units, create increased employment of 121 persons in the recycling sector, and decrease the costs of collection and disposal of waste by JPY 66 million. In similar terms for Samoa, Vanuatu and Tonga the growth in recycled waste amount would increase by 3,000 tons, 6,000 tons and 1,000 tons respectively, raising number of container units for export to 150, 300 and 40 units and increasing the number of employees in the recycling countries in these countries to 28 persons, 53 persons and 8 persons. On the other hand reductions in collection and disposal costs of JPY 15 million, JPY 29 million and JPY 4 million may be expected in Samoa, Vanuatu and Tonga respectively. For Tuvalu the recycling amount is expected to grow by 30 tons

**Table 6-4 Effects of Achieving the Target Recycling Rates**

Item	Category I	Category II			Category III
	Fiji	Samoa	Vanuatu	Tonga	Tuvalu
Recycled amount in 2011, tons	38,081	4,741	4,642	598	103
Recycled amount in 2020, tons	51,407	7,813	10,526	1,470	135
Growth amount (tons)	13,326	3,072	5,884	872	32
Container units increase (units/year)	630	150	300	40	2
Recycling companies increased employment <sup>(1)</sup> (person)	121	28	53	8	0
Reduction in costs of collection and disposal <sup>(2)</sup> (FJ\$/year)	1,532,000	353,000	677,000	100,000	4,000
Reduction in costs of collection and disposal <sup>(2)</sup> (JPY/year)	66,000,000	15,000,000	29,000,000	4,000,000	200,000
<p>(1) : Our survey result shows that the production rate of one recycling company employee is 110 t/year</p> <p>(2) : National Solid Waste Management Strategy 2011-2014, Fiji indicates that cost for collection and disposal is FJ\$ 115/ year</p> <p>Source: JICA Study Team</p>					

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## 6.2 Policies and Strategies to promote Reverse Logistics

Detailed policies and strategies shall be described hereafter for each of the three categories in order to improve reverse logistics at the different phases of the system and towards the public and private sectors respectively.

### 6.2.1 Category I Policies and Detailed Strategies

The country of category I, Fiji, will implement required countermeasures under the policy of “Private recycling agents maximize the items and volume of RWG and improve the collection ratio of RWG to further develop reverse logistics system. Public sector supports their businesses, if necessary.” aiming to improve reverse logistic in cities which have international ports; inland cities and towns which are located on islands where there are international ports and outer islands. Existing reverse logistics for scrap metal such as discarded vehicles and white goods will be improved and their exports will be maximized.

Existing reverse logistics for PET bottles also will be improved and possibility of domestic recycling will be considered. In addition, existing reverse logistics for waste paper and cardboard will be improved and existing domestic recycling also will be maximized.

#### (1) Collection Stage

Although the national strategy for solid waste management has already been formulated, however, specific activity and policy for bulky waste are not mentioned. At first the government will analyze the current situation and then formulate policy for collection of recyclable waste goods and their recycling. The policy is expected to stipulate targeted recyclable waste goods and their respective recycling rates and tentatively the following countermeasures are proposed to achieve the targets;

- ü Strengthen partnership with recyclers and establish an association
- ü Implement economic incentives
- ü Strengthen regional cooperation among PICs
- ü Collect and provide relevant information of recycling activity
- ü Study on possibility of PPP (Public-Private Partnership) and
- ü Support RWG collection from outer islands

Public and private sectors will implement RWG collection in line with the policy.

Institutional and legal set up are required to realize the policy. There are few recovery factories of RWM in Fiji and most of the RWM is exported to foreign countries. Recyclers in Fiji which follow the market principal encounter limitations in the volumes and diversity of targeted RWG because of the high total costs for recycling including maritime transportation cost. Without any economic incentives offered by the public sector, RWGs of low value are difficult to recycle.

Institutional and legal set up based on the producer responsibility are not suitable to Fiji which imports most of commodities from foreign countries. It would be more suitable to apply responsibility to importers, dealers and consumers. The Department of Environment of Fiji is promoting the Container Deposit Legislation and Refund System for Fiji (CDL), however there are few measures related to adding levies to waste cars and white goods. To reduce the waste amount and increase the recycling rate, the government should consider that importers, dealers and consumers will bear a part of cost for the recycling, such as 1) levy on car and white goods at the time of import into, sale and purchase; 2) Introduce and promote CDL; 3) provide subsidy for collection and recycling activities; and 4) preferential taxation for collection and recycling activities. One option for the government of a country depending on imports is to levy deposit on the incoming goods within the custom duty at custom clearance. The deposit will be managed as a Recycling Fund with the purpose of promoting RWG collection and recycling activity. In addition, Capacity Development of relevant government officers is required for the policy formulation and the legal set up.

Existing collection system will be improved and expanded in international port cities and inland cities in islands with international port. With regard to the private sector, recyclers will enhance their collection system for RWGs such as vehicles, heavy equipment and white goods, and cooperate in RWG collection schemes carried out by the public sector. Dealers for vehicles and white goods will be expected to provide deposit funds for RWG. Even though a few recyclers collect waste papers and PET bottles, collection of those goods requires support from the public sector due to low market value especially low price and less generation amount. Therefore public sector will collect those goods and improve their reverse logistics.

Collection system will be introduced in outer islands. Considering that collection systems for general waste are sporadic in the outer islands, as a first step the public sector will start waste collection and then introduce collection system for RWG. Recyclers may be reluctant to do business in the outer islands, and therefore the public sector will take the lead by starting a pilot project for RWG collection.

**Table 6-5 Improvement Measures in the Collection Stage**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public Sector	Private Sector
International Port City	Collection of RWGs	Expansion of collection of RWGs	<ul style="list-style-type: none"> <li>• Establish RWGs recycling strategy (recycling targets, identify target RWGs, etc.)</li> <li>• Prepare the related legal framework (determine responsibilities of importer, dealers and consumers; introduce economic incentives)</li> <li>• Implement separate collection (can, paper, pet</li> </ul>	<ul style="list-style-type: none"> <li>• Recycling companies will collect waste vehicles, heavy equipment and white goods</li> <li>• Recycling companies will process RWGs collected by public authorities</li> <li>• Dealers of vehicles and white goods will arrange</li> </ul>

			bottles) • Increase public awareness	drop off points for waste vehicles and white goods
Inland cities in islands with international port	Collection of RWGs	Establish a RWG collection system	As above	As above
Outer Islands	Collection of RWGs	Introduce collection system (include within solid waste collection)	<ul style="list-style-type: none"> <li>• Develop related legislation</li> <li>• Develop capacities of related government authorities</li> <li>• Introduce waste collection</li> <li>• Implement RWG collection pilot project</li> <li>• Increase public awareness</li> </ul>	<ul style="list-style-type: none"> <li>• Obtain community cooperation through increased public awareness</li> </ul>

**(2) Transport Preparation Stage**

Transport preparation stage includes preliminary shredding and dismantling, as well as primary storage of RWG collected in outer islands or inland cities in islands with international port, before transporting RWG to the recycling companies in international port city.

For the smooth implementation of this process, it is crucial to install facilities for preparatory treatment and storage in the inland cities in islands with international port. It is suggested that the operation and maintenance of the facilities shall be carried out by private sector, while public sector supports them by providing a preferential treatment such as tax incentives.

It is also necessary to develop those facilities in an outer island. However, there is little incentive for a private company to undertake the development. Therefore, it would be more practical that public sector builds facilities and private sector dispatch workers and operates the facility.

Whichever sector develops facilities for preprocessing and storage, unification of the fundamental functions of the facilities is essential in order to have a versatile system for domestic export, as well as to increase transport efficiency. For this, it is necessary and effective to have a guideline for facility development stating necessary facility, capacity of the facility, planning criteria, selection of machinery and equipment, environmental protection measures, etc.

**Table 6-6 Improvement Measures in the Transport Preparation Stage**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public Sector	Private Sector
Inland cities in islands with international port	Pretransport processing and storage	Construction of preprocessing and storage facility	Provide preferential treatment e.g., tax incentives	Develop facility
		Operation of facility	Provide preferential treatment e.g., tax incentives	Operate facility
Outer island	Pretransport processing and storage	Construction of preprocessing	Develop facility	-

		and storage facility		
		Operation of facility	Provide preferential treatment e.g., tax incentives	Operate facility

**(3) Domestic Transportation Stage**

It is difficult to handle a RWG cargo by human power, and its transportation cost is one of the barriers to entering the global market. In general, there are two transportation stages for the RWG cargo. One is RWGs’ land transport between a local city and a central city in the main island. The other is RWGs’ marine transport from local islands to the main island. Hence, in a domestic transportation stage, an efficient transportation system without any loading of cargo or unloading is highly required. As mentioned above, RWG’s transportation covers not only marine transport but also land transportation. The team proposes a RORO system that enables to transport container and truck without any loading or unloading of cargo.

As for land transportation in the main island, improvement of route condition and introduction of a truck and a trailer are possible measures for efficient transportation. Public sector shall improve road condition such as paving and widening road, and/or shall introduce reduction or exemption of tax for private companies’ purchasing the tractor and trailer. Private recycling companies and land transportation companies shall be encouraged to introduce the tractor and trailer for transportation measures in order to mechanize and improve the efficiency of RWG cargo handling.

As for marine transportation between local islands and the main island, RORO system is an essential measure to transport RWGs. Introduction of a RORO ship for domestic shipping routes, construction of port facilities that can accommodate a RORO ship, and reduction of freight rate should be planned and prepared. In order to materialize the plan, public sector should support a private shipping company to replace the existing vessel with a RORO ship, and construct port facilities for the RORO ship. Public also shall offer a RORO ship or subsidize a private RORO ship purchase for RORO operation in remote islands route where private companies cannot serve lines independently due to the high cost operation. In addition, RWG collection requires environmental and sanitary improvement in the islands, and thus introduction of subsidy covering operational cost of domestic route is worth examining.

On the other hand, a private shipping company shall introduce a RORO ship for RORO transport to pursue efficient transport. Public sector support shall be available for the purchase of the RORO ship, if necessary. Furthermore, freight rate adjustment shall be examined by the private shipping company in order to alleviate the imbalance of import and export cargoes.

Finally, a trial demonstration of RWG transportation with the existing route and the ship will be carried out. Public and private sectors will work together on the trial. They can identify the problems

for facilitating the RWG transport through the trial, and they can explore the feasibility of introducing reverse logistics in PICs.

In addition, volume of cargoes to/from local islands is small. There is a possibility of over investment when cargo handling facilities for twenty-foot container are introduced. At present, handy containers, less than twenty feet container capacity, are introduced in domestic routes in Samoa and Tonga. It is worth examining the feasibility of introducing these smaller-sized containers in all PICs. Public sector will conduct a feasibility study to introduce the handy container, and set standards for the handy container and prepare a port plan for the container. Private sector will follow the public sector's study and will examine the feasibility of introducing the handy container and install the container cargo handling equipment and ship's equipment, if possible.

**Table 6-7 Improvement Measures for Domestic Transportation**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public Sector	Public Sector
International Port City	-	-	-	-
Inland cities in islands with international port	Land transportation	Improvement of land transportation	+Road construction, and Improvement of road condition for RORO transportation  +Facilitation for introduction of a trailer, i.e. tax exemption when purchasing trailers	+Land transport operator purchases trailers and transport RWGs
Outer island	Land transportation	Improvement of land transportation	+Road construction, and Improvement of road condition for RORO transportation  +Facilitation for introduction of a trailer, i.e. tax exemption when purchasing trailers	+Land transport operator purchases trailers and transport RWGs
	Marine transportation	Improvement of marine transportation	+Trial demonstration of RWG transportation with an existing ship and its route  + Freight rate alleviation measures  +Operational subsidy and public's purchasing a ship in remote island route  +facilitation for replacement to a RORO Ship in main island routes	+Trial demonstration of RWG transportation  +Deployment RORO ship  +Freight adjustment for RWG cargo
		Improvement of port facility	+Construction of port facility and navigation aid for RORO ship	None
		Introduction of handy container	+Installment of cargo handling facilities for a handy container (set for handy container spec, yard pavement, folk-lift and other handling machine )	+introduction of handy container and handling equipment



**(4) Treatment Stage**

All the RWG collected in outer islands and/or inland cities in islands with international port are subject to a treatment to add value at a recycling company's plant in an international port city.

The main policies in the treatment stage are improvement of treatment and storage facilities and enhancement of environmental protection measures. For the facility improvement, private sector shall first identify the customer needs and quarantine regulation of the receiving countries to introduce an appropriate facility so that the RWM can be sold at higher prices. It is also needed to introduce new treatment technology to convert RWM into high value-added products, as well as to acquire recycling technology where possible. Public sector shall support private sector to upgrade their technique and/or introduce new technology. In regard to this, provision of technical guidance from Japanese recyclers to local recyclers would be effective, as in "Mottainai Project" in Tonga.

For environmental protection, Category I country has already introduced a permit and monitoring system for recycling companies, however, there is still room for improvement in implementation. Public sector shall ensure a thorough implementation of the existing monitoring system and oversee the recyclers to prevent inadequate treatment. Private companies shall practice the environmental protection measures in line with a national guideline.

**Table 6-8 Improvement Measures for the Treatment Process**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public sector	Private sector
International port city	Enhancement of value added to products, Storage	Improvement of treatment and storage facilities	Provide assistance in obtaining and upgrading of techniques	<ul style="list-style-type: none"> <li>• Introduce appropriate facilities after identifying customer needs and quarantine regulation</li> <li>• Acquire and introduce new technology</li> <li>• Examine and introduce recycling technology</li> </ul>
		Strengthening of environmental protection measures	Thoroughly implement monitoring	Implementation of environmental protection measures

**(5) International Transportation Stage**

It is essential to reduce the total marine transportation cost when exporting RWGs for foreign markets. To achieve this goal, it is necessary to enhance efficiency of port operation and to modernize port facilities and cargo handling equipment. In addition, as a high freight rate is caused by imbalance of volumes of import and export cargo, promotion of volume of export cargo might also improve efficiency of transportation in the PICs,

In order to alleviate the present situation, public sector should take an action for development of capacity for port operation and cargo handling, and introduction of an IT system for port operation. Public sector should support construction of port facilities and improvement cargo handling equipment as well. In addition, promotion of cargo generation from the islands will be another option to moderate the freight rate from the islands. Besides recycling business, collection of RWG will contribute to improve sanitation in the island. Not only a recycling company but also public health authorities may work together to collect RWGs from the islands.

Private sector should work together with public sector to improve the efficiency of transportation. A port operator should improve the efficiency of terminal operation and introduce an IT system in port operation and modernize cargo handling equipment. An international shipping company should work together with a consigner and public sector for alleviating freight rate that is a burden for selling RWMs to the global market. The team estimated that export volume of RWM from Fiji will increase from 1,960TEU, in 2011 to 2,510TEU in 2020. This means RWMs might be an important export commodity for Fiji's economy. Therefore, if RWMs supply is stabilized it may be possible to lower the freight rate although this will ultimately be determined by negotiations.

**Table 6-9 Improvement Measures for International Transportation**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public Sector	Public Sector
International port city	International Marine transportation	Improvement of port operation	+Capacity development for cargo handling efficiency + Introduction of IT system for port operation	+Capacity development of cargo handling skill +Introduction of IT system for port operation
		Improvement and modernization of port facility and handling equipment	+Improvement of port facilities (berth, yard, stock house, and etc) for enhancing port efficiency	+Improvement of equipment for enhancing handling efficiency
		Improvement of transport efficiency through export cargo	+Promotion of export cargoes by stimulating industry	+Promotion of export cargo including RWM

#### (6) Exporting and Selling Stage

When a recycling company sells RWM to foreign market, information on recycling business is essential. At present, private recyclers and interested individuals are searching information on quarantine regulation and buyers in foreign countries by themselves. Formation of a function that individuals can easily access the information on world market as well as regulation in the destination countries is highly expected.

To realize the plan, the public sector should establish a system that provides quarantine regulation on the destination countries and should inform the recycling companies on quarantine and customs regulation in the destination countries. The Public sector should work to collect the regulation

information and to enhance skills to recycling agents for packaging and transporting RWM to meet the regulation, as well as to collect information on recycling business market.

**Table 6-10 Improvement Measures in the Exporting and Selling Stage**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public Sector	Public Sector
International port city	Quarantine and selling	Learning regulation on destination countries	+Formulation of platform for providing quarantine and customs information in destination countries +Providing quarantine and customs information to recycling company	+Collecting quarantine and other regulation information of RWM export +Enhancement of skill for packing and exporting RWM
		Accessing global market information	+Providing market information to recycling agent	+Collecting information of the market.

### 6.2.2 Category II Policies and Detailed Strategies

The countries of category II, Samoa, Vanuatu and Tonga, will implement required countermeasures under the policy “Public sector leads and works together with private recycling companies to improve reverse logistics system. Focusing on RMG which are economically feasible and aiming at fostering and sustaining private recycling agents.” aiming to improve existing reverse logistic in international port cities and establish reverse logistic in inland cities in islands with international port and outer islands. Existing reverse logistic for scrap metal such as discarded cars and white goods will be improved and their export will be maximized. As for waste PET bottle, papers and cardboard, reverse logistics system needs to established, as there are no existing ones. In addition, export of waste papers to Fiji which has a factory producing toilet paper from waste paper may be considered.

#### (1) Collection Stage

Countries of category II with support from SPREP are in various stages of formulating their national strategies for solid waste management. At first the governments will analyze the current situation and then formulate policy for collection of recyclable waste goods and their recycling. The policy is expected to stipulate targeted recyclable waste goods and their respective recycling rates . The following countermeasures are tentatively proposed to achieve the targets;

- Ü Strengthen partnership with recyclers and establish an association
- Ü Implement economic incentives
- Ü Strengthen regional cooperation among PICs
- Ü Collect and provide relevant information of recycling activity
- Ü Study on possibility of PPP (Public-Private Partnership) and

Ü Support RWG collection from outer islands

Public and private sectors will implement RWG collection in line with the policy.

Institutional and legal set up are required to realize the policy. There are no recovery workshops of RWM in those countries and all RWMs are exported to foreign countries. Recyclers in those countries which follow the market principal encounter the limitation of the volume and targeted RWG because of high total cost for recycling including maritime transportation cost. Without any economic incentives from public sector, low value RWG could not be recycled

Institutional and legal set up based on the producer responsibility are not suitable to those countries which import most of commodities from foreign countries. It is more suitable to allocate responsibility to importers, dealers and consumers. These governments have tried to introduce levy system such as Container Deposit Legislation and Refund System and pay waste bag for general wastes. Besides, there are few measures of additional levy to cars and white goods. To reduce the waste amount and increase the recycling rate, the government should consider that importers, dealers and consumers will bear a part of cost for the recycling, such as 1) levy on vehicles and white goods; 2) subsidy for collection and recycling activities; and 3) preferential taxation for collection and recycling activities. One option for countries depending on imports is for their governments to levy a deposit on the imported goods to be included on custom duty at custom clearance. The deposit will be managed as Recycling Fund with the purpose of promoting RWG collection and recycling activity. In addition, Capacity Development of relevant government officers is required for the policy formulation and the legal set up.

Along with Category I, existing collection system will be improved and expanded in international port cities and inland cities in islands with international port. The Public sector will take the initiative to collect waste cans, papers, PET bottle, cars, heavy equipment and white goods. Particularly, papers and PET bottle are not collected due to lower market prices than that of scrap metal. Collection of those RWGs requires support from the public sector. With regard to the private sector, recyclers will cooperate with public sector and process RWG collected by the public sector. Dealers for vehicles and white goods will be expected to provide deposit funds for RWG to promote RWG collection carried out by public sector.

Collection system will be introduced in outer islands. In consideration of few collection systems for general waste in outer islands, at first public sector will start waste collection and then introduce a collection system for RWG. Recyclers may be reluctant to do business in the outer islands, and therefore the public sector will kick-start the effort through implementation of a pilot project for a RWG collection.

**Table 6-11 Improvement Measures in the Collection Stage**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public Sector	Private Sector

International Port City	Collection of RWGs	Expansion of Collection System	<ul style="list-style-type: none"> <li>• Establish RWGs recycling strategy (recycling targets, identify target RWGs, etc.)</li> <li>• Prepare the related legal framework (determine responsibilities of importer, dealers and consumers; introduce economic incentives)</li> <li>• Develop capacities of related government authorities</li> <li>• Implement separate collection (can, paper, pet bottles)</li> <li>• Increase public awareness</li> </ul>	<ul style="list-style-type: none"> <li>• Recycling companies will process RWGs collected by public authorities</li> <li>• Dealers of vehicles and white goods will arrange drop off points for waste vehicles and white goods</li> </ul>
Inland cities in islands with international port	Collection of RWGs	Introduction of Collection System	As above	As above
Outer islands	Collection of RWGs	Introduce collection system (include within solid waste collection)	<ul style="list-style-type: none"> <li>• Develop related legislation</li> <li>• Develop capacities of related government authorities</li> <li>• Introduce waste collection</li> <li>• Increase public awareness</li> </ul>	<ul style="list-style-type: none"> <li>• Obtain community cooperation through increased public awareness</li> </ul>

**(2) Transport Preparation Stage**

Transport preparation stage includes preliminary shredding and dismantling, as well as primary storage of RWG collected in the outer islands or inland cities in islands with international port, before transporting to the recycling companies in the international port cities.

For the smooth transport, it is crucial to install facilities for preprocessing and storage. The project suggests that the public sector construct facility and private sector support its operation in the inland cities in islands with an international port. In outer islands, it is desirable that public sector conducts the development and operation of the facilities and private sector provide technical assistance in facility operation.

Even though the preprocessing and storage facilities are developed by public sector, it is still necessary and effective to have guidelines for the facility development (incl. necessary facility, capacity, planning criteria, selection of machinery and equipment) and environmental protection measures.

**Table 6-12 Improvement Measures in the Transport Preparation Stage**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public sector	Private sector
Inland cities in islands with international port	Pre-transport processing and storage	Construction of preprocessing and storage facility	<ul style="list-style-type: none"> <li>• Secure land for the facility</li> <li>• Procurement of equipment</li> </ul>	-

		Operation of facility	• Provide assistance to private sector	• Operate the facility
Outer islands	Pre-transport processing and storage	Construction and operation of preprocessing and storage facility	• Construct and operate preprocessing and storage facility	• Provide technical guidance to the facility developed by public sector

### (3) Domestic Transportation Stage

It is essential to secure smooth transportation between a main island and local islands in order to expand recycling system to local cities in the main island and the local islands. For land transportation in the main island, improvement of route condition and introduction of a truck and a trailer are possible measures for efficient transportation as we mentioned in category I. Public sector shall improve road condition such as paving and widening road and/or shall introduce reduction or exemption of tax for private companies' purchasing the tractor and the trailer. Private recycling companies and land transportation companies shall be encouraged to introduce the tractor and the trailer for transportation measures in order to mechanize and improve the efficiency of cargo handling.

As for marine transportation, introduction of a RORO ship for domestic shipping routes, development of port facilities that can accommodate a RORO ship, and reduction of freight rate should be planned and prepared as we mentioned in category I. Public sector should support a private shipping company to replace the existing vessel with a RORO ship, and construct port facilities for the RORO ship. Specifically supports for remote island routes in Tonga and main island routes in Vanuatu should be considered.

On the other hand, a private shipping company shall introduce a RORO ship for RORO transport to pursue efficient transport. Public support should be available for the purchase of the RORO ship, if necessary. Furthermore, freight adjustment shall be examined by the private shipping company in order to alleviate the imbalance of import and export cargoes. Finally, a trial demonstration of RWG transportation with the existing route and the ship will be carried out. Public and private sectors will work together on this trial. They can identify the problems for facilitating RWG transport through the trial, and can explore feasibility of introducing reverse logistics. Finally, it is worth examining the feasibility of introducing the smaller-sized containers in all PICs as we proposed earlier in this report.

**Table 6-13 Improvement Measures for the Transportation Stage**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public Sector	Public Sector
International Port City	-	-	-	-
Inland	Land	Improvement	+Road construction, and	+Land transport operator

cities in islands with international port	transportation	of land transportation	Improvement of road condition for RORO transportation +Facilitation for introduction of a trailer, i.e. tax exemption when purchasing trailers	purchases trailers and transport RWGs
Outer islands	Land transportation	Improvement of land transportation	+Road construction, and Improvement of road condition for RORO transportation +Facilitation for introduction of a trailer, i.e. tax exemption when purchasing trailers	+Land transport operator purchases trailers and transport RWGs
	Marine transportation	Improvement of marine transportation	+Trial demonstration of RWG transportation with an existing ship and its route + Freight rate alleviation measures +Operational subsidy and public's purchasing a ship in remote island route in Tonga +facilitation for replacement to a RORO Ship in Vanuatu	+Trial demonstration of RWG transportation +Deployment RORO ship +Freight adjustment for RWG cargo
		Improvement of port facility	+Construction of port facility and navigation aid for RORO ship in Main island routes in main island routes	None
		Introduction of handy container	+Installment of cargo handling facilities for a handy container (set for handy container spec, yard pavement, folk-lift and other handling machine )	+introduction of handy container and handling equipment

#### (4) Treatment Stage

RWG collected in outer islands and in inland cities in islands with international port are subject to a treatment to add high value at a plant of recycling company in an international port city.

The main policies in the treatment stage are improvement of treatment and storage facilities and strengthening of environmental protection measures. With respect to the facility improvement, the role of public sector is to give assistance to private sector's upgrading and/or introduction of technologies, as well as to construct a facility to treat and store the RWG from outer islands.

Private sector shall make a concerted effort to establish reverse logistics from outer islands by effectively using their own factory and/or treatment and storage facilities prepared by public sector. At the same time, private sector shall identify the customer needs and quarantine regulation of the receiving countries to introduce an appropriate facility, so that RWM can be sold at higher prices.

Furthermore, it is also needed to introduce new treatment technology to convert RWGs into high value-added products. For this, provision of technical guidance from Japanese recyclers to local recyclers is an effective way, as proved in "Mottainai Project" in Tonga.

To strengthen environmental protection measures, public sector shall introduce a permit and monitoring system for recyclers in reference to the system of Fiji and Japan, and also provide

environmental education and/or support for technology acquisition in order to cultivate good recyclers. Private sector shall practice the environmental protection measures in line with the national guidelines.

**Table 6-14 Improvement Measures in the Treatment Stage**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public sector	Private sector
International port city	Enhancement of value added to products, storage	Improvement of treatment and storage facilities	<ul style="list-style-type: none"> <li>ž Provide assistance in obtaining and upgrading of technique</li> <li>ž Install treatment/storage facility for RWG from outer islands</li> </ul>	<ul style="list-style-type: none"> <li>• Introduce appropriate facilities after identifying customer needs and quarantine regulation</li> <li>• Acquire and introduce new technology</li> <li>• Actively utilize the treatment/storage facility prepared by public sector</li> </ul>
	Enhancement of value added to products, storage	Strengthening of environmental protection measures	<ul style="list-style-type: none"> <li>ž Introduce a permit/monitoring system</li> <li>ž Provide support in environmental education and acquisition of techniques</li> </ul>	Implement environmental protection measures

### (5) International Transportation Stage

In category II, it is essential to follow plans and measures as we discussed in category I. In sum, it is necessary to enhance efficiency of port operation and to modernize port facility and cargo handling equipment. In addition, promotion of export cargo will also improve efficiency of transportation in the PICs, because high freight rate is caused by imbalance of volumes of import and export cargo.

The team estimated that total export volume of RWM in Samoa, Tonga and Vanuatu will reach to 900TEUs in 2020 which will be almost double compared to that in 2011. These country do not have a sufficient volume of export cargo, so RWMs might be a major commodity for export. Therefore, freight rate might be reduced if RWMs supply could be stabilized.

**Table 6-15 Improvement Measures for International Transportation Stage**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public Sector	Public Sector
International port city	International Marine transportation	Improvement of port operation	<ul style="list-style-type: none"> <li>+Capacity development for cargo handling efficiency</li> <li>+ Introduction of IT system for port operation</li> </ul>	<ul style="list-style-type: none"> <li>+Capacity development of cargo handling skill</li> <li>+Introduction of IT system for port operation</li> </ul>
		Improvement and modernization of port facility	+Improvement of port facilities (berth, yard, stock house, and etc) for enhancing port efficiency	None



		and handling equipment		
		Improvement of transport efficiency through export cargo	+Promotion of export cargoes by stimulating industry	+Promotion of export cargo including RWG

**(6) Exporting and Selling Stage**

When a recycling company sells RWGs to foreign market, information on recycling business is essential. At present, private recyclers and individuals are searching for information on quarantine regulation and buyers in foreign countries. Formation of a function that individual can easily access the information on world market as well as regulation in the destination country is expected.

To realize the plan, as already explained in category I, public sector should establish a system that provides quarantine regulation on the destination countries and should inform the recycling companies on quarantine and customs regulation in the destination countries. Public sector should work to collect the regulation information and enhance skills for packaging and transporting RWGs to meet the regulation. It also devotes to collect information on recycling business market.

**Table 6-16 Improvement Measures in the Exporting and Selling Stage**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public Sector	Public Sector
International port city	Quarantine and selling	Learning regulation on destination countries	+Formulation of platform for providing quarantine and customs information in destination countries  +Providing quarantine and customs information to recycling company	+Collecting quarantine and other regulation information of RWM export  +Enhancement of skill for packing and exporting RWMs
		Accessing global market information	+Providing market information to recycling agent	+Collecting information of the market.

### 6.2.3 Category III Policies and Detailed Strategies

The country of category III, Tuvalu, will implement required countermeasures under the policy of “Public sector should play a main role and involve private sector to establish reverse logistics system in a country.” The activities will be implemented only in an international port city.

#### (1) Collection Stage

The country of category III, Tuvalu, with support from SPREP and EU has formulated a national strategy for solid waste management. At first the government will analyze the current situation and then formulate policy for collection of recyclable waste goods and the recycling. The policy is expected to stipulate targeted recyclable waste goods and their recycling rate in each and tentatively following countermeasures to achieve the targets;

• Strengthen partnership with recyclers and establish an association

• Strengthen regional cooperation among PICs

• Collect and provide relevant information of recycling activity

Public and private sectors will implement RWG collection in line with the policy.

Institutional and legal set up are required to realize the policy. Now EU prepares a basic law for solid waste management, Waste Operation and Public Act. The government has interest in levy system such as Container Deposit Legislation and Refund System. In addition, capacity development of relevant government officers who formulate the policy and prepare the legal basis is also required for promoting RWG collection.

It is necessary for country of category III to establish reverse logistics, and at first collection for cans and vehicles will be established in the international port city. Even though a processing workshop for RWG will be constructed in the landfill site under the EU funded project, the project does not include introduction of RWG collection. Therefore the public sector will implement collection for cans, vehicles, heavy equipment and white goods. The recyclers will cooperate with collection and recycling of RWG.

**Table 6-17 Improvement Measures in the Collection Stage**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public Sector	Private Sector
International Port City	Collection of RWGs	Establishment of Collection System	<ul style="list-style-type: none"> <li>• Establish RWGs recycling strategy (recycling targets, identify target RWGs, etc.)</li> <li>• Prepare the related legal framework</li> <li>• Implement separate collection (can, paper, pet</li> </ul>	<ul style="list-style-type: none"> <li>• Recycling companies will process RWGs collected by public authorities</li> </ul>

			bottles) • Increase public awareness	
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**(2) Transport Preparation Stage**

Category III shall initially focus on establishing reverse logistics in the international port city and does not target outer islands and inland cities in islands with an international port. Therefore, this project does not address the RWG transport preparation stage for category III.

**(3) Domestic Transportation Stage**

Category III shall initially focus on establishing reverse logistics in the international port city and does not target outer islands and inland cities in islands with an international port. Therefore, this project does not address the RWG transport preparation stage for category III.

**(4) Treatment Stage**

The main policies to improve treatment stage include improvement of treatment and storage facilities and enhancement of environmental protection measures. However, EU has already planned to construct a RWG treatment facility, which can realize “improvement of treatment and storage facility” if it is carried out as planned. In this case, due to the limited generation amount of RWG, the existing recycling company would not be able to continue its business. Public sector shall take some measures to avoid this, for instance, entrusting the facility operation to the existing recycling company.

For strengthening of environmental protection measures, public sector shall provide environmental education and/or support for technology acquisition to the operator of the waste treatment facility. The operator shall conduct environmental protection measures in accordance with the national guidance.

**Table 6-18 Detailed Strategy by Implementing Sector in the Treatment Stage**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public sector	Private sector
International port city	Enhancement of value added to products, Storage	Improvement and maintenance of treatment/storage facility	<ul style="list-style-type: none"> <li>ž Construct a treatment facility with aid from EU</li> <li>ž Entrust operation of the facility to existing recyclers</li> </ul>	<ul style="list-style-type: none"> <li>ž Support treatment facility operation</li> </ul>
		Strengthening of environmental protection measures	<ul style="list-style-type: none"> <li>ž Provide support for environmental education and technical acquisition</li> </ul>	<ul style="list-style-type: none"> <li>ž Implement environmental protection measures</li> </ul>

**(5) International Transportation Stage**

Due to all the international container to Tuvalu is transshipped in Suva port, Fiji, imbalance of large amount of import cargoes and few export cargoes in Tuvalu, and absolute small amount of cargo transportation, freight rate is the highest among PICs. In addition, a private recycling agent has little knowledge of RWG's transportation and handling and processing.

A marine transportation agent should examine to alleviate the freight rate, especially export rate. If the marine agent's support is far from the expectation, Tuvalu government or foreign donors should support to moderate freight rate. Tuvalu is located geographically remote, thus public sector support is highly needed. Next, it is expected that volume of annual cargo will be few, public sector should prepare stock yard for RWG to fill up twenty-foot container or examine introduction of a handy container that will make easy to export RWM from Tuvalu to a foreign country.

On the other hand, private should devote to enhance capacity of transporting and handling RWMs and obtain equipment maintenance skills.

**Table 6-19 Improvement Measures for International Transportation Stage**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public Sector	Public Sector
International port city	International transportation	Moderation of freight rate	+Provide financial support for freight rate	+Examine the alleviation of freight rate, especially export cargo
		Providing transportation and handling machine, and stock yard for RWG	+Providing transportation and cargo handling measures to private +Providing stock yard for RWG + Introduction of handy container	
		Enhancing transportation and handling equipment skill	+Developing capacity of transportation skill and maintenance skill	+Enhancing operational skill for transporting and handling RWM

**(6) Exporting and Selling Stage**

When a recycling company sells RWMs to foreign market, information on recycling business is essential. At present, private recycler is searching information on quarantine regulation and buyers in foreign countries. Formation of a function that the recycler can easily access the information on world market as well as regulation in the destination countries is expected.

To realize the plan, as already explained in category I, public sector should establish system that provides quarantine regulation on the destination countries and should inform the recycling companies on quarantine and customs regulation in the destination countries. Public sector should work to collect the regulation information and enhance skills for packaging and transporting RWMs to meet the

regulation. It also devotes to collect information on recycling business market.

**Table 6-20 Improvement Measures in the Exporting and Selling Stage**

Spatial Characteristics	Activity	Policy	Detailed Strategy by Implementing Sector	
			Public Sector	Public Sector
International port city	Quarantine and selling	Learning regulation on destination countries	+Formulation of platform for providing quarantine and customs information in destination countries  +Providing quarantine and customs information to recycling company	+Collecting quarantine and other regulation information of RWM export  +Enhancement of skill for packing and exporting RWMs
		Accessing global market information	+Providing market information to recycling agent	+Collecting information of the market.

“6.2 Policies and Strategies to promote Reverse Logistics” is arranged according to the category.

**Table 6-21 List of the detailed policies and strategies in the category I (Fiji)**

Stage	Spatial Characteristics	Activity	To promote reverse logistic business		Policy	Detailed Strategy by Implementing Sector		Support menu JICA ( Cooperation with an international organization )
			Current state	Problem		Public sector	Private sector	
Collection stage	International Port City	Collection of RWGs	<ul style="list-style-type: none"> <li>Public sector implements solid waste management.</li> <li>Recyclers collect RWGs (cars, heavy equipment, white goods, cans, PET bottle, papers)</li> <li>Public sector does not provide separate collection.</li> </ul>	There are a lot of uncollected RWGs.	Expansion of collection of RWGs	<ul style="list-style-type: none"> <li>Establish RWGs recycling strategy (recycling targets, identify target RWGs, etc.)</li> <li>Prepare the related legal framework (determine responsibilities of importer, dealers and consumers; introduce economic incentives)</li> <li>Implement separate collection (can, paper, pet bottles)</li> <li>Increase public awareness</li> </ul>	<ul style="list-style-type: none"> <li>Recycling companies will collect waste vehicles, heavy equipment and white goods</li> <li>Recycling companies will process RWGs collected by public authorities</li> <li>Dealers of vehicles and white goods will arrange drop off points for waste vehicles and white goods</li> </ul>	<ul style="list-style-type: none"> <li>Support for formulating policy on RWG collection (cans, papers, PET bottle, cars, heavy equipment and white goods)</li> <li>Pilot project for collection of RWG (cans, papers and PET bottle)</li> <li>Support for institutional and legal set up</li> <li>Training in Japan to officers from presiding authority</li> </ul>
	Inland cities in islands with international port		<ul style="list-style-type: none"> <li>Public sector implement solid waste management in most of the inhabited area.</li> <li>Recyclers collect scrap metals.</li> <li>Public sector does not provide separate collection.</li> </ul>	RWG collection by recyclers shall be strengthened and promoted.	Establish a RWG collection system	As above	As above	As above
	Outer Islands		<ul style="list-style-type: none"> <li>Public sector implements solid waste management in city areas</li> <li>Recyclers collect scrap metals in some limited areas</li> </ul>	RWG collection by recyclers shall be strengthened and promoted. There are few recyclers if any at all.	Introduce collection system (include within solid waste collection)	<ul style="list-style-type: none"> <li>Develop related legislation</li> <li>Develop capacities of related government authorities</li> <li>Introduce waste collection</li> <li>Implement RWG collection pilot project</li> <li>Increase public awareness</li> </ul>	<ul style="list-style-type: none"> <li>Obtain community cooperation through increased public awareness</li> </ul>	<ul style="list-style-type: none"> <li>Support for institutional and legal set up</li> <li>Training in Japan for officers from presiding authority</li> </ul>
Transport Preparation Stage	Inland cities in islands with international port	Pretransport processing and storage	RWG is roughly shredded for ease of truck loading.	Preprocessing and storage are required for ease of transport.	Construction of preprocessing and storage facility	Provide preferential treatment e.g., tax incentives	Develop facility	Formulation of guidelines on construction of preprocessing and storage facility
					Operation of facility	Provide preferential treatment e.g., tax incentives		
	Outer Islands	Pretransport processing and	Pre-processing and storage are basically not implemented due to lack of RWG	Preprocessing and storage are required for ease of	Construction of preprocessing	Develop facility	-	

		storage	collection.	transport.	and storage facility			
					Operation of facility	Provide preferential treatment e.g., tax incentives	Operate facility	
Domestic transportation stage	Inland cities in islands with international port	Land transportation	+Paved road is limited. Trucks and other large vehicles can only pass this road in a limited area. A truck and other large vehicles can pass the road in a limited area. +Tractors and trailers for carrying containers have not been widely introduced because of heavy taxation. Introduction of tractors and trailers that can carry a container is limited because of heavy taxation.	Collection of RWG is the first priority, however improvement of road condition and introduction of trucks and trailers are possible measures.	Improvement of land transportation	+Road construction, and Improvement of road condition for RORO transportation +Facilitation for introduction of trailers, i.e. tax exemption when purchasing trailers	+Land transport operator purchases trailers and transports RWGs	+Assistance in policy making through implementing a survey on introduction of unit load system on land transportation
	Outer island	Land transportation	+Little RWG transport is conducted because there is no collection of RWG in the islands or because of a shortage of paved roads. Transportation is implemented in island because of no collection of RWG in the islands, or shortage of paved road for RORO transport,. + Tractors and trailers for carrying containers have not been widely introduced because of heavy taxation. Introduction of a trailer and a truck is limited because of heavy taxation on purchasing them.	+ The collection of RWG is the first priority, however improvement of route condition and introduction of trailers and trucks are essential.	Improvement of land transportation	+ Road construction and improvement of road condition for RORO transportation. + Facilitation for introduction of trailers, i.e. tax exemption when purchasing trailers	+Land transport operator purchases trailers and transports RWGs	+Assistance in policy making through on implementing a survey on introduction of RORO system.
		Marine transportation	+Private companies are operating main routes, while a public company is operating remote island route. +RORO system is introduced between Viti-Levu and Vanua-Levu. RWG is transported in the route. However no RWG is transported in the other islands as RWG is not collected in the islands; port facilities	+The collection of RWG is the first priority, however the development of port facilities that enable RORO transport, operation of RORO vessels, setting freight that enables RWG	Improvement of marine transportation	+Trial demonstration of RWG transportation with an existing ship and its route + Freight rate alleviation measures +Operational subsidy and s purchasing of ship by public sector in remote island route +facilitation for replacement to a RORO Ship in main island routes	+Trial demonstration of RWG transportation +Deployment RORO ship +Freight adjustment for RWG cargo	+Assistance in policy making through on implementing a survey on introduction of RORO system. +Financial support for introducing RORO vessels in the remote island routes.

			are poor as well. due to no collection of RWG in the islands, nor poor port facility for EORO transport. +A handy container is not introduced.	transport should be examined.. +As total volume of RWG is small, introduction of a handy container less than a 20 feet container should be examined.	Improvement of port facility	+Construction of port facility and navigation aid for RORO ship	None	+To conduct a study on introducing RORO system in each county. +Financial support for port development that enables RORO transport.
					Introduction of handy container	+Installment of cargo handling facilities for a handy container (set for handy container spec, yard pavement, fork-lift and other handling machines )	+Introduction of handy container and handling equipment	+Assistance in policy making for establishing a handy container standard, and introducing the container in PICs. +Financial support for introducing a handy container.
Treatment Stage	International Port City	Enhancement of value added to products, Storage	Most recyclers cannot add sufficient value to their RWM except for some RWMs	<ul style="list-style-type: none"> <li>Commercialization in international markets are required</li> <li>Improvement of work conditions and mitigation of environmental impacts are required</li> </ul>	Improvement of treatment and storage facilities	Provide assistance in obtaining and upgrading of techniques	<ul style="list-style-type: none"> <li>Introduce appropriate facilities after identifying customer needs and quarantine regulation</li> <li>Acquire and introduce new technology</li> <li>Examine and introduce recycling technology</li> </ul>	<ul style="list-style-type: none"> <li>Technical support to recyclers to add more value to their processed RWMs and to enhance their efficiency</li> </ul>
					Strengthening of environmental protection measures	Thoroughly implement monitoring	Implementation of environmental protection measures	<ul style="list-style-type: none"> <li>Strengthening monitoring system</li> </ul>
International transportation	International port city	International Marine transportation	+ RWG is handled in Suva port, however cargo handling efficiency in Suva port is not good condition due to insufficient cargo handling equipment. This leads to longer cargo handling, dummurage of ship, and raises cost of cargo handling. +Since international container ships are part of a multi calling network, delay of cargo handling in one port adversely affect the entire shipping	+ It is necessary to reduce operational cost in port. +It is necessary to modernize port facility and cargo handling equipment, and to improve delay of cargo handling and ship schedule. +It is necessary to	Improvement of port operation	+Capacity development for cargo handling efficiency + Introduction of IT system for port operation	+Capacity development of cargo handling skill +Introduction of IT system for port operation	+Capacity building for improving cargo handling. +assistance for introducing IT system for port operation.
					Improvement and modernization of port facility and handling equipment	+Improvement of port facilities (berth, yard, stock house, and etc) for enhancing port efficiency	+Improvement of equipment for enhancing handling efficiency	+financial support for improving port facility.



			<p>schedule.</p> <p>+Imbalance of import and export cargo leads to inefficient transport.</p>	<p>improve efficiency of transport through gaining additional export cargoes.</p>	<p>Improvement of transport efficiency through export cargo</p>	<p>+Promotion of export cargoes by stimulating industry</p>	<p>+Promotion of export cargo including RWM</p>	<p>+ Implementing a survey on export cargo including first industry commodity and support for producers</p> <p>+Implementing a survey on RWG transport in the respect of improving environment in the islands.</p>
Exporting and selling RWM stage	International port city	Quarantine and selling	<p>+Recycling company sometimes does not obtain sufficient RWM's information on destination country.</p> <p>+Individual is searching information and exporting GWMs by himself, he tends to be lack recycling market information.</p>	<p>+It is necessary to notice quarantine information on destination countries.</p> <p>+It is necessary to make access easier the global recycling market.</p>	<p>Learning regulation on destination countries</p>	<p>+Formulation of platform for providing quarantine and customs information in destination countries</p> <p>+Providing quarantine and customs information to recycling company</p>	<p>+Collecting quarantine and other regulation information of RWM export</p> <p>+Enhancement of skill for packing and exporting RWM</p>	<p>+Assistance for forming a framework on quarantine and customs information for exporting RWGs.</p>
							<p>+Collecting information of the market.</p>	<p>+Assistance for enhancing skills to recycling agents for packaging and transporting RWGS to meet the regulation.</p>
					<p>Accessing global market information</p>	<p>+Providing market information to recycling agent</p>	<p>+Collecting information of the market.</p>	

Table 6-22 List of the detailed policies and strategies in the category II (Samoa, Tonga, Vanuatu)

Stage	Spatial Characteristics	Activity	To promote reverse logistic business		Policy	Detailed Strategy by Implementing Sector		Support menu JICA ( Cooperation with an international organization )
			Current state	Problem		Public sector	Private sector	
Collection stage	International Port City	Collection of RWGs	<ul style="list-style-type: none"> <li>Public sector implements solid waste management.</li> <li>Recyclers collect scrap metals</li> <li>Public sector does not provide separate collection.</li> </ul>	There are a lot of uncollected RWGs.	Expansion of Collection System	<ul style="list-style-type: none"> <li>Establish RWGs recycling strategy (recycling targets, identify target RWGs, etc.)</li> <li>Prepare the related legal framework (determine responsibilities of importer, dealers and consumers; introduce economic incentives)</li> <li>Develop capacities of related government authorities</li> <li>Implement separate collection (can, paper, pet bottles)</li> <li>Increase public awareness</li> </ul>	<ul style="list-style-type: none"> <li>Public sector implements solid waste management.</li> <li>Recyclers collect scrap metals</li> <li>Public sector does not provide separate collection.</li> </ul>	There are a lot of uncollected RWGs.
	Inland cities in islands with international port		<ul style="list-style-type: none"> <li>Public sector implements solid waste management in most of the inhabited area.</li> <li>Recyclers collect scrap metals.</li> <li>Public sector does not provide separate collection.</li> </ul>	RWG collection by recyclers shall be strengthened and promoted.	Introduction of Collection System	As above	<ul style="list-style-type: none"> <li>Public sector implements solid waste management in most of the inhabited area.</li> <li>Recyclers collect scrap metals.</li> <li>Public sector does not provide separate collection.</li> </ul>	RWG collection by recyclers shall be strengthened and promoted.
	Outer Islands		<ul style="list-style-type: none"> <li>Public sector implements solid waste management in the city areas</li> <li>There is no collection for scrap metals</li> </ul>	RWG collection by recyclers shall be strengthened and promoted. There are no recyclers.	Introduce collection system (include within solid waste collection)	<ul style="list-style-type: none"> <li>Develop related legislation</li> <li>Develop capacities of related government authorities</li> <li>Introduce waste collection</li> <li>Increase public awareness</li> </ul>	<ul style="list-style-type: none"> <li>Public sector implements solid waste management in the city areas</li> <li>There is no collection for scrap metals</li> </ul>	RWG collection by recyclers shall be strengthened and promoted. There are no recyclers.
Transport Preparation Stage	Inland cities in islands with international port	Pretransport processing and storage	RWG is roughly shredded for ease of truck loading.	Preprocessing and storage are required for ease of transport.	Construction of preprocessing and storage facility	<ul style="list-style-type: none"> <li>Secure land for the facility</li> <li>Procurement of equipment</li> </ul>	-	<ul style="list-style-type: none"> <li>Formulation of guidelines on construction of preprocessing and storage facility</li> </ul>
					Operation of facility	<ul style="list-style-type: none"> <li>Provide assistance to</li> </ul>	<ul style="list-style-type: none"> <li>Operate the facility</li> </ul>	<ul style="list-style-type: none"> <li>Construction of preprocessing and</li> </ul>

						private sector		storage facility
	Outer Islands	Pretransport processing and storage	Pre-processing and storage are basically not implemented due to lack of RWG collection.	Preprocessing and storage are required for ease of transport.	Construction and operation of preprocessing and storage facility	<ul style="list-style-type: none"> <li>Construct and operate preprocessing and storage facility</li> </ul>	<ul style="list-style-type: none"> <li>Provide technical guidance to the facility developed by public sector</li> </ul>	
Domestic transportation stage	Inland cities in islands with international port	Land transportation	+Paved road is limited. A truck and other large vehicles can pass the road in a limited area.	+Collection of RWG is the first priority, however improvement of road condition and introduction of trucks and trailers are possible measures.	Improvement of land transportation	+Road construction, and improvement of road condition for RORO transportation +Facilitation for introduction of trailers, i.e. tax exemption when purchasing trailers	+Land transport operator purchases trailers and transports RWGs	+Assistance in policy making through implementing a survey on introduction of unit load system on land transportation
	Outer island	Land transportation	+Little RWG transport is conducted because there is no collection of RWG in the islands or because of a shortage of paved roads.	+ The collection of RWG is the first priority, however improvement of route condition and introduction of trailers and trucks are essential.	Improvement of land transportation	+ Road construction and improvement of road condition for RORO transportation in major outer islands. + Facilitation for introduction of trailers, i.e. tax exemption when purchasing trailers	+Land transport operator purchases trailers and transports RWGs	+Assistance in policy making through on implementing a survey on introduction of RORO system.
		Marine transportation	+In Samoa, a privatized national shipping company is operating frequent marine service between two main islands. However there is no RWG transport between the islands. +In Vanuatu, middle or small shipping companies are operating. Deployed vessels are small and cannot carry RWG. +In Tonga, privatized national shipping company is operating. At present, there is no RWG transport among the islands, because of limited generation of RWG and poor port facilities in the islands. + Handy containers have already	+The collection of RWG is the first priority, however the development of port facilities that enable RORO transport, operation of RORO vessels, setting freight that enables RWG transport should be examined. +As total volume of RWG is small, introduction of a handy container less than a 20 feet container should be examined.	Improvement of marine transportation	+Trial demonstration of RWG transportation with an existing ship and its route + Freight rate alleviation measures such as operational subsidy and purchasing of ship by public sector in remote island route +In Tonga, assistance for purchasing RORO vessels and its operation in remote island routes. + In Vanuatu, assistance for replacement of RORO Vessels in major outer islands.	+Trial demonstration of RWG transportation +Deployment RORO ship +Freight adjustment for RWG cargo	+Assistance in policy making through on implementing a survey on introduction of RORO system. +Financial support for introducing RORO vessels in the remote island routes.

			been introduced in Samoa and Tonga. These are still premature stages. The specifications of the handy containers are different.		Improvement of port facility	+Construction of port facility and navigation aid for RORO ship in major outer islands	None	+To conduct a study on introducing RORO system in each county. +Financial support for port development that enables RORO transport.
					Introduction of handy containers	+Installment of cargo handling facilities for a handy container (set for handy container spec, yard pavement, fork-lift and other handling machines )	+Introduction of handy container and handling equipment	+Assistance in policy making for establishing a handy container standard, and introducing the container in PICs. +Financial support for introducing a handy container.
Treatment Stage	International Port City	Enhancement of value added to products, Storage	Most of recycler can not add sufficient value to their RWM except for some RWMs	<ul style="list-style-type: none"> <li>Commercialization in international markets is required</li> <li>Improvement of work conditions and mitigation of environmental impacts are required</li> </ul>	Improvement of treatment and storage facilities	<input type="checkbox"/> Provide assistance in obtaining and upgrading of technique <input type="checkbox"/> Install treatment/ storage facility for RWG from outer islands	<ul style="list-style-type: none"> <li>Introduce appropriate facilities after identifying customer needs and quarantine regulation</li> <li>Acquire and introduce new technology</li> <li>Actively utilize the treatment/storage facility prepared by public sector</li> </ul>	<ul style="list-style-type: none"> <li>Technical support to recyclers to add more value and to enhance their efficiency</li> <li>Construction of treatment and storage facility</li> </ul>
					Strengthening of environmental protection measures	<input type="checkbox"/> Introduce a permit/monitoring system <input type="checkbox"/> Provide support in environmental education and acquisition of techniques	Implement environmental protection measures	<ul style="list-style-type: none"> <li>Support for introduction of permission and monitoring system</li> </ul>
International transportation stage	International port city	International transportation	+ Containerized RWGs are handled in Apia port in Samoa, Nukualofa port in Tonga, Portvilla port and EspirituSanto port in Vanuatu, however cargo handling efficiency in these ports are not good condition due to insufficient cargo handling equipment. This leads to longer cargo handling, dummurage	<ul style="list-style-type: none"> <li>It is necessary to reduce operational cost in port.</li> <li>It is necessary to modernize port facility and cargo handling equipment, and to improve delay of cargo handling and ship schedule.</li> </ul>	Improvement of port operation	+Capacity development for cargo handling efficiency + Introduction of IT system for port operation	+Capacity development of cargo handling skill +Introduction of IT system for port operation	+Capacity building for improving cargo handling. +assistance for introducing IT system for port operation.
					Improvement and modernization of port facility and handling equipment	+Improvement of port facilities (berth, yard, stock house, and etc) for enhancing port efficiency	+Improvement of equipment for enhancing handling efficiency	+financial support for improving port facility.

		<p>of ship, and raises cost of cargo handling.</p> <p>+Since international container ships are part of a multi calling network, delay of cargo handling in one port adversely affects the entire shipping schedule.</p> <p>+Imbalance of import and export cargo leads to inefficient transport.</p>	<p>+It is necessary to improve efficiency of transport through gaining additional export cargoes.</p>	<p>Improvement of transport efficiency through export cargo</p>	<p>+Promotion of export cargoes by stimulating industry.</p> <p>+Examination of financial support to RWGs transport in terms of environment improvement in the islands.</p>	<p>+Promotion of export cargo including RWM</p> <p>+Examination of international shipping companies' cooperation for facilitating export cargoes.</p>	<p>+ Implementing a survey on export cargo including first industry commodity and support for producers</p> <p>+Implementing a survey on RWG transport in the respect of improving environment in the islands.</p>
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**Table 6-23** List of the detailed policies and strategies in the category III (Tuvalu)

Stage	Spatial Characteristics	Activity	To promote reverse logistic business		Policy	Detailed Strategy by Implementing Sector		Support menu JICA ( Cooperation with an international organization )
			Current state	Problem		Public sector	Private sector	
Collection stage	International Port City	Collection of RWGs	<ul style="list-style-type: none"> <li>Public sector implements solid waste management.</li> <li>Recyclers collect scrap metals</li> <li>Recycler do business on a low scale level</li> </ul>	There are a lot of uncollected RWG.	Establishment of Collection System	<ul style="list-style-type: none"> <li>Establish RWGs recycling strategy (recycling targets, identify target RWGs, etc.)</li> <li>Prepare the related legal framework</li> <li>Implement separate collection (can, paper, pet bottles)</li> <li>Increase public awareness</li> </ul>	<ul style="list-style-type: none"> <li>Recycling companies will process RWGs collected by public authorities</li> </ul>	<ul style="list-style-type: none"> <li>Support for formulating policy on RWG collection (cans, cars and heavy equipment)</li> <li>Pilot project for collection of RWG</li> <li>Support for institutional and legal set up</li> </ul>
Treatment Stage	International Port City	Enhancement of value added to products, Storage	The recycler can not add sufficient value to their RWM	<ul style="list-style-type: none"> <li>Commercialization in international markets is required</li> <li>Improvement of work conditions and mitigation of environmental impact are required</li> </ul>	Improvement and maintenance of treatment/storage facility	<input type="checkbox"/> Construct a treatment facility with aid from EU <input type="checkbox"/> Entrust operation of the facility to existing recyclers	<input type="checkbox"/> Support treatment facility operation	<ul style="list-style-type: none"> <li>Technical support to recyclers to add more value and to enhance their efficiency</li> </ul>
					Strengthening of environmental protection measures	<input type="checkbox"/> Provide support for environmental education and technical acquisition	<input type="checkbox"/> Implement environmental protection measures	---
International transportation stage	International port city	International transportation	Funafuti is the only port where a container ship calls, however its cargo handling is conducted by a ship crane. In addition, cargoes are transshipped in Suva port, Fiji and there is a severe imbalance of import/export cargoes. This result is in a higher freight rate than other	It is necessary to reduce operational cost and secure stock yard, and maintain cargo handling equipment .	Improvement of marine freight rate	Examination of assistance for transshipment cargo	Examination of shipping companies' assistance for facilitating exporting cargoes.	+Assistance for policy making assistance for improving transshipment.
					Securing stock yard for RWGs	+Securing stock yard of RWGs		
					Enhancement of cargo	+ Grant for cargo	+Capacity building on	+Capacity building on cargo

			route in PICs and makes it difficult to export RWG from Tuvalu. , + Several container yards are scattered in the island. And operational duration of cargo handling machine is low due to poor maintenance.		handling equipment and maintenance skills.	handling equipment. +Capacity building on cargo handling equipment operation and maintenance. + Examination of introduction of a handy container	cargo handling equipment operation and maintenance.	handling equipment operation and maintenance.
Exporting and selling RWM stage	International port city	Quarantine and selling	+Recycling company sometimes does not obtain sufficient RWM's information on destination country. +Even though individual companies search for information, and export GWMs by themselves, there tend to be a lack of recycling market information.	+It is necessary to notice quarantine information on destination countries. +It is necessary to make access easier the global recycling market.	Learning regulation on destination countries	+Formulation of platform for providing quarantine and customs information in destination countries +Providing quarantine and customs information to recycling company	+Collecting quarantine and other regulation information of RWM export +Enhancement of skill for packing and exporting RWM	+Assistance for forming a framework on quarantine and customs information for exporting RWGs.
							+Collecting information of the market.	+Assistance for enhancing skills to recycling agents for packaging and transporting RWGS to meet the regulation.
					Accessing global market information	+Providing market information to recycling agent	+Collecting information of the market.	

### 6.3 Road map for establishing reverse logistic system in PICs

The team proposed five year plans to implement measures mentioned in the previous sections.

**Table 6-24 Road map for establishing reverse logistic system**

Stage of Activities	Road Map of Project Ideas - - coverage of Category I and II - -					Achievement Level
	First Year	Second Year	Third Year	Fourth Year	Fifth Year	
Collection Stage		Technical Support for Policy Preparation of RWM Collection				<ul style="list-style-type: none"> <li>Realization of Segregation &amp; Collection System in Local Town of Main Island &amp; Remote Islands under Setting of Achievement Level of Collection (example: Establishment of Collection System of Plastic bottle, Paper &amp; Cardboard in Category-II)</li> <li>Targeted Recycling Rate: C-I: present +5-10%, C-II: +10% or more, C-III: A few percent</li> </ul>
	Implementation of Pilot Project I			Implementation of Pilot Project II		
		Technical Support for Preparation of Relevant Legislation				
			Training of Government Personnel in Japan			
Preparation of Transportation Stage		Technical Support for Preparation of a Guideline for Pre-Treatment & Storage Facility		Support for Development of Storage Facility		<ul style="list-style-type: none"> <li>Secure Implementation of Pre-Treatment &amp; Storage for smooth Domestic Transportation</li> </ul>
Domestic Transportation Stage		Technical Support for Policy Preparation of Unit Load System in Land Transportation				<ul style="list-style-type: none"> <li>Identification of Prioritized Remote Islands for Development of RoRo Facility and Implementation</li> <li>Realization of Smooth Transportation through Operation of RoRo Vessels between Main Island and Remote Islands</li> <li>Realization of Efficient Transportation of RWM through Introduction of Small-Size Container in Domestic Shipping Lines</li> </ul>
		Technical Support for Policy Preparation of RORO Transportation System			(Category-II)	
			Support for Introduction of RORO Vessel & Port facility			
		Technical Support for Policy Preparation of Introduction of Small Sized Container in PICs			Support for Introduction of Small-Sized Container	
Treatment Stage		Support for Development of Treatment & Storage Facility				<ul style="list-style-type: none"> <li>Category -I: Maximization of Export of Scrap Metals, Promotion of Exportation of Plastic Bottle, Maximization of Domestic Recycling &amp; Promotion of Export of Paper &amp; Cardboard</li> <li>Category-II: Maximization of Export of Scrap Metals, Establishment of Export of Plastic Bottle, Establishment of Regional Export of Paper &amp; Cardboard</li> </ul>
			Technical Support for Heightening of Added Value & Improvement of Efficiency			
			Technical Support for Strengthening of Monitoring			
		Technical Support for Introduction of Business Permission & Monitoring System (Category-II)				
International Transportation Stage		Technical Support for Capacity Building for Improvement of Efficiency of Port Operation				<ul style="list-style-type: none"> <li>Improvement of Operational Efficiency (handling container) by 1.5 times in Container Terminal</li> <li>Improvement of Port Facility to cope with Increase of Containers</li> </ul>
			Technical Support for Capacity Building in PICs			
			Support for Improvement of Port Facility			
			Technical Support for Increment of Export Cargo through Industrial Promotion			
Export & Selling Stage : similar items between Category I & II		Technical Support for Establishment of Providing System of Quarantine Information				<ul style="list-style-type: none"> <li>Obtaining of Quarantine Information and Realization of Smooth Export</li> <li>Obtaining of Market Information of RWM and Realization of Sustainability of Recycling Business</li> </ul>
			Technical Support for Acquisition of Skills for Control of Quarantine			
			Technical Support for Establishment of Providing System of RWM Market Information			

The reverse logistic system is organized when a recycling flow is fully accomplished. The flow contains following recycling activities such as collecting RWGs, preparing transportation, domestic transportation, processing, international transportation, export and selling. At present, each activity needs improvement. Thus public and private sectors should work together to deal the recycling activities simultaneously.

Next, the team proposed priority project that will be the most effective for improving the present status of RWG recycling.



## **6.4 Proposal for priority projects**

### **6.4.1 Basic Idea for Selecting Priority Projects**

As described above, there are many measures to be taken to establish a reverse logistics, which can be classified into three main points: ensuring adequate quantity of RWG, reducing transport cost, and selling products at high price. As a solution, the project suggests to establish the reverse logistics system described in 6.1.1., in which RWG are collected from outer islands where there is no existing waste collection. This system also aims to encourage a multinational collaboration to secure the quantity of RWM and achieve economies of scale. In this context, the project suggests to prioritize the following project: 1) collection of RWGs in new areas (e.g., outer islands); 2) reduction of transport cost by improving cargo handling efficiency and domestic shipping; and 3) establishment of a system to offer information about quarantine and market. In alliance with SPREP and SPC, this information delivery system would also be an information platform for the several countries to collaborate. This system offers information such as market price of RWM in major exporting countries

#### **(1) Solid Waste Management Sector**

This Study proposes to establish a reverse logistics system that combines domestic transportation with international transportation. Domestic transportation is used to collect RWG from outer islands, such as discarded vehicles and heavy equipment observed in outer islands during the site survey. However, recyclers are reluctant to run a business in outer islands due to the limited generation amount of RWG and inadequate transport infrastructure. Therefore, it is suggested to conduct a RWG collection pilot project in order to establish a reverse logistics for RWM in outer islands. The project also includes development of pre-transport processing facility.

#### **(2) Maritime and Ports Sector**

Reduction of freight rate in marine transportation through improvement of port operation and modernization of domestic transportation is considered to be one of the support tools for forming a reverse logistics system. Initially, the support tools focus on RWG/RWM, not on general cargoes. In addition, the share of RWG/RWM is not large among the trade. However the improvement of RWG/RWM transport will eventually have a positive effect on conventional cargo transportation. Therefore, it is worth exploring the feasibility of improving the transport of not only RWG/RWM but also general cargo. There are two approaches in reducing the marine transportation cost; one is to save time and reduce cost of cargo handling by improving cargo handling operation in ports. Public sector is expected to play an important role in its effort. In particular, our team is proposing that international container terminals be improved, especially in Suva port and other international ports which handled a large number of containers in PICs.

And the other is to improve the domestic transportation system. Truck and container transportation have not spread in PICs. It is essential for bulky cargoes like the RWG/RWM to introduce the unit load transportation system and to realize efficient transportation between a main island and local islands. The RWG/RWM is too large and heavy for laborers to handle by themselves. It is highly required to introduce machinery and pursue efficiency of transportation.

**(3) Intra-sector projects for forming information platform**

By forming information platform for collecting data on reverse logistics business, the present problems associated with reverse logistics business can be eased. A recycling company will be able to communicate with government authorities and private companies through the platform on reverse logistics. The platform will make it easier to develop new businesses on reverse logistics. For these reasons, our team proposes that an information platform be formed on reverse logistics that will cover both waste recycling field and transportation field. It will promote communication between relevant private companies and PICs and increase the possibility of introducing reverse logistics business.

**6.4.2 The Priority Project and its Procedures**

**(1) Solid Waste Management Sector: Introduction of RWG Collection in New Areas(Outer islands) and Policy Making Support**

**a) Background**

In terms of the development status of basic infrastructure and solid waste management system there is quite a large difference between outer islands and the main island with a capital city, even allowing for the wide population gap between them. Many islands do not have sufficient basic infrastructure such as road and port, and moreover, some islands do not even have regular waste collection. In such islands, there is little possibility for private company to run recycling business, and it is very difficult to promote reverse logistics for RWM unless there is a strong commitment of the public sector. Amongst others, the development of pre-transport processing facility and stock yard are essential for the transport of RWG to the main island.

**b) Outlines of the Project**

In this project, a pilot project is conducted to collect RWG in outer islands, transport to main islands to sell them to recyclers. The project examines the feasibility of and difficulties in developing reverse logistics from outer islands through the pilot project. The team will also make a policy proposal based on the lessons learnt.

The pilot project will be conducted in Savaii islands, Samoa. Samoa is classified as Category II, where the public sector is expected to take the lead in improving reverse logistics in collaboration with private sector. Moreover, Savaii has five liners plying between the main island, Upolu, each day, which can be utilized in the pilot project. The population of the Savaii is about 45,000 as of 2006, which is predicted to generate a sufficient amount of RWGs for the pilot project. The Study estimates that a few thousands of scrap metals are generated a year if other waste metal is included.

The implementing agencies are Ministry of Natural Resource and Environment, and Ministry of Public Work and Transportation, because reverse logistics from outer islands cannot be established without a close cooperation and coordination between the said two agencies.

This pilot project is suggested to be implemented as a technical cooperation project, in which necessary machinery and equipment shall also be provided.

### c) Framework of the Project and its Development

This technical cooperation project is proposed as a package type technical project that features the pilot project, identify the issues through the pilot project, and provide necessary support for policy making as well as technical guidance to improve treatment techniques.

#### Implementation of the Pilot Project

The proposed pilot project is to collect and store RWG in Savaii, Samoa, to transport RWG from Salelologa wharf to Mulifanua wharf in Upolu Island, and to sell to recycling companies there. This project will establish an implementation plan of the pilot project and carry out the pilot project in collaboration with residents, recycling companies, and ferry companies. The pilot project can be outlines as in the table below.

**Table 6-25 Outline of the Pilot Project (Tentative)**

Targeted RWG	Vehicles, white goods, cans, other metal products
Generation amount and collection amount	In Savaii, it is estimated that a few thousand tons of metallic RWG (incl. vehicles, white goods, cans, other metal products) is generated yearly. The proposed pilot project aims to collect 10% of the generated amount (estimated to be a few hundred tons per year).
RWG collection method	Residents to bring targeted RWG items to stockyards Bulky RWG items e.g., vehicles, will be collected with support of the collection company entrusted waste collection by MNRE.
Pretransport processing facility	Prepare a stockyard near the Salelologa wharf, where collected RWG will be roughly dismantled before being loaded to truck

Transport method	Load RWG to truck in the stockyard, and transport it to a recycler in Upolu by a truck ferry
Installation of equipment	Machinery and equipment to dismantle bulky RWG (to be prepared by Japan) Stockyard (to be prepared by Samoa)

After the pilot project is completed, the Project Team will evaluate and analyze the result to identify the issues in developing a reverse logistics system. The Project Team will determine the countermeasures and establish a concrete policy and institutional framework, and draw up a road map.

### **Policy making support through the pilot project**

The project will provide a support for policy to establish reverse logistics, including the following:

- ž Support for introduction of a permit and monitoring system for recyclers
- ž Examination of deposit system as a responsibility of dealer and consumer
- ž Introduction to the Japan's recycling related laws and determination of applicability to Samoa
- ž Establishment of national strategy on RWG collection

### **Assistance for Capacity Building of Recyclers and Enhancement of Value added to Product**

RWG collected in the main islands and outer islands will be brought to a recycling factory to be processed, such as dismantling, crushing, and segregation. One of the measures to enhance reverse logistics business is to advance the recycler's treatment technology and produce high value-added RWM to export. In Tonga, there is an on-going technical cooperation project funded by Japan. This project is called "Great Vava'u and Okinawa Mottainai Movement Project", which has developed by Okinawa Citizens Recycling Movement to transfer the recycling technology to the local recyclers. This project also tries to improve the local recyclers' treatment capacity by inviting some of them to Japan for training, and dispatching Japanese recyclers to give guidance.

### **Collaboration with SPREP and Realization of Pacific Regional Solid Waste Management Strategy 2010-2015**

Our priority projects are deeply linked to some activities of the Pacific Regional Solid Waste Management Strategy introduced in Chapter 2. Therefore, the Project Team will collaborate with SPREP in implementing the pilot project, and consequently will contribute to the realization of the Pacific Regional Solid Waste Management strategy 2010-2015.

## **(2) Improvement of International Container Terminal Operations**

### **a) Background of the Project**

At present, transport efficiency on the international shipping route is low due to the imbalance

of import and export cargoes. In addition, cargo handling productivity at international container terminals in PICs is poor due to insufficient cargo handling equipment. This leads to longer cargo handling, demurrage of ship, and raises the cost of cargo handling. Furthermore, since international container ships are part of a multi calling network, delay of cargo handling in one port will adversely affect the entire shipping schedule, thereby increasing navigational cost. Accordingly, our team proposes the improvement of container cargo handlings in Suva port, Apia port and Nulualofa port respectively. Even though these attempts aim to improve container cargo handling, container carried RWG transportation cost will be eventually be reduced.

**b) Outline of the Project**

**i) Suva port in Fiji**

Suva port is the largest port among the five countries. It handles 50,000 TEUs of international containers including 5,000 TEUs of transshipment cargoes annually. Containers are handled by ship cranes or two quay cranes in Suva terminal. Container handling by ship gear is unstable and productivity is only around 10 boxes per hour. This number is less than the world average. Constant demurrage occurs frequently due to poor quay crane operation and suspension of operation in rain. Technical assistance for improving the cargo handling operation in Suva port is urgently required.

**ii) Apia port in Samoa**

Apia port is a gateway of Samoa. Since the port faces the open sea, it is susceptible to sea swells, which often prevents smooth berthing and cargo handling at this port. One out of the two existing jetties is deteriorated and needs replacement. Containers are handled by ship cranes in Apia terminal. Container handling by ship gear is unstable and productivity is only around 8 boxes per hour. Technical assistance for improving the cargo handling operation is urgently required.

**iii) Nulualofa port in Tonga**

Nukluolofa has two international wharves: wharf 1 is 13 meters in depth and 105 meters in length and wharf 2 is 10-11 meters in depth and 114 meters in length. Which wharf can be used is decided based on the wind. Domestic wharf is 5-7 meters in depth and 114 meters in length. Container yard has not been paved and trafficability of trucks and cargo handling machines is poor. These spoil the efficiency and safety of cargo handling. The domestic terminal yard is limited while international terminal yard is relatively large. In order to increase capacity of cargo handling and safety of the port, terminal layout should be assessed.

**c) Scope of the Project**

**i) Suva port ,Fiji**

Survey on cargo handling efficiency of container terminal: It is highly required to improve the efficiency of container terminal operation. At first JICA should consult with the Fiji government and dispatch container handling experts. The experts will conduct a survey of container cargo handling

capacity in Suva port, identify issues and propose an improvement plan.

A technical assistance for improving container cargo handling in Suva port: Based on the above mentioned survey, JICA should develop a technical cooperation project for cargo handling improvement including grant aid of cargo handling machines.

ii) Apia port, Samoa

Survey on cargo handling efficiency of container terminal: It is highly required to improve the efficiency of container terminal operation. At first JICA should consult with the Samoa government and dispatch container handling experts and a port facility engineer. The experts will conduct a survey of container cargo handling capacity in Suva port, identify issues and propose an improvement plan. The engineer will conduct a survey on port facility durability.

A technical assistance for improving container cargo handling in Suva port: Based on the above mentioned survey, JICA should develop a technical cooperation project for cargo handling improvement and port facility rehabilitation. Grant aid for providing cargo handling machines and for rehabilitation of port facility should be considered.

iii) Nukualofa port in Tonga

Port terminal rehabilitation study: It is highly required to rehabilitate the terminal. Limited space of domestic terminal, poor performance of container handling and poor safety standards due to unpaved yard are identified as major problems. JICA should consult with the Tongan government, and dispatch container handling experts, conduct a survey on container handling and propose a technical assistance project.

### **(3) Development of Unit-Load System in Domestic Shipping**

#### **a) Background**

It is essential to introduce a unit load system for the transport of recycling waste goods, usually bulky cargo, between the main island and local islands. By introducing a unit load system, it would become possible for bulky cargo to be transported with container and/or pallet and utilizing truck and container-trailer. As recycling waste goods are able to be handled the same as bulky cargo, transportation of recycling waste goods from local islands to the main island will be realized through the unit load system.

Furthermore, the possibility of introducing small sized containers, which have already been introduced in Tonga and Samoa, from the viewpoint of improvement of efficiency of recycling waste goods' cargo transport between local islands and the main island should be examined.

Though each country is making efforts to develop port facilities in the islands, cargo are still forced to be loaded/unloaded offshore between a ship and a barge, and a unit load system is not yet developed in terms of port facilities and handling equipment. Furthermore, aids to navigation are

insufficient on navigation routes with coral leaves which are an obstacle for navigation at night. In addition, many of the vessels going into service cannot cope with unit load type cargo.

On the other hand, to realize collection and transportation of recycling waste goods in local islands other than the main islands, introduction of a unit load system utilizing trucks and containers in domestic shipping is essential.

#### **b) Outline of the Project**

In Fiji, port facilities and vessels accommodating a unit load system are already introduced between the main island – Viti Levu – and the second largest island – Vanua Levu – and recycling waste goods are transported between two islands. In the next stage, introduction of a unit load system should be examined in other islands and remote islands in line with expansion of recycling waste goods' collection system.

On the other hand, among the islands which were surveyed in Vanuatu, there is a small ramp in Malekula Island which is located in the central region, however, there is no space for cargo handling and storage. Tanna Island, which is located in the southern region, has no facility for accommodating a unit load system. These islands together with Efete Island and Espiritu-Santo Island where international ports are located form an axis for national development, and thus introduction of a unit load system among these islands should be examined in the first place. (The Asian Development Bank and New Zealand have pledged to extend a small port improvement project. Confirmation is required to ensure consistency and avoid duplication.)

Therefore, transportation demand of cargo between the main island and major local islands should be examined in Fiji, Vanuatu and Tonga (which a site survey could not be conducted) and then ports and navigation routes for introduction of a unit load system should be nominated and prioritized considering the status of road development in the island.

In addition, the necessity of modernizing the domestic shipping fleet which means introduction of RORO vessel should be examined, and if necessary, it should be considered whether official support will be extended or not.

#### **c) Scope of the Project**

This project is to be conducted as a development study and its tentative title is “the study on introduction of a unit load system in domestic shipping to facilitate recycling waste goods' transportation”.

The study area is Fiji, Tonga and Vanuatu. Scope of the study is

- ž To grasp the present status of domestic maritime transportation,
- ž To examine the future demand of recycling waste goods and other cargo between the main island and the major islands,
- ž To nominate the priority routes for introduction of a unit load system,
- ž To propose urgent projects and conduct feasibility study, and

- ž To clarify the method of implementation of the urgent project

The term of the study is estimated to be range from 12 months to 18 months. Regarding the introduction of small sized containers, it is desirable to use it in plural countries because use in one country would not be effective. Therefore, a study for standardization of smaller-sized containers should be conducted aiming at introducing it in all Pacific Island countries. Implementation agencies are transportation sector and maritime and port sector, however, coordination with the waste management sector and private sector will be inevitable.

**(4) Cross – Sectorial Field :Technical Cooperation Project for Development of Information Platform on Reverse Logistics**

**a) Background and Purpose of the Project**

There are several reasons why it is difficult to expand the reverse logistics business in the Pacific Island countries. Small scales of the population, vulnerability of the economic base and remoteness from the major markets of recycling waste goods are among the major ones. SPREP and J-PRISM have been activate in the region in the field of urban and household waste, however, scrap, white goods and other recyclable waste goods which are objectives of reverse logistics are poorly handled by the government and each country has a different system of waste management even if a waste management system is partially introduced. On the other hand, most of the recycling companies are small businesses, therefore, they usually cannot obtain necessary information on recycling business in a timely manner and such companies cannot coordinate with each other to get information of reverse logistics from the government.

Under such a background, this project is a technical cooperation project to develop the information platform for reverse logistics in the Pacific Island countries. The purpose of the information platform is to collect, compile and provide the information necessary to facilitate reverse logistics business through establishment of close coordination among public and private sectors.

**b) Outline and Scope of the Project**

The purpose of the project is to conduct a study for development of the information platform and develop it as necessary to promote the reverse logistics business. Development of the information platform includes establishment of a collection. Items of the examination are;

- ž kinds of necessary information and available existing information system,
- ž method of collection, compilation and provision of the information,
- ž proponent of management and operation of the information platform,
- ž method of utilization and monitoring system,
- ž procedure, time schedule and cost for development of the information platform,

and so on. To conduct these study, technical cooperation project will be extended and develop the information platform for reverse logistics business.



Expected information necessary to promote the reverse logistics platform is

- ž information for relevant laws and regulations on recycling business,
- ž information of collection and storage of recycling waste goods,
- ž information of port operation and management,
- ž information of international and domestic maritime transportation,
- ž information of quarantine of imported country,
- ž information of recycling market, and so on.

Many agencies and organizations will be involved in development of the information platform. Public sector such as waste management sector, recycling business regulation sector, maritime and port sector, and custom and quarantine sector and so on, and private sector such as recycling companies, associations/groups of recycling business and related industries should cooperate with each other to develop the information platform

### **c) Implementation of the Project**

This project is implemented by JICA, however, the JICA project team will work together with international organizations such as SPREP and SPC (Secretariat of the Pacific Community) which are playing an active role in the region and these organizations should play a key role in management and operation of the information platform.

For this reason, working groups which consists of SPREP, SPC, JICA and representatives from the Pacific Island countries will be set up and JICA project team will offer support and guidance from the technical point of view to develop the information platform. Successive implementation of workshops (one was held during this survey on reverse logistics) seems to be one of the effective methods to strengthen the relation and linkage among concerned agencies and people.

## **Appendix Workshop on Improvement of Bulky Waste Recycling in the PICs through Reverse Logistics**

JICA reverse logistic study team, comprised of OCDI and Yachiyo Engineering Co.,Ltd, and J-PRISM held a workshop on the 26th and 27th of September, 2012 in Suva, Fiji.

### **(1) Background and Objectives of the Workshop**

JICA reverse logistic study team, OCDI and Yachiyo Engineering Co.,Ltd, were commissioned by JICA to carry out “A data collection survey to identify issues and develop plans to strengthen the circulation of recycling materials by utilizing reverse logistics in Pacific Island Countries (PICs)”. In its interim report the team showed preliminary estimates that some 75,000 tons of recyclable waste were available for recycling in Fiji in 2011, and that of that amount 38,200 tons (51% of the total) were actually recycled. The remaining amount was landfilled, abandoned or stored on private premises. The team is proposing the introduction of source separation, improving the processing of recyclable materials both economically and environmentally, and reducing transportation cost by improving cargo handling efficiency in ports. The main objective of the workshop was to provide an opportunity for the stakeholders to exchange information and opinions on bulky waste recycling with the aim of improving the bulky waste recycling activities in the PICs through reverse logistics.

### **(2) Participants**

More than 50 participants joined the workshop, including related government officials, recycling companies, port authorities, and maritime transport companies from the five PICs covered under the study (Fiji, Samoa, Tonga, Tuvalu, Vanuatu). Officials and experts from SPREP, JICA and JICA study team also participated. This was the first time for various stakeholders related to bulky waste material recycling in the PICs to gather together and discuss common issues.

### **(3) Input and outcomes of the workshop**

The workshop on the 26th consisted of presentations from SPREP, JPRISM, YAMANAKA (a recycling company in Japan) and JICA team in the morning session, while three groups discussed the themes of; a) waste recycling, b) port and marine and c) public support in the afternoon session. The workshop concluded with recommendations to enhance this important activity.

Main proposal for improving reverse logistics

- a) Waste recycling: Market expansion, support from governments to improve recycling, dealers and importers responsibility, improve the collection system, collection of other RWGs such as paper, improvement of transportation sector's.

- b) Marine transport: international route connection, improvement of domestic routes, terminal operation improvement, information on recycling operations, expansion of RORO network.
- c) Public support: raise public awareness on source separation, facilitate recycling companies activities, monitoring environmental and health impacts at the yards, improve port facilities and operations.

On the following day (September 27th), participants visited a landfill site, a private recycling facility and a container terminal in Suva, Fiji. A local TV covered whole two days and reported twice.

## Workshop programme



**Workshop on Improvement of Bulky Waste Recycling in the PICs through Reverse Logistics**  
 Suva, Fiji 26<sup>th</sup> 27<sup>th</sup> September 2012  
 Organized by:  
 JICA Study Team for Data Collection Survey on Reverse Logistics in the Pacific Islands  
 Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries  
 (J-PRISM)

No.	Topic	Time	Comment
A	Registration	8:30 – 9:00	
B	Morning Session – Seminar / Presentations	9:00 – 12:00	
(1)	Welcome speeches	9:00 – 9:20	
	JICA Fiji Office	(10 minutes)	Mr. Yutaka Fukase Deputy Representative
	Fiji Official from Ministry of Local Government, Urban Development, Housing & Environment	(10 minutes)	Ms. Taina Tagicakibau Permanent Secretary
(2)	Importance of Solid Waste Recycling in the PICs	9:20 – 9:35	Ms. Esther Richards SPREP
(3)	Progress on SWM in the PICs	9:35 – 10:15	Mr. Shiro Amano J-PRISM
	Coffee break	10:15 – 10:30	
(4)	JICA Study Findings and Reverse Logistics Concept (incl. Q&A)	10:30 – 11:10	Mr. A. Koyama JICA Study Team
(5)	Introduction of recycling practices in Japan	11:10– 11:30	Mr. Yamada Yamanaka
(6)	Introduction of Resources Recycling experience in Okinawa– The Tropical Islands in Japan and Practices in 'ava'u Islands Tonga	11:30-11:50	Mr. Hiroshi Kogachi Okinawa
(7)	Introduction of Workshop themes, and explanation of afternoon session proceeding	11:50– 12:00	Mr. M. Riad JICA Study Team
C	Lunch	12:00 – 13:00	
D	Afternoon Session – Workshop	13:00 – 17:00	
(8)	Panel Discussions– Group A	13:00 – 14:00	Ms. Esther facilitating (Mr. T. Arai support)
(9)	Panel Discussions– Group B	14:10 – 15:10	Mr. Motono facilitating (Ms. Esther support)
	Coffee break	15:10 – 15:30	
(10)	Panel Discussions– Group C	15:30– 16:30	Ms. Esther facilitating (Mr. Koyama support)
(11)	Drafting Workshop Recommendations and adoption	16:30 – 16:50	J-PRISM, SPREP, JICA Study team
(12)	Workshop closing	16:50 – 17:00	Mr. Toyama, Director South Asia 8th and Pacific Division JICA

**Day 2 Schedule : Field Visit**

**Please Note :**

- 27th September, 2012. At 8:50am, pickup from Capricorn Hotel , 7 Saint Fort Street, Suva.
- All participants are humbly requested to wear closed shoes for compliance with the Ports Authority & Naboro Landfill Health and Safety requirement.

No.	Topic	Time	Comment
(1)	Naboro Sanitary Landfill	9:30-10:00	Mr. Mark Hirst, Manager, HG Leach (Fiji) Ltd
(2)	Pacific Scrap Metal ( Recycling Yard )	10:15 – 10:40	Mr. Sunil Singh, Director
(3)	Lami Rehabilitation Site	10:50 -11:15	Mr. Rahul Dutt, Landfill Operations Officer
(4)	Port Visit	11:25-12:00	Mr. Kurusiga, General Manager, Ports Operation, Fiji Ports Corporation Ltd
	Tanoa Hotel ( Lunch )	12:30- 13:30	
(5)	Capricorn Hotel	13:40	

## List of workshop participants

1	Mr Setoa Apo	Ministry of Natural Recourses and Environment	Samoa
2	Mr Lotomau Tomane	Samoa Ports Authority	Samoa
3	Mr Ioane Sio	Pacific Recycle	Samoa
4	Ms Mafile'o Masi	Ministry of Environment & Climate Change	Tonga
5	Mr William Udarbe Tuikolovatu	Gio Recycling	Tonga
6	Mr Filimone Tuikolovatu	Gio Recycling	Tonga
7	Mr Viliami Vi	Friendly Islands Shipping Agent,Tonga	Tonga
8	Ms Tepola Taulaga	Ministry of Home Affairs	Tuvalu
9	Ms Carol Rovo	Ministry of Land and Natural Resources	Vanuatu
10	Mr Andrew Hibgame	Recycle Corp	Vanuatu
11	Ms Christina Hibgame	Recycle Corp	Vanuatu
12	Mr Russell Mitchell	Ifira Port Development Services	Vanuatu
13	Ms Taina Tagicakibau	Ministry of Local Government, Urban development housing & Environment	Fiji
14	Mr Raul Datt	Department of Environmet, Ministry of Local Government, Urban development housing & Environment	Fiji
15	Ms.Laisani Lewanavanua	Department of Environmet, Ministry of Local Government, Urban development housing & Environment	Fiji
16	Mr Lote Rasuqoli	Department of Environmet, Ministry of Local Government, Urban development housing & Environment	Fiji
17	Mr Lui Naisara	Transport Management Unit, Ministry of Works, Transport and Public Utilities	Fiji
18	Mr Naresh Narayan	Suva City	Fiji
19	Mr Shalend Prem Singh	Lautoka City	Fiji
20	Mr Sunil Singh	Pacific Scrap Buyers	Fiji
21	Mr Jokini Taoi	Port Terminal Limited. Fiji Ports Corporation	Fiji
22	Mr Ben Naidu	Venu Shipping	Fiji
23	Mr Lesi Lopteti	Venu Shipping	Fiji
24	Mr Ilaisa Labaibure	Carpenters Shipping	Fiji
25	Mr Hector Smith	Consort Shipping	Fiji
26	Mr Panapasa Vakatale	Government Shipping Service	Fiji
27	Mr Samisoni Dabea	Government Shipping Service	Fiji
28	Mr Bruce Tweed	Secretariat of the Pacific Community	Fiji
29	Mr Alobi Bomo Rigam	Secretariat of the Pacific Community	Fiji
30	Ms Esther Richard	Secretariat of the Pacific Regional Environmental Programme (SPREP)	Fiji
31	Mr Hideaki Kuroki	Embassy of Japan in Fiji	Japan
32	Mr Hiroshi Kogachi	JICA Partnership Program(JPP) for"Great Vava'u and Okinawa Mottainai Project"	Japan
33	Mr Takeshi Kushima	JICA Partnership Program(JPP) for"Great Vava'u and Okinawa Mottainai Project"	Japan
34	Mr Satoru Shirome	JICA Partnership Program(JPP) for"Great Vava'u and Okinawa Mottainai Project"	Japan
35	Mr Naoki Yamada	YAMANAKA Co. Ltd.	Japan
36	Mr Shiro Amano	J-PRISM	Japan
37	Mr Hiromichi Kanou	J-PRISM	Japan
38	Mr Ogawa Masayoshi	J-PRISM	Japan
39	Mr Takashi Toyama	JICA Tokyo	Japan
40	Mr Yutaka Fukase	JICA Fiji	Japan
41	Mr Kentaro Yoshida	JICA Fiji	Japan
42	Ms Frances Tavaiaqia	JICA Fiji	Japan
43	Mr Akira Koyama	JICA team	Japan
44	Mr Takatoshi Arai	JICA team	Japan
45	Mr Ichio Motono	JICA Team	Japan
46	Mr Mahamoud Riad	JICA Team	Japan
47	Mr Takayuki Iijima	JICA Team	Japan
48	Ms Anshoo Ashika	JICA Team	Fiji
49	Mr Sentiki Bati	JICA Team	Fiji
50	Ms Vani Qoroya	JICA Team	Fiji

## Group discussion

Group A
Bulky waste Recycling in PICs
Mr. Ioane Sio (Pacific Recycle, Samoa)
Mr. William Udarbe Tuikolovatu (Gio Recycling, Tonga)
Mr. Filimone Tuikolovatu (Gio Recycling, Tonga)
Mr. Andrew Hibgame (Recycle Corp, Vanuatu)
Mr. Lee, Managing Director (Sun & Bright Ltd. Fiji)
Mr. Shalend Pren Singh (Lautoka City, Fiji)
Ms Carol Rovo (Ministry of Land and Natural Resources, Vanuatu)
Ms. Laisani Lewanvanua (Department of Environment, Fiji)
Chairperson
Facilitater: Ms. Esther (SPREP)
Support: Mr. T. Arai (JICA study team)

## • Proposal

A-1	<p>Market expansion</p> <ul style="list-style-type: none"> <li>• Governments and companies should partner together with support from international organizations directly to companies</li> <li>• Regulations should be strengthened to obtain communities support to recycling as well as dealers and importers</li> <li>• Governments need to provide incentives but only for non-profitable RWGs</li> </ul>
A-2	<p>Support from governments to improve recycling</p> <ul style="list-style-type: none"> <li>• Public awareness raising and bringing in communities on 3Rs</li> <li>• Recycling campaigns</li> </ul>
A-3	<p>Dealers, importers responsibilities</p> <ul style="list-style-type: none"> <li>• Consider introducing disposal fees on new purchases of white goods</li> <li>• Require dealers to shoulder some of the recycling costs</li> </ul>
A-4	<p>Improve collection system</p> <ul style="list-style-type: none"> <li>• Environmental education should be introduced in schools</li> <li>• Public awareness for adults needs to be continuous</li> </ul>
A-5	<p>Collection of other RWGs such as paper</p> <ul style="list-style-type: none"> <li>• Consumers of packaging paper and plastics should bare some of the costs of the recycling</li> </ul>
A-6	<p>Transportation sector</p> <ul style="list-style-type: none"> <li>• Shipping companies need to consider providing better rates</li> <li>• Facilities at many wharves are not sufficient for storage and loading</li> <li>• Time allocated at ports for filling containers is sometimes not enough</li> </ul>

Group B
Potential for maritime transport reverse logistics support to recycling
Mr. Viliami Vi (Friendly Islands Shipping Agent, Tonga)
Mr. Russell Mitchell (Ifra Port Development Services, Vanuatu)
Mr. Panapasa Vakatale (Government Shipping Service, Fiji)
Mr. Ben Naidu (Venu Shipping, Fiji)
Mr. Lesi Lopteti (Venu Shipping, Fiji)
Mr Ilaisa Labaibure (Carpenter Shipping)
Mr. Hector Smith (Consort Shipping, Fiji)
Mr. Lui Naisara (Ministry of Works, Transport and Public Utilities, Fiji)
Mr. Jokini Taoi (Ports terminal Limited, Fiji Ports Corporation, Fiji )
Mr. Alobi Bomo, SPC
Chairperson Mr Lui Naisara
Facilitater: Mr. Motono(JICA study team)
Support: Ms. Esther (SPREP)

• Proposal

B-1	International route connections <ul style="list-style-type: none"> <li>Utilizing international container shipping route for exporting scrap to foreign countries should be considered</li> <li>In addition to waste bulky waste, waste oil is a common problem in PICs and should to considered.</li> </ul>
B-2 B-3	. Improvement of domestic routes <ul style="list-style-type: none"> <li>Problem of jetties conditions, at least mooring buoys in outer islands should be provided.</li> <li>Not enough emphasis on taking scrap metal business forward – freight rates can be decided based on subject loads (reduce during low cargo runs)</li> <li>Concentration of RORO terminal, introduction of handy container and environmental awareness should be considered.</li> </ul>
B-4	Terminal operations improvement Improving port operation efforts continues such as 24 hour operation, reduction of freight rate, 72 working hours free storage on cargo and etc. a dry port and high container truck rate should be considered.
B-5	Information on recycling operations <ul style="list-style-type: none"> <li>A opinion that transport sector's role is limited and these are shipper and buyer's role.</li> </ul>
B-6	Institutional support <ul style="list-style-type: none"> <li>Improving port operation introduction of RORO infrastructure facilities in outer islands, support for uneconomical route should be considered.</li> </ul>



Group C
Government roles and support
Mr. Setoa Apo (Ministry of Natural Recourses and Environment, Samoa)
Ms. Mafile’o Masi (Ministry of Environment & Climate Change, Tonga)
Ms. Tepola Taulaga (Ministry of Home Affairs, Tuvalu)
Ms. Carol Rovo (Ministry of Land and Natural Resources, Vanuatu)
Mr. Jope R. Davetanivalu (Department of Environment, Fiji)
Ms. Laisani Lewanvanua (Department of Environment, Fiji)
Mr. Naresh Narayan (Suva City, Fiji)
Mr. Shalend Pren Singh (Lautoka City, Fiji)
Mr. Lotomau Tomane (Samoa Ports Authority, Samoa)
Mr. Lui Naisara (Ministry of Works, Transport and Public Utilities, Fiji)
Mr. Jokini Taoi (Ports terminal Limited, Fiji Ports Corporation, Fiji )
Mr. Alobi Bomo, SPC
Mr. Bruce Tweed, SPC
Chairperson Ms. Laisani Lewanvanua
Facilitater: Ms. Esther (SPREP)
Support: Mr. Koyama (JICA study team)

• Proposal

C-1	<p>Raise public awareness on source separation</p> <ul style="list-style-type: none"> <li>• Need to ensure that campaigns are based on established systems that will actually deliver</li> <li>• Source separation projects should be developed under national standards</li> <li>• Pilot projects are a good way to start</li> </ul>
C-2	<p>Facilitate recycling companies activities</p> <ul style="list-style-type: none"> <li>• National policy and plans should be developed engaging all levels of society</li> <li>• Budget allocations should be made to support campaigns and awareness</li> <li>• Pacific Islands unique nature of engaging informally should be promoted in resolving issues</li> </ul>
C-3	<p>Monitoring environmental and health impacts at the yards</p> <ul style="list-style-type: none"> <li>• Develop regulations</li> <li>• Strengthen monitoring capabilities</li> <li>• Ensure F/S for businesses are well prepared</li> </ul>
C-4	<p>Improve port facilities and operations</p> <ul style="list-style-type: none"> <li>• Issue of multi-purpose berth needs to be addressed</li> <li>• Improve efficiency of port operation</li> <li>• International obligations will continue to be recognized</li> </ul>

**Status of workshop and field survey**



**Presentation in the workshop in the morning of 26<sup>th</sup> September)**



**Panel discussion in the workshop in the afternoon of 26<sup>th</sup> September**



**Field survey (left: Naboro Sanitary Landfill, right : Pacific Scrap Metal)**