

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

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

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### Currency exchange rate

27-May-2012

	USA (US\$)	Japan (JPY)	Fiji (FJS)	Samoa (WST)	Tonga (TOP)	Tuvalu (AUS)	Vanuatu (VUV)	NewZealand (NZ\$)	Australia (AUS)
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
NDS	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.

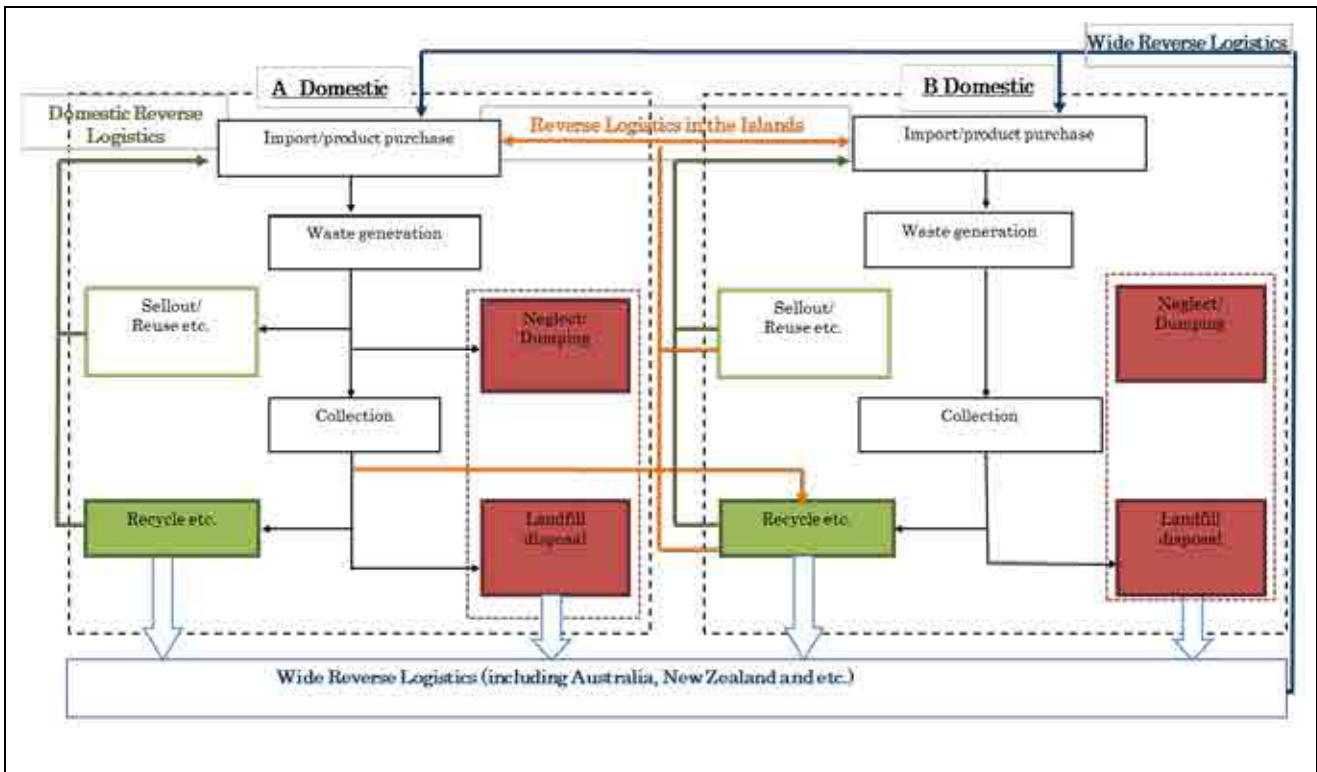
**Table Socio-economic indicator of each country**

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”

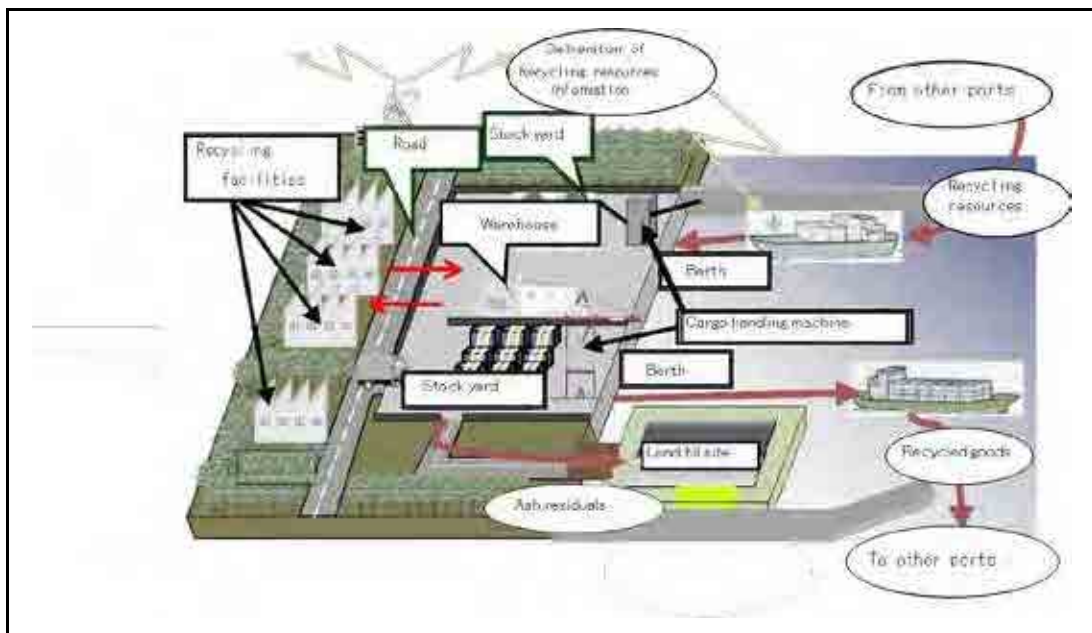
#### (1) What is “Reverse Logistics” ?

“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
∅ Vehicles, white goods, heavy equipment and cans	Existing	Existing	Existing	Existing	Existing
∅ Papers	Existing	No	No	No	No
∅ 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%
Total Main Importers	52.9	52.9	56.8	58.6	56.6	
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%
Total Main Exporters	47.4	47.9	52.0	56.7	56.4	
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.

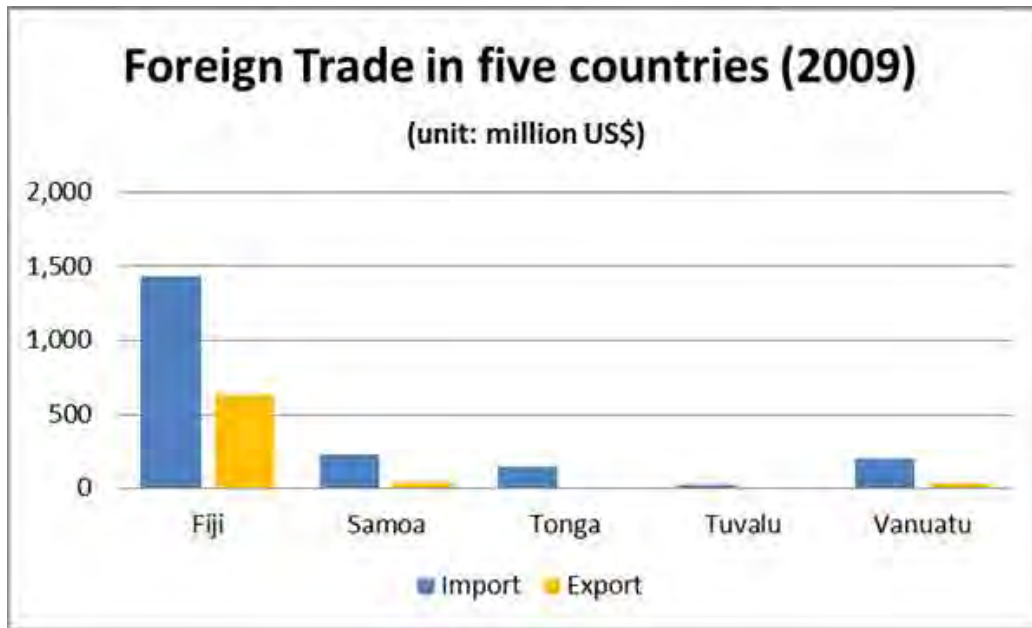
Table Export amount of RWM (TEU)

	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

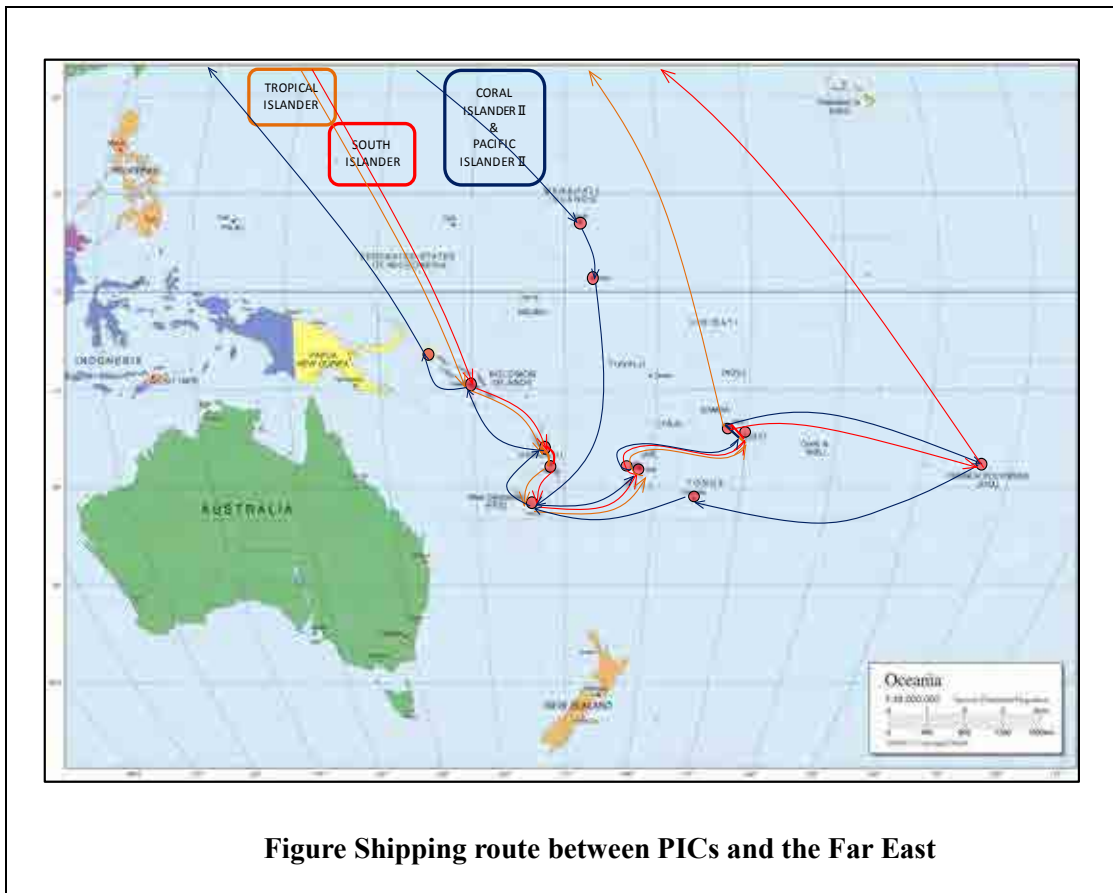
There is heavy dependency on the import of consumer goods in the PICs. Various commodities, food, machines, clothes and transportation vehicles are imported but few cargoes, only first industry production, sugar, fish and copra are export commodities. Fiji, the largest exporter of PICs, exports one-fourth 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		
					<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.					

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, Elmgton, Denarau and Ysawa i Rara	2007 Population Census of Fiji
	VANUALEVU	135,961	16%	Malau, Galoa, Wairiki and Savusavu	Nabouwalu, Malau, Savusavu, Taveuni	Natuvu	
	LOMAIMITI	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, Mulinuanua		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

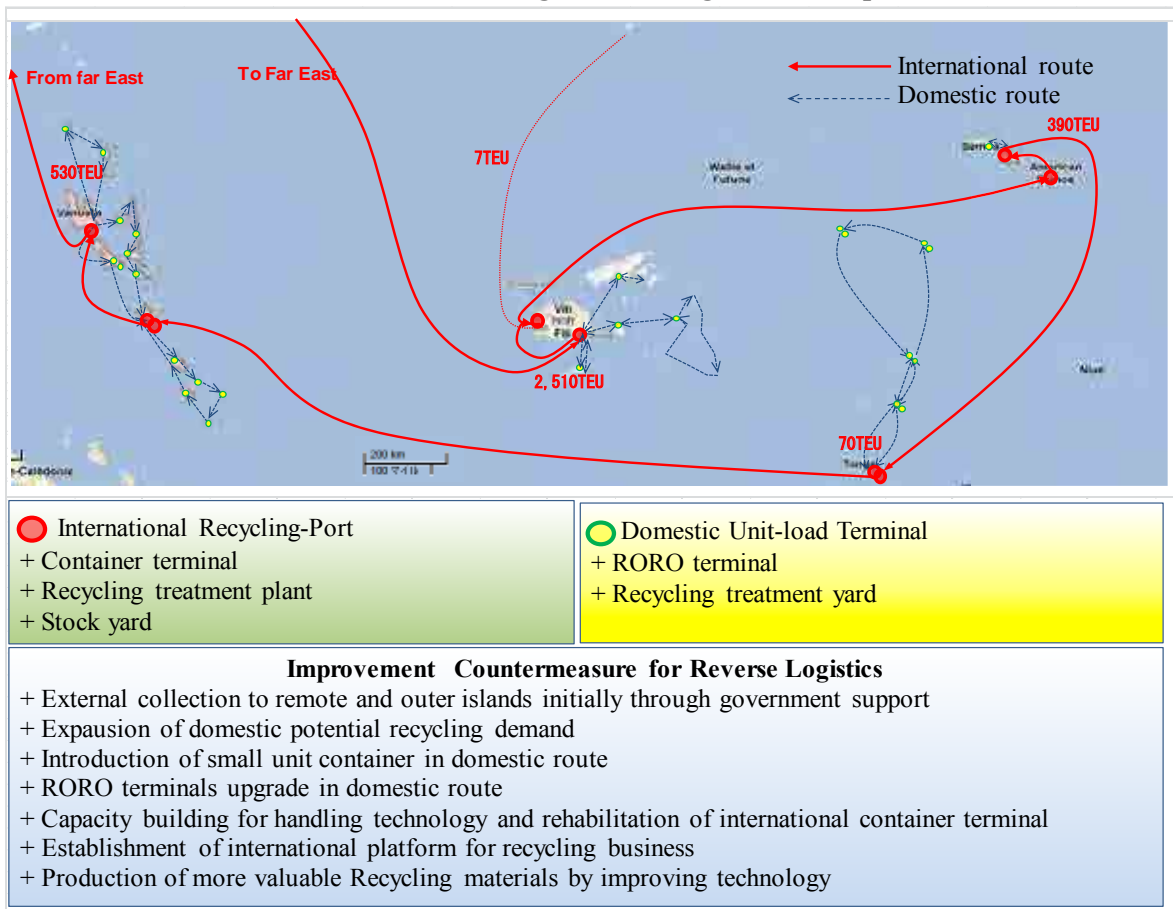
## **6. Forming reverse logistics in the pacific islands**

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

(1) Concept of reverse logistic system

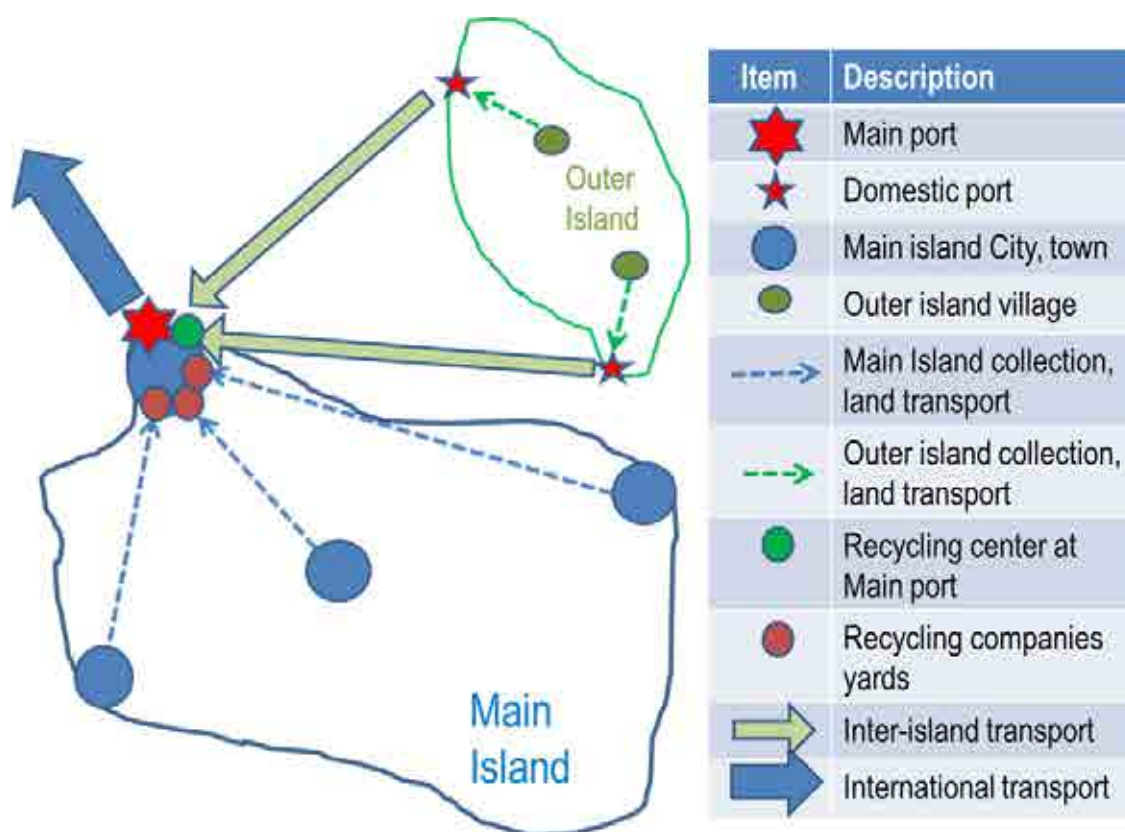
A regional framework of reverse logistics system in the pacific islands is shown below. RWGs generated in local islands are expected to be collected and transported to an international port in the main island by domestic shipping. The accumulated RWGs are cleaned, selected, and sorted as commercial commodities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

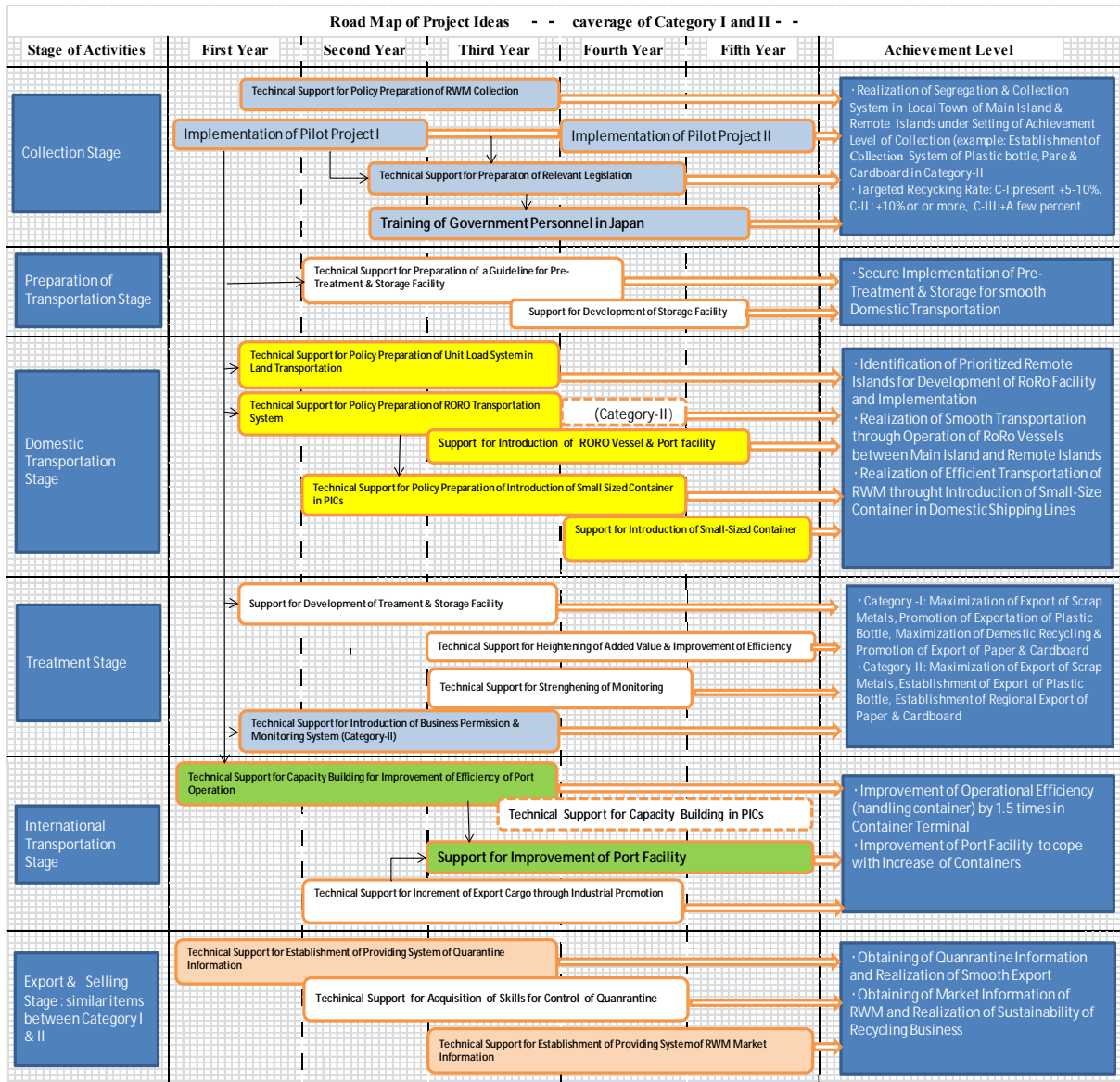
			protection measures		
International transportation	International port city	International Marine transportation	Improvement of port operation	+Capacity development for cargo handling efficiency + Introduction of IT system for port operation	+Capacity development of cargo handling skill +Introduction of 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

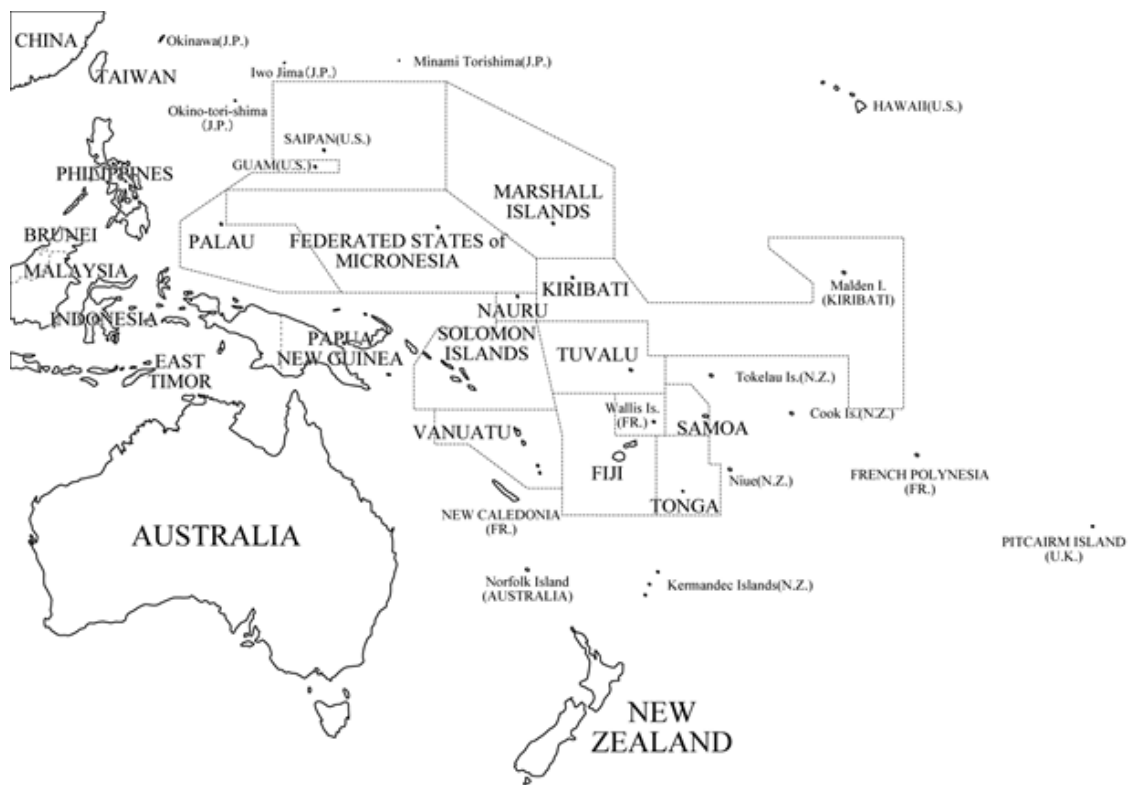
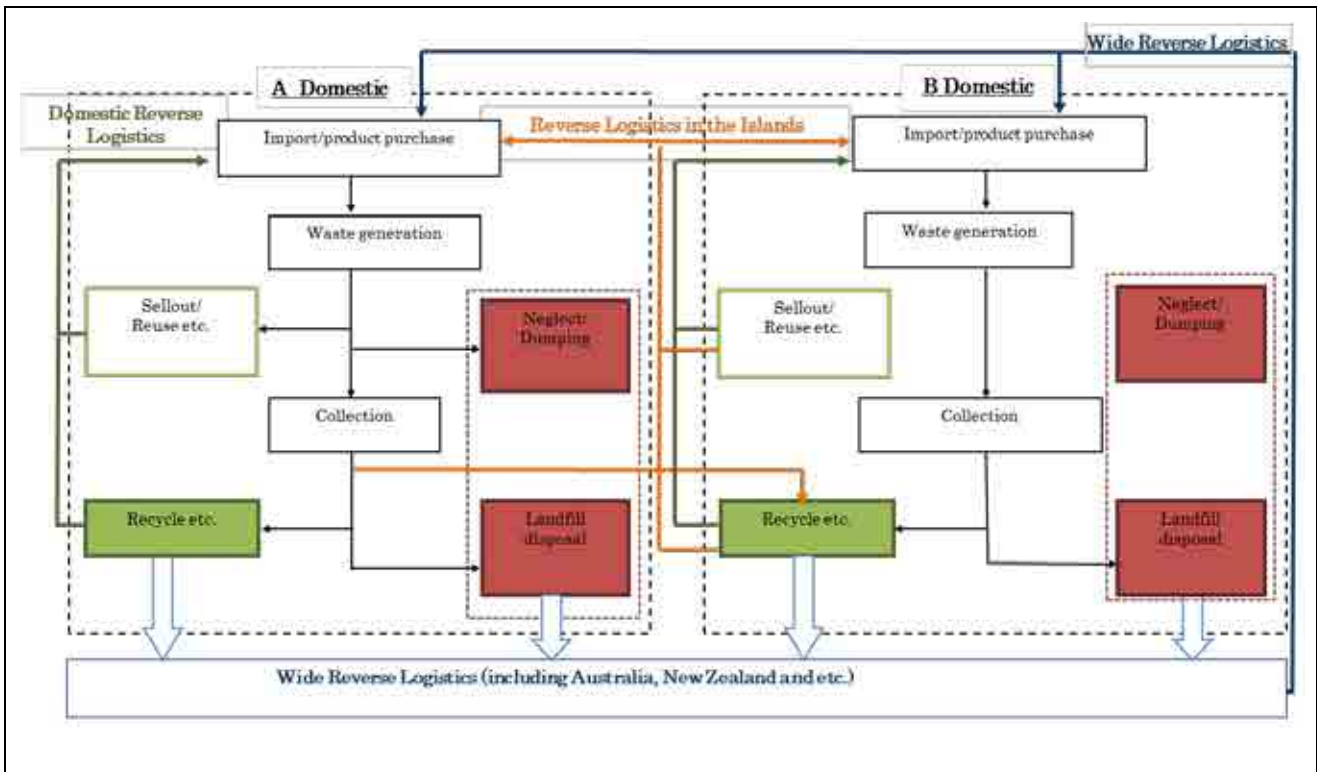


Figure 1-1 Map of the Pacific Island Countries

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

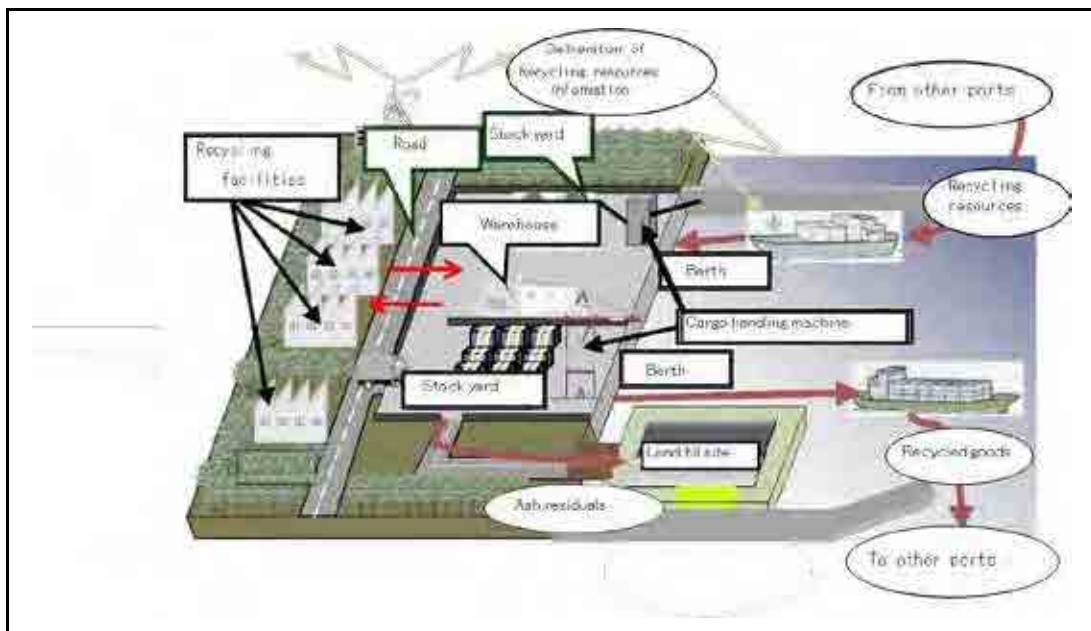
#### (1) What is “Reverse Logistics” ?

“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.



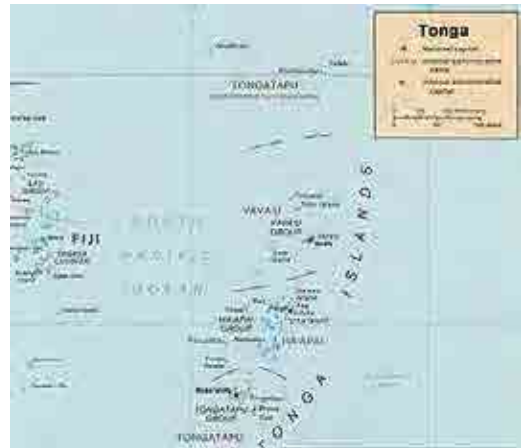
### (2) Samoa

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.



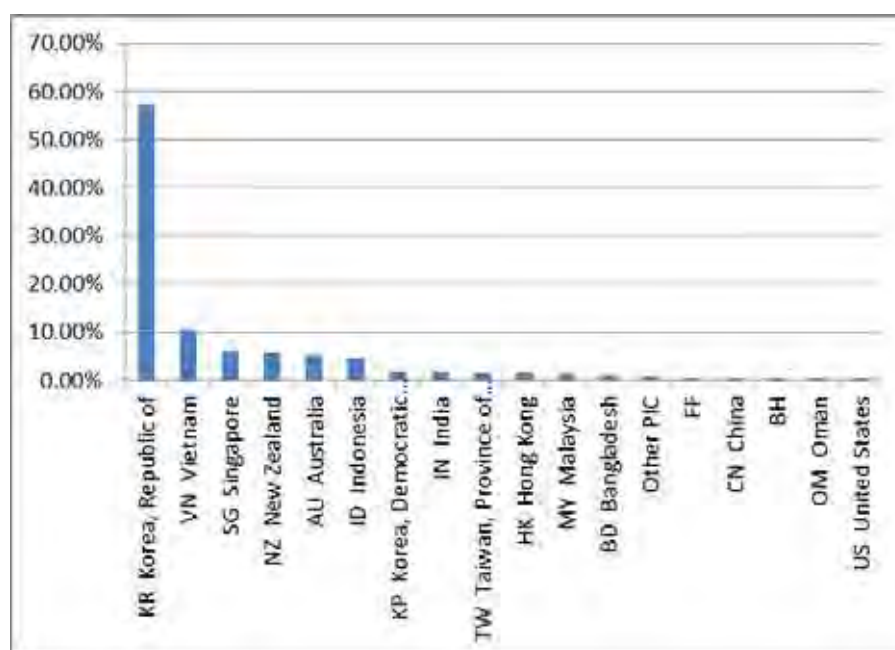
**Figure 2-4 Recycler Company of Waste Paper**

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 then 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:</p> <ul style="list-style-type: none"> <li>Green waste: 38.70%</li> <li>Food scrap: 3.80%</li> <li>Paper: 6.93%</li> <li>Cardboard: 0.27%</li> <li>Plastic bags/papers: 6.52%</li> <li>Plastic bottles/containers: 6.52%</li> <li>Diapers: 15.08%</li> <li>Glass: 2.17%</li> <li>Metals (excl. Cans): 8.83%</li> <li>Steel cans: 2.83%</li> <li>Aluminum cans: 1.77%</li> <li>Textiles: 6.79%</li> <li>Others: 4.35%</li> <li>Total: 100.00%</li> </ul>
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.

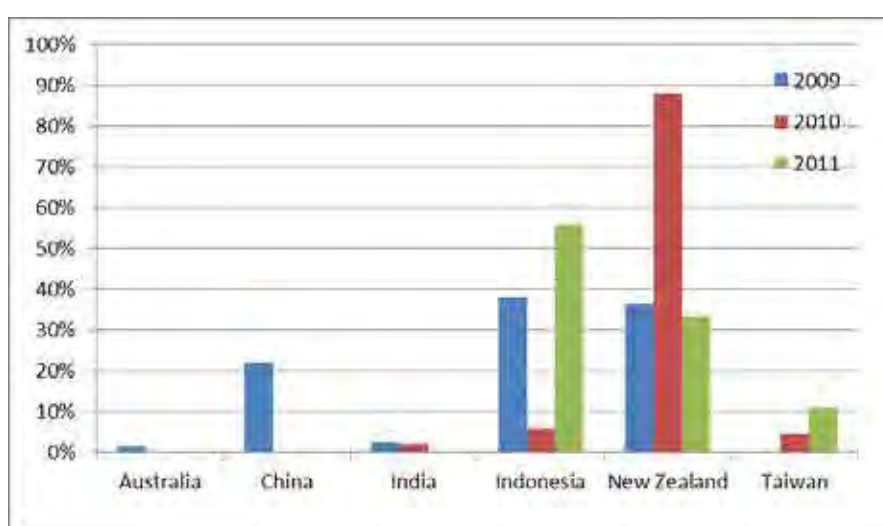
**Table 2-13 Export Destination Countries of the Recycled Waste Materials**

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**

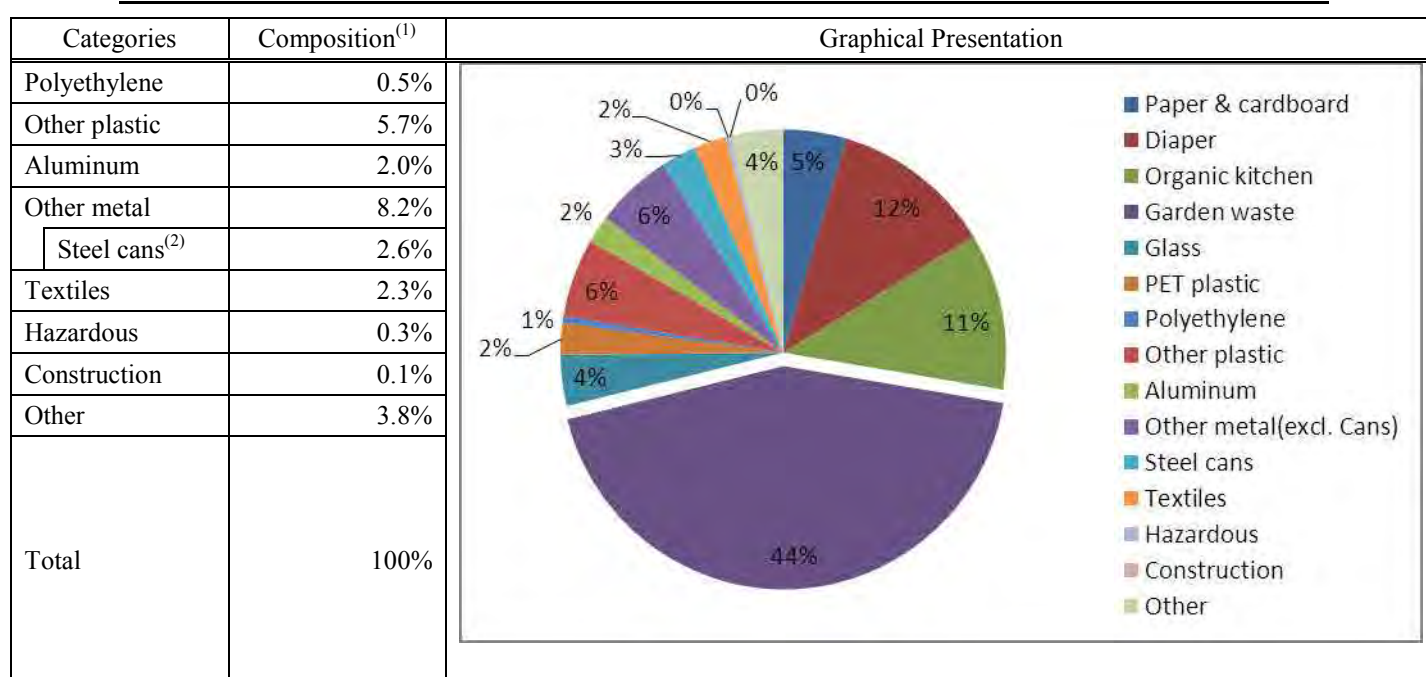
1) UGR and Composition of Municipal Solid Waste

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%	



Source: (1) Household Economic Survey, June 2005

(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 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

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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 corresponding to the table:</p> <ul style="list-style-type: none"> <li>Kitchen and Yard waste: 52.4%</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> <li>Total: 100%</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).

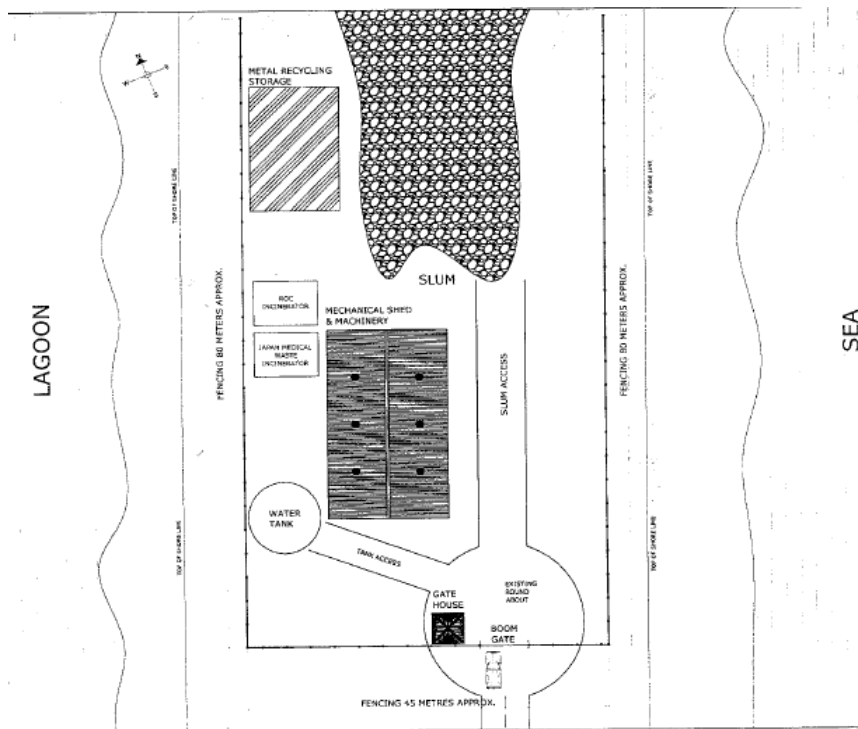
## 4) Relevant Recyclers and Stakeholders

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.

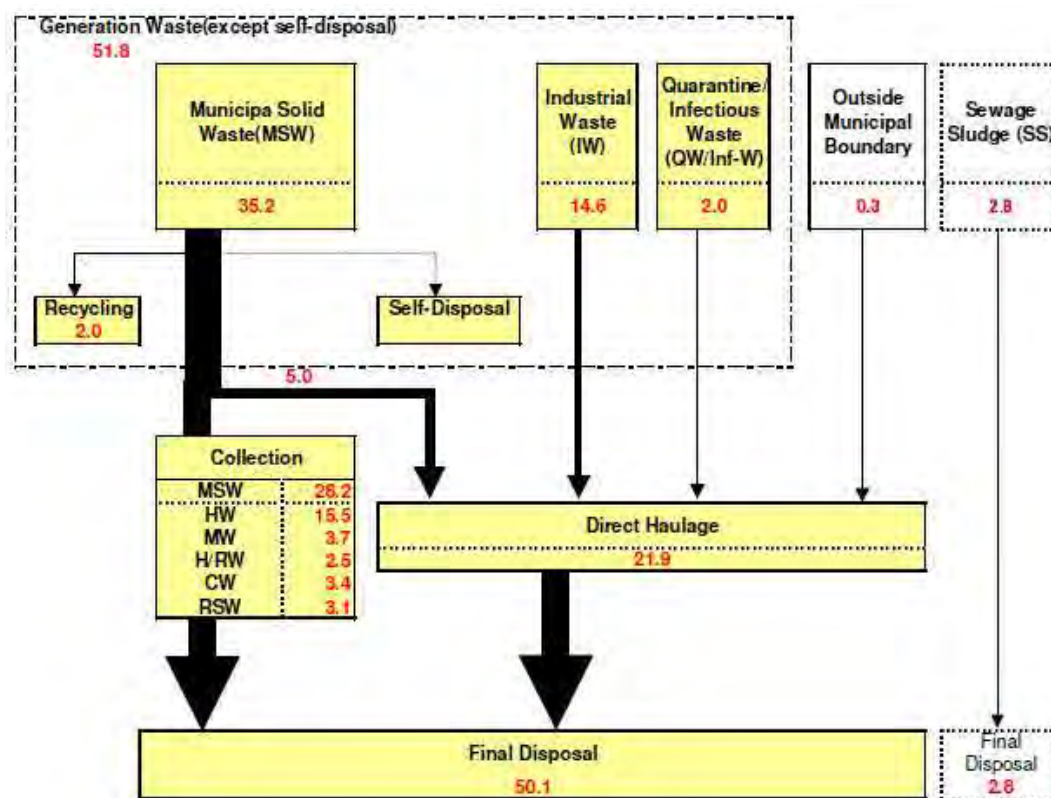
**Table 2-27 Solid Waste Composition, Port-Vila, 2011**

Items	Composition <sup>(1)</sup>	Graphical Presentation
Vegetable/Putrescible	61.50%	
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
SUSTAINABLE FINANCING			
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
INTEGRATED SOLID WASTE MANAGEMENT			
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
LEGISLATION			
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
AWARENESS, COMMUNICATION & EDUCATION			
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
CAPACITY BUILDING			
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
ENVIRONMENTAL MONITORING			
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 the 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>l Reluctance of used car owners to release their waste cars to the project</li> <li>l Lack of appropriate machineries for processing, loading and transport</li> <li>l Shortage of stockpile areas</li> <li>l 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.

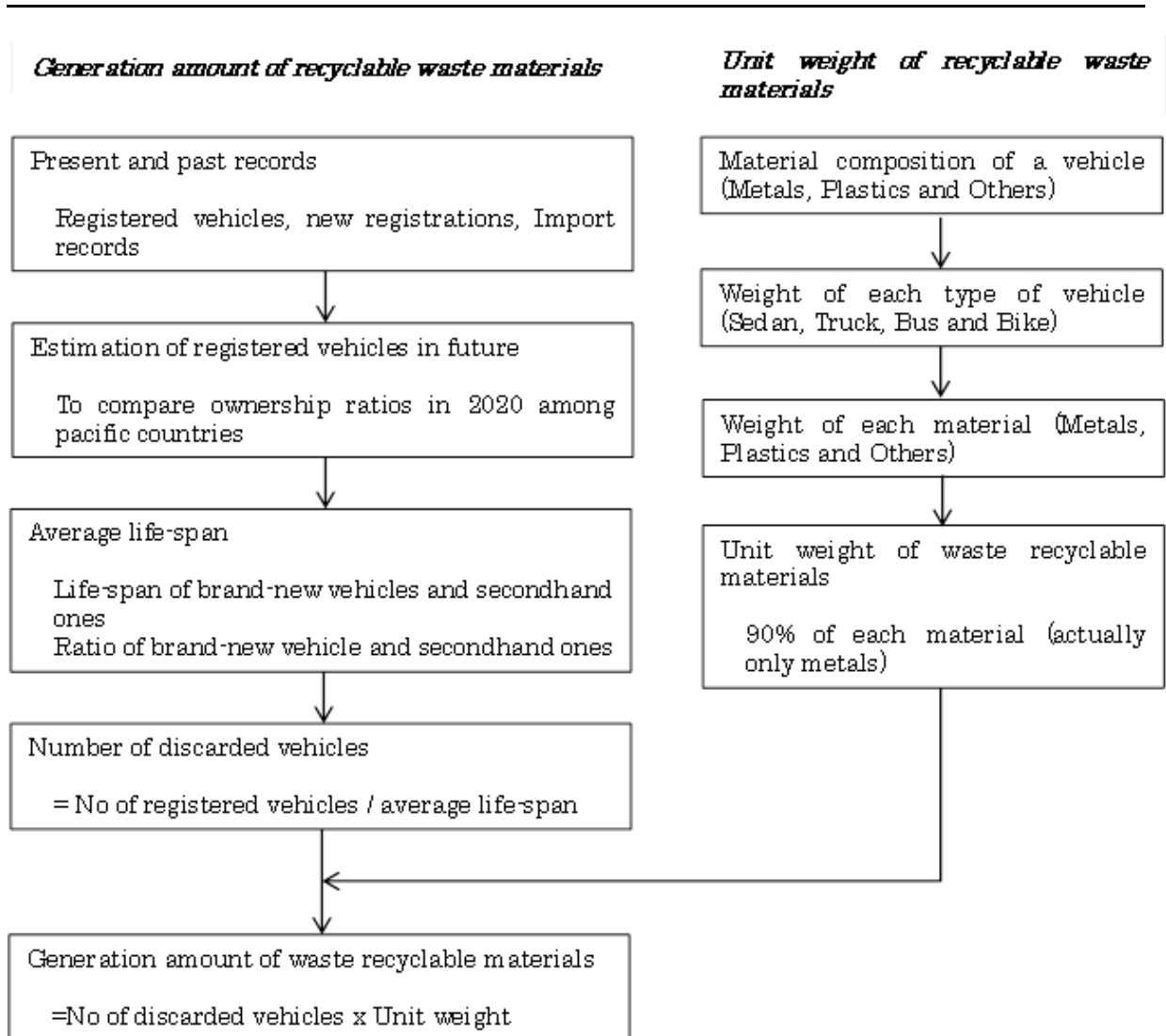
**Table 3-1 Targeted Recyclable Waste Goods and Recycled Waste Materials**

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**

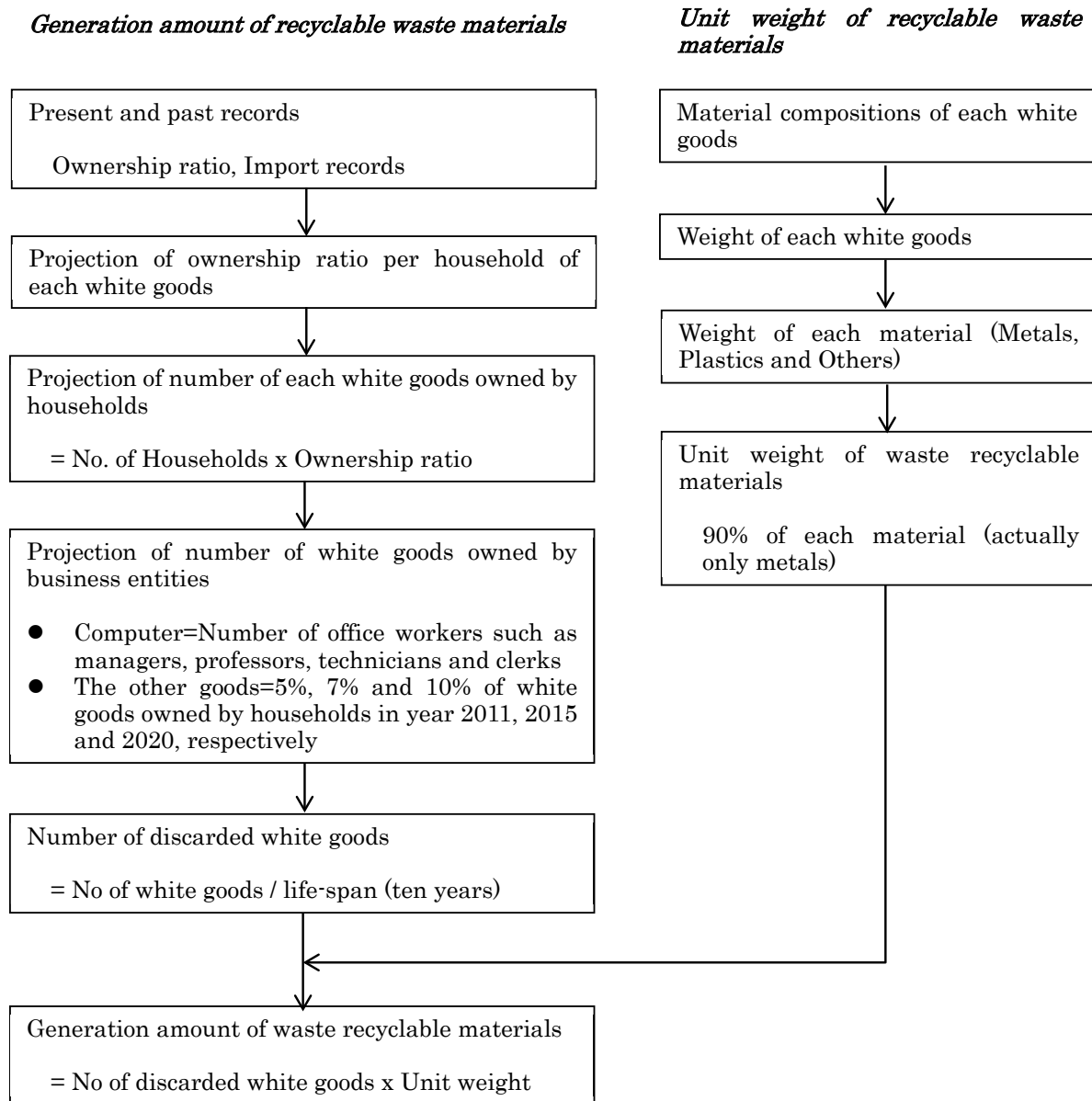
There were basically two estimation flows in parallel; the first was to determine the number of discarded vehicles, by vehicle type to be collected by the recycling companies. The total numbers of registered vehicles for the year 2020 were projected, by vehicle type, taking into account the vehicle ownership 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:

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

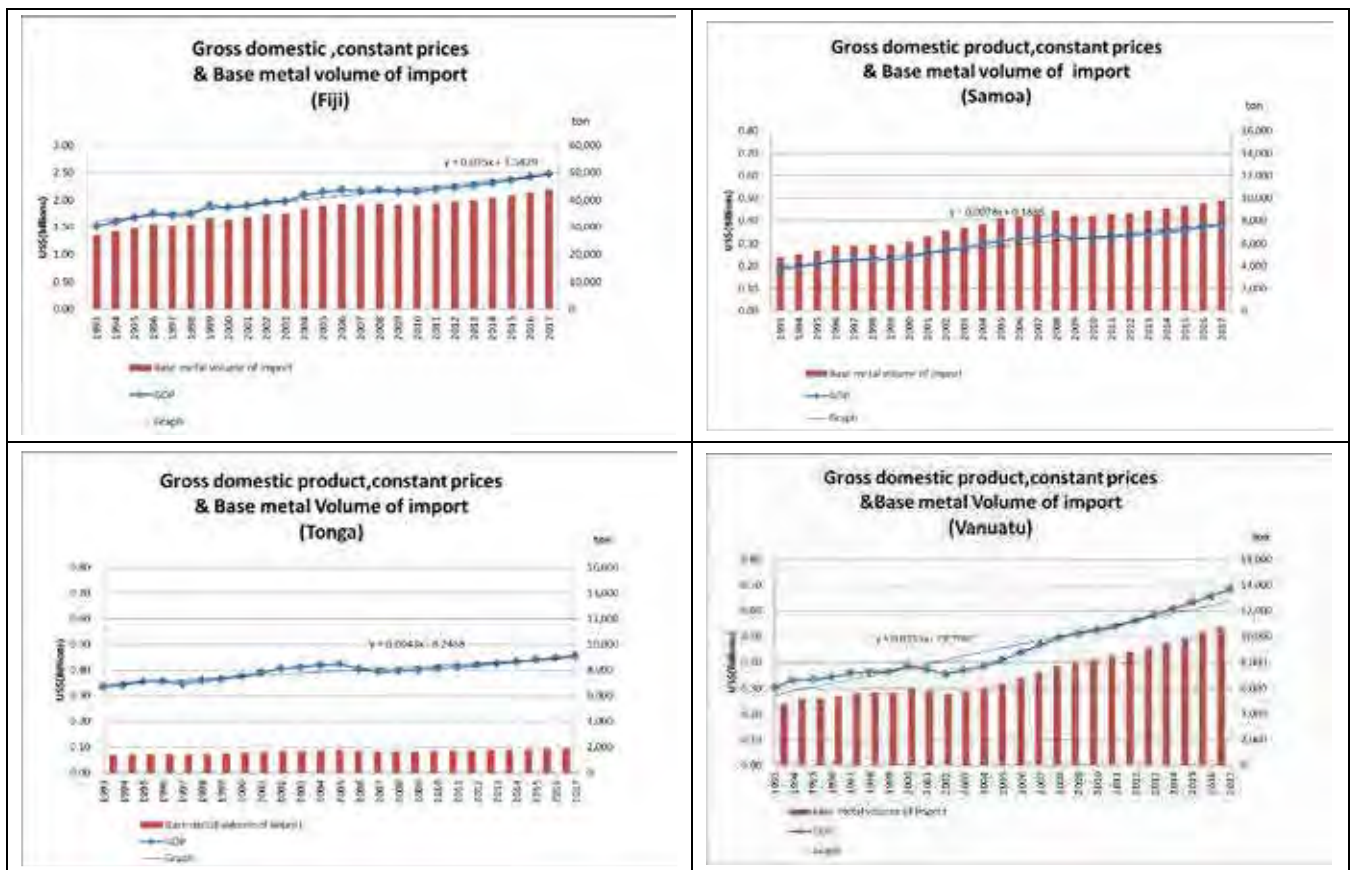
The Recycling Rate depends on the activities of the Collection Contractors and the Recycling Companies in the past few years. How long the Recycling Companies have been active is an important factor. Are the “Other Metal Products” wastes being collected as soon as their life-spans expire, or due to the 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.

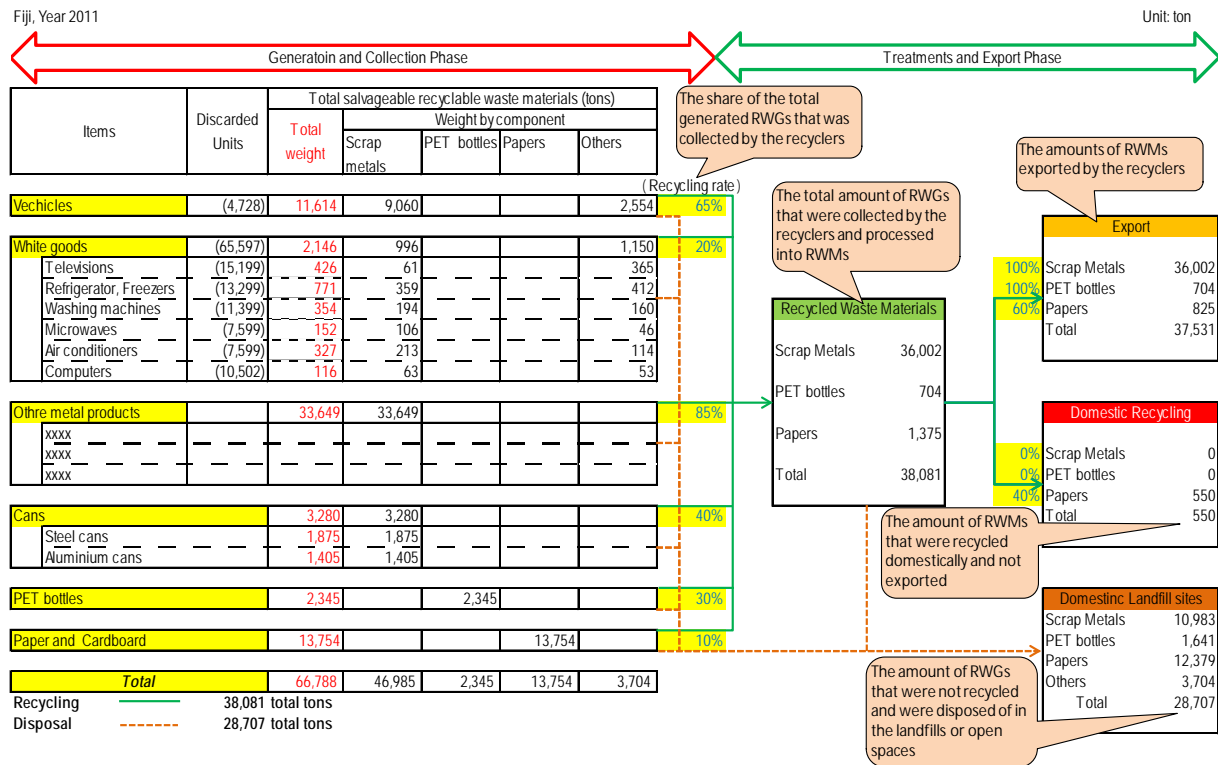


Figure 3-4 Sample flow of the RWGs and RWMs quantities estimation process (for explanation)

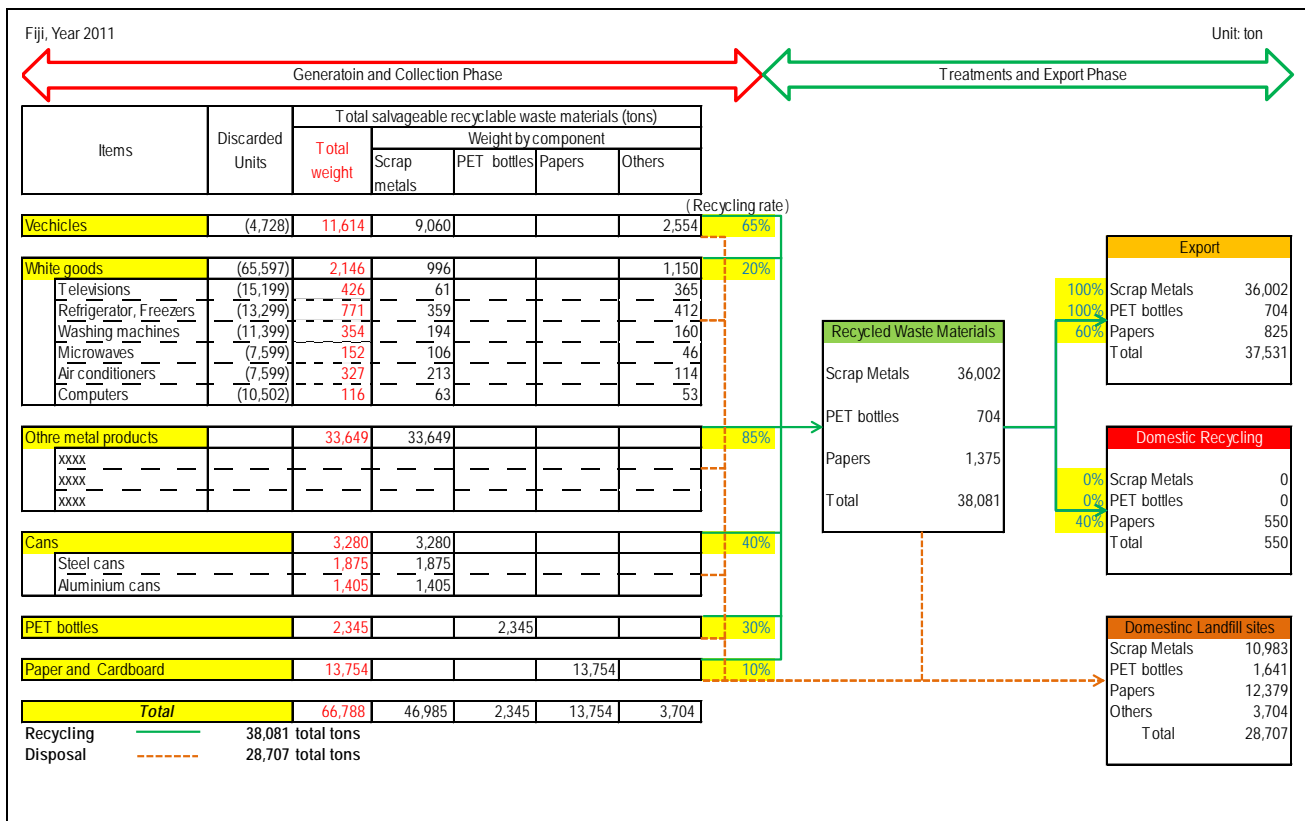


Figure 3-5 Fiji 2011 Recyclable Waste Goods Flow

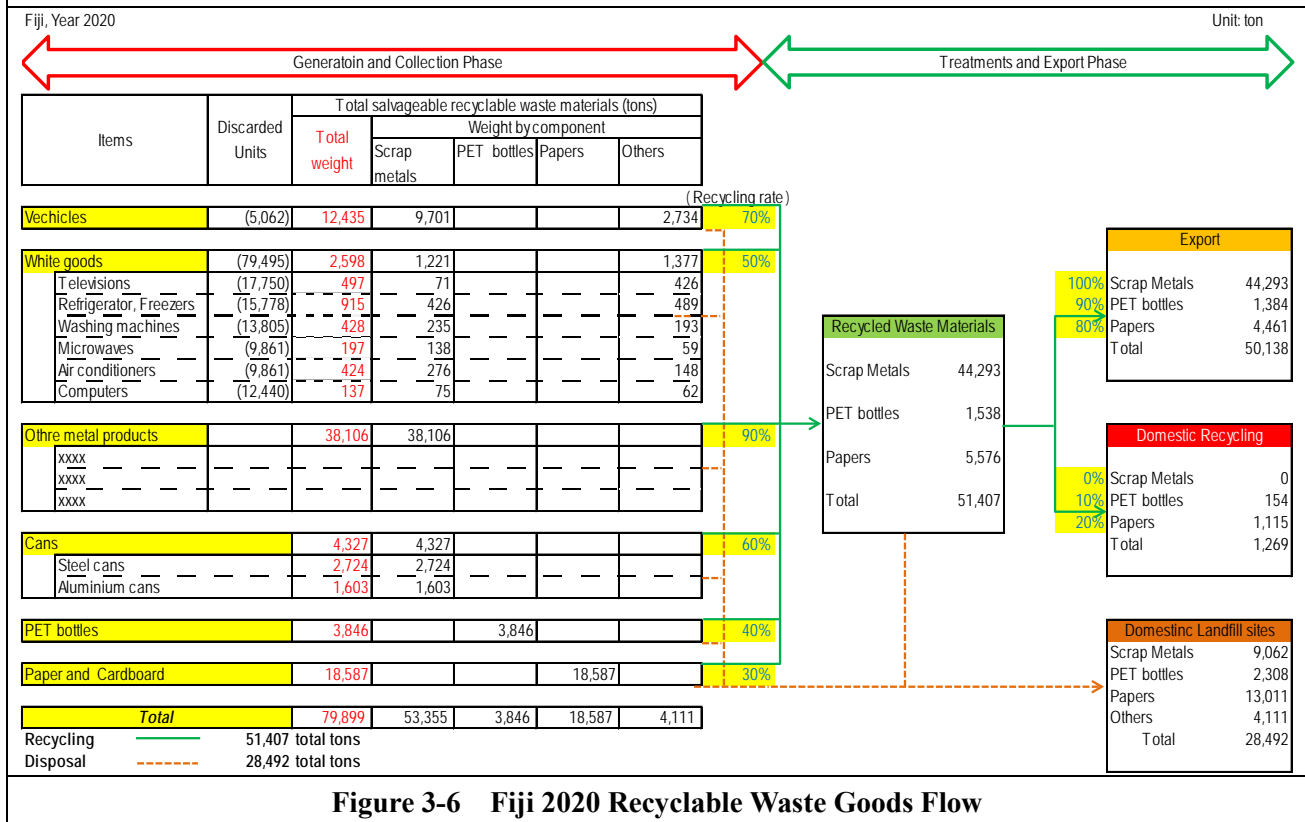


Figure 3-6 Fiji 2020 Recyclable Waste Goods Flow

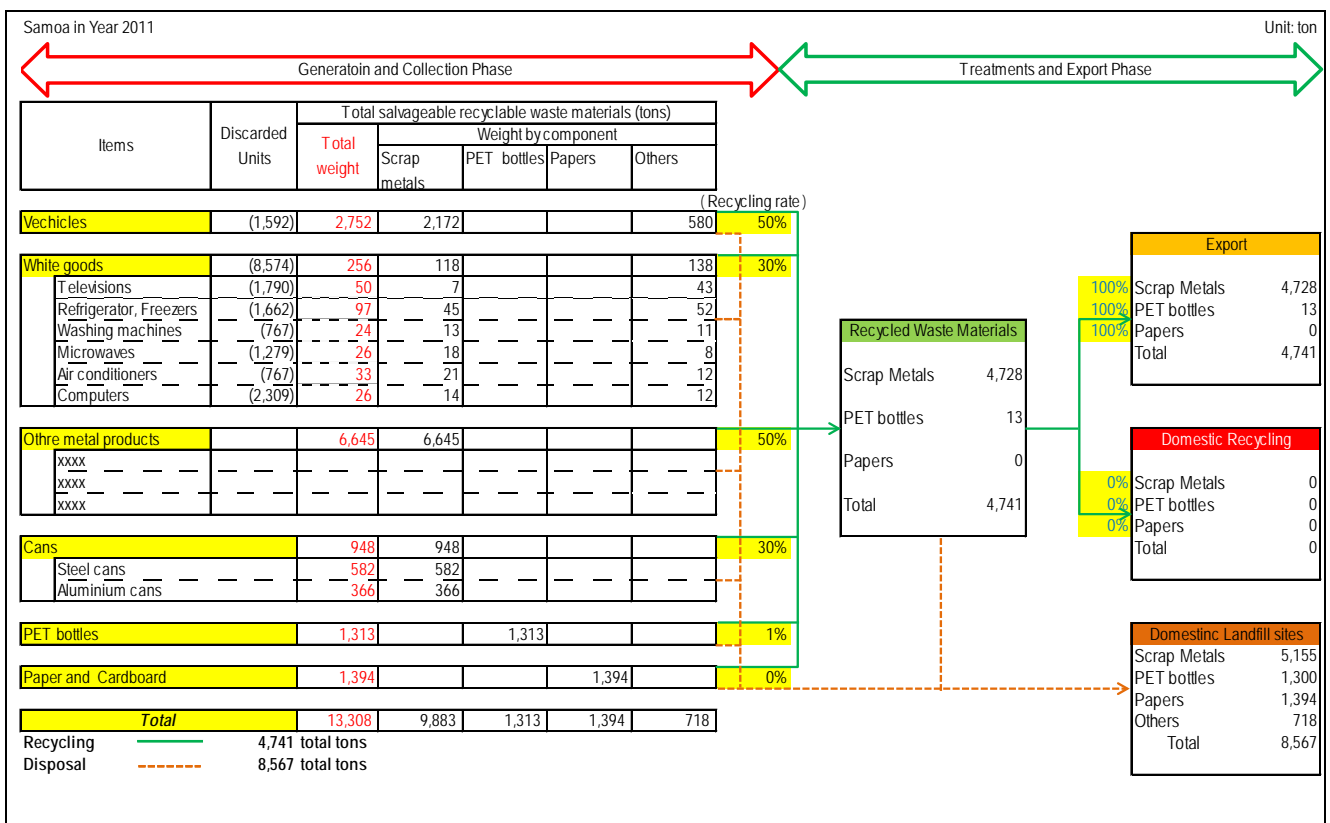


Figure 3-7 Samoa 2011 Recyclable Waste Goods Flow

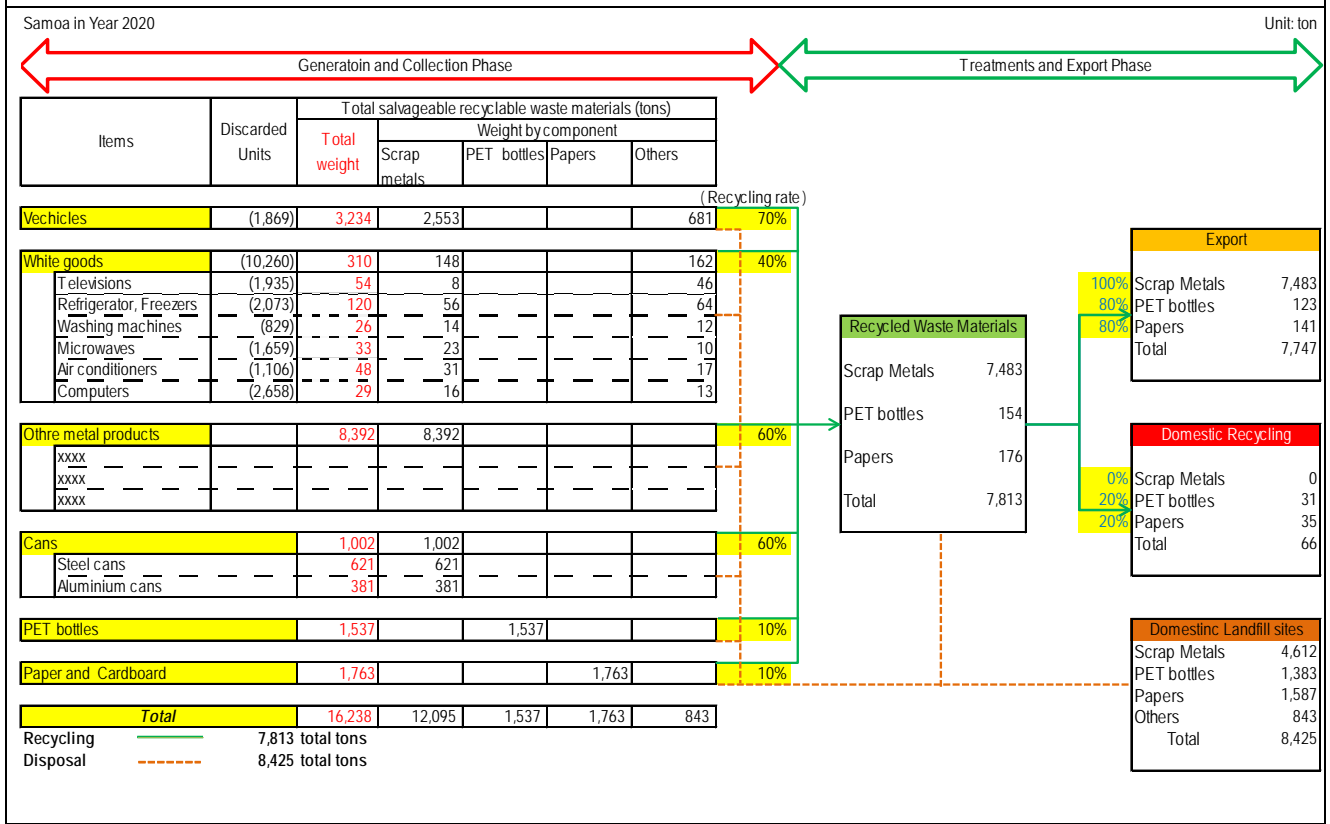


Figure 3-8 Samoa 2020 Recyclable Waste Goods Flow

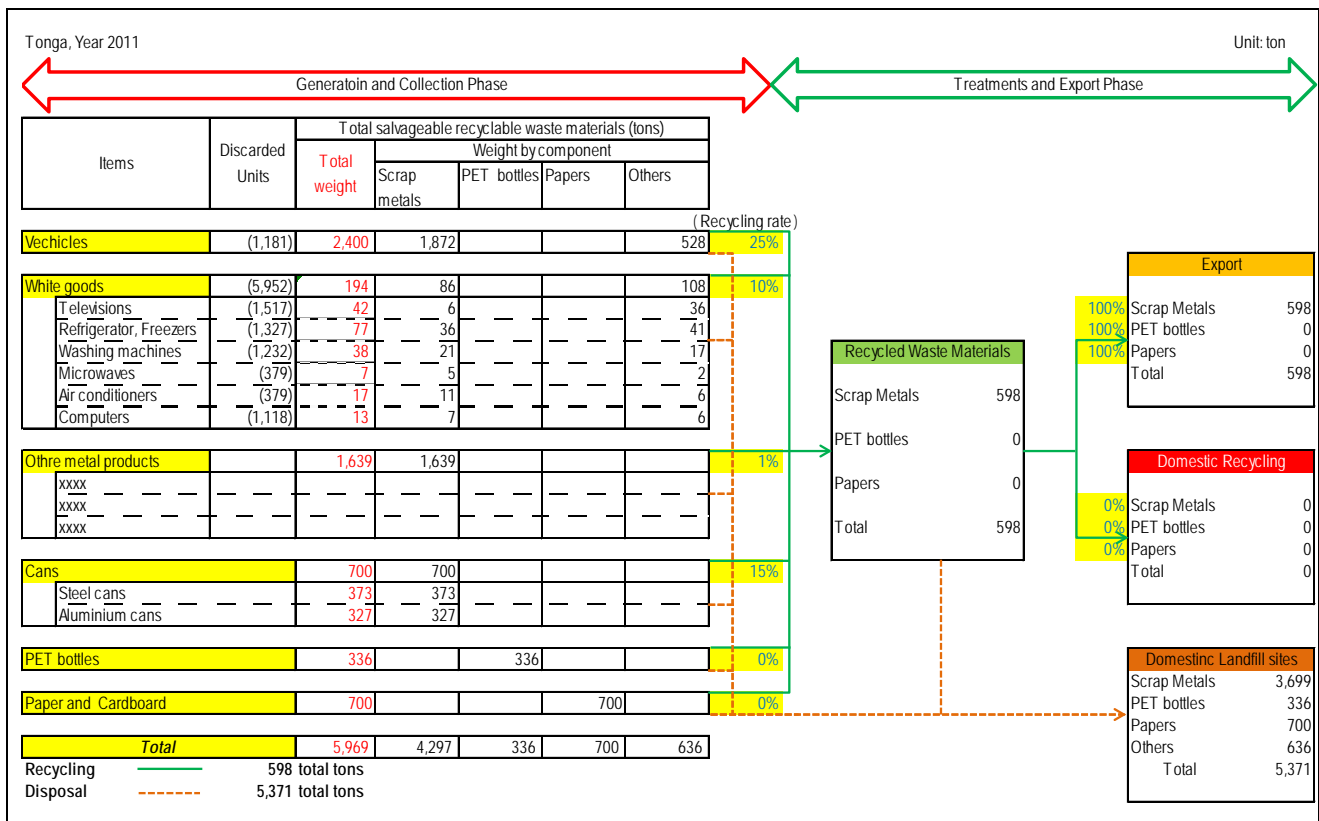


Figure 3-9 Tonga 2011 Recyclable Waste Goods Flow

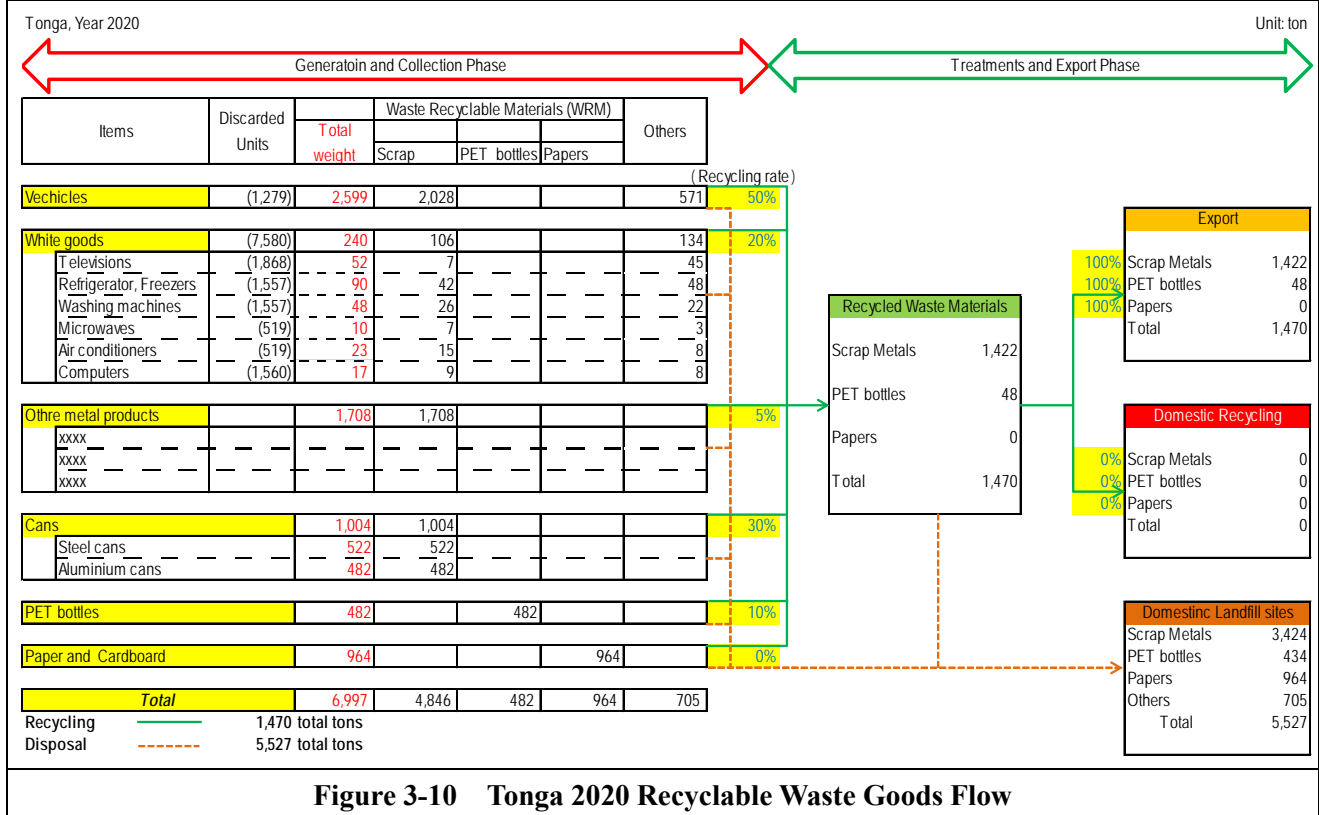


Figure 3-10 Tonga 2020 Recyclable Waste Goods Flow



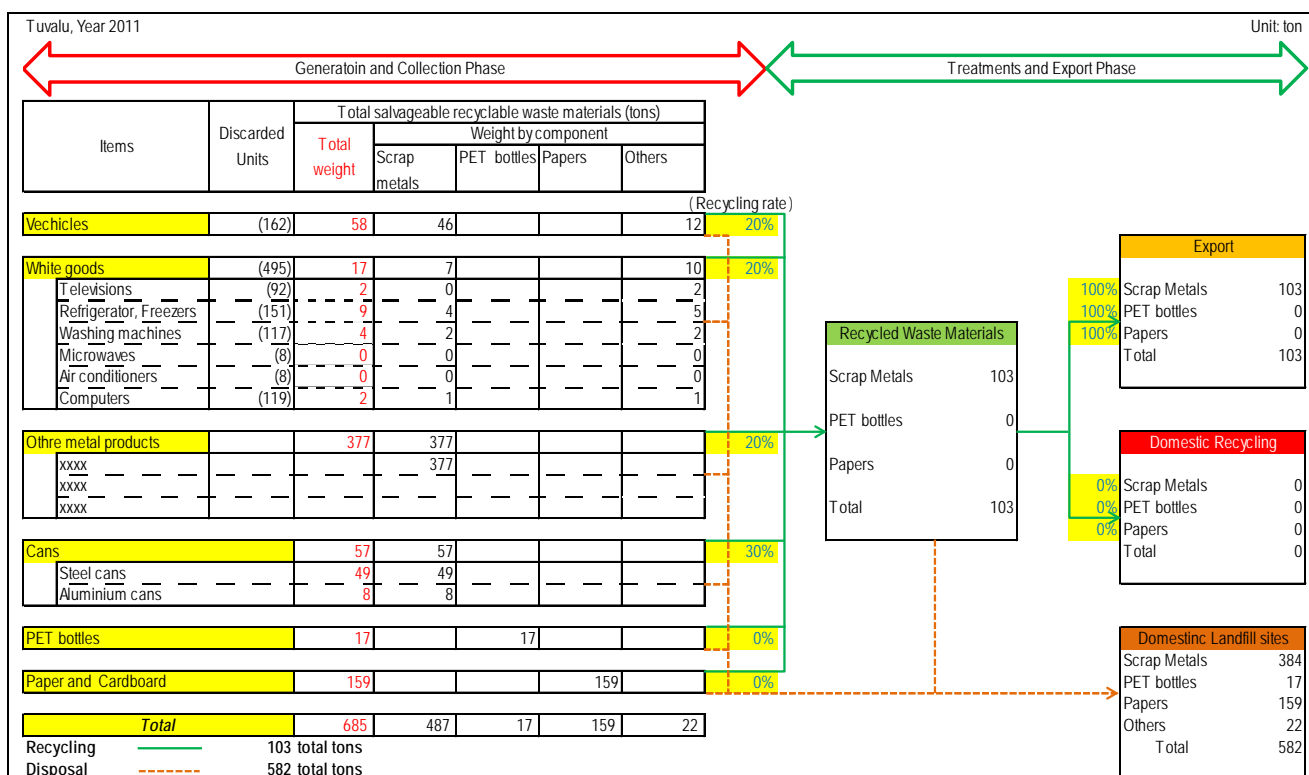


Figure 3-11 Tuvalu 2011 Recyclable Waste Goods Flow

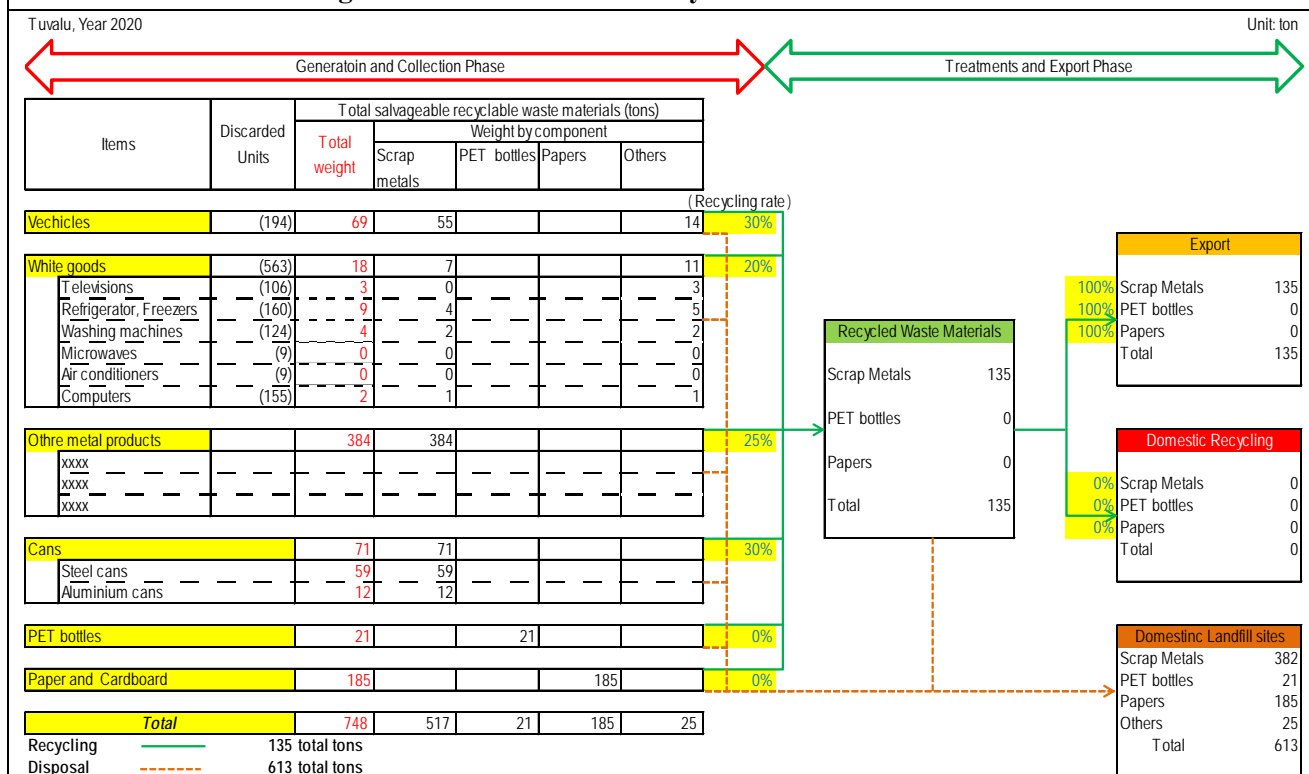


Figure 3-12 Tuvalu 2020 Recyclable Waste Goods Flow

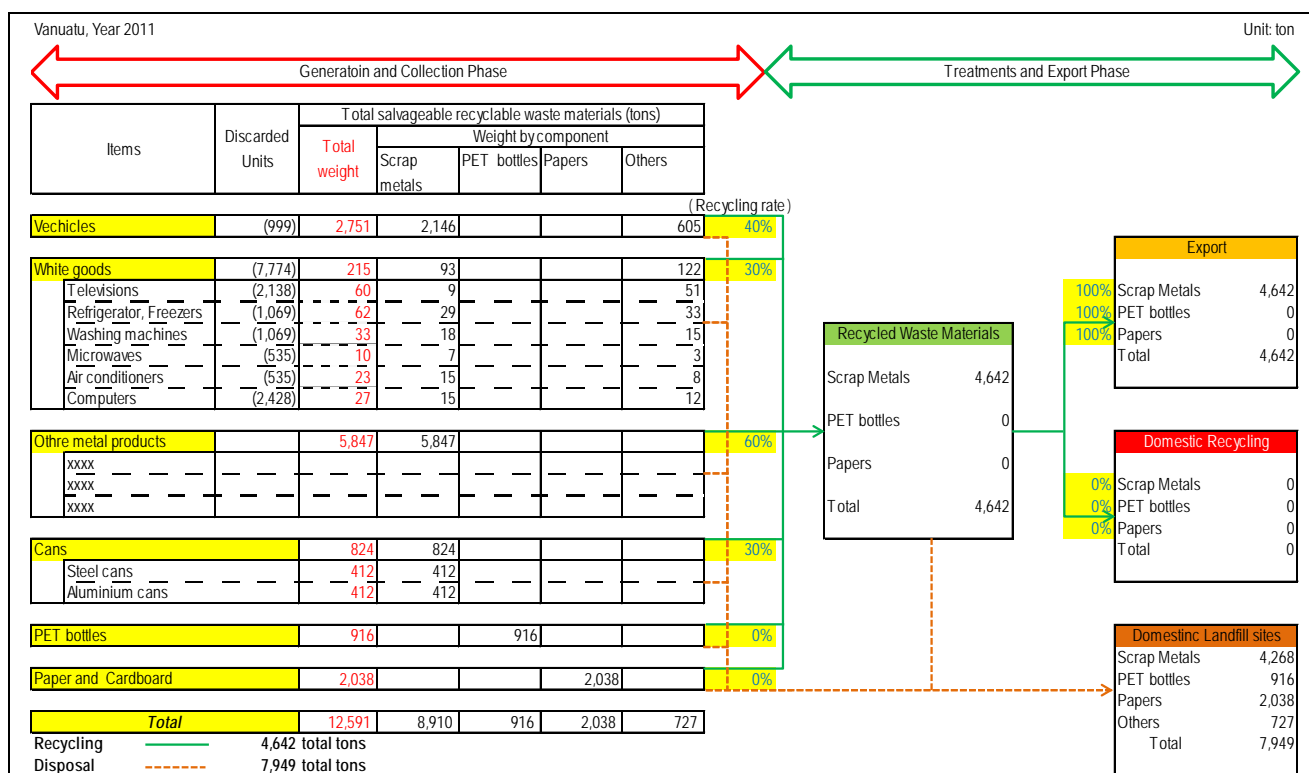


Figure 3-13 Vanuatu 2011 Recyclable Waste Goods Flow

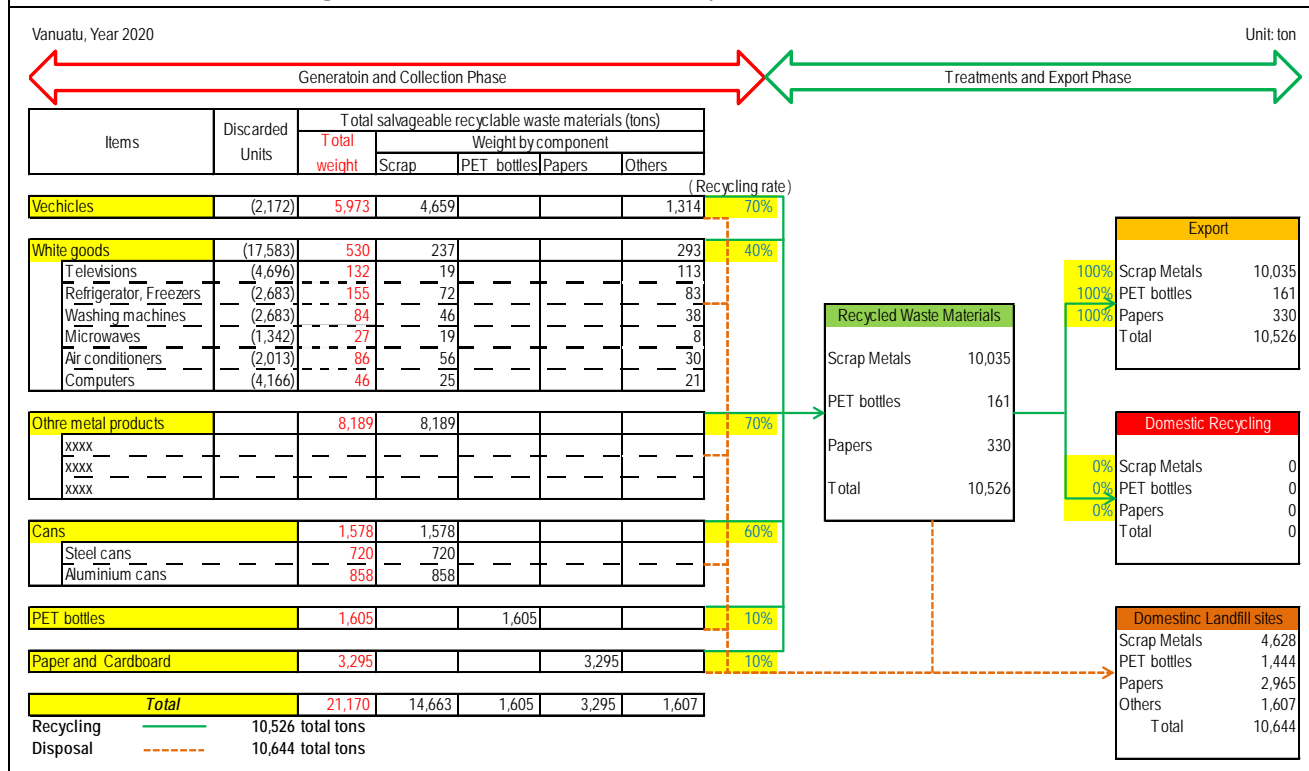
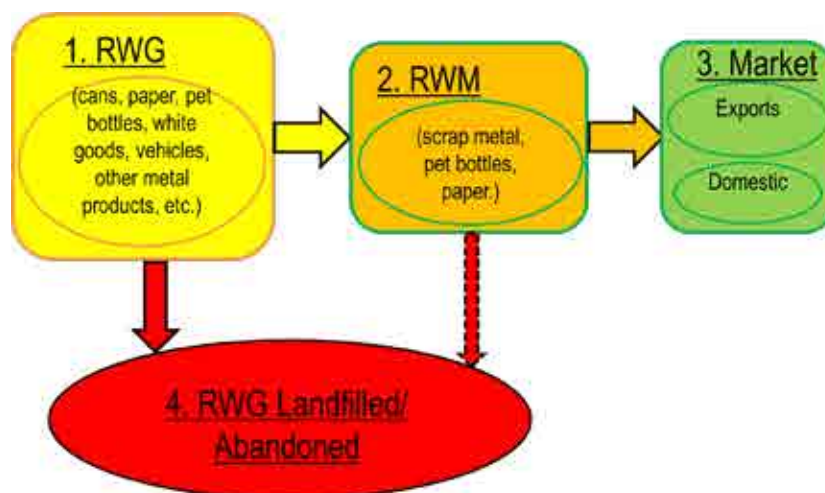


Figure 3-14 Vanuatu 2020 Recyclable Waste Goods Flow

### 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