

**The Republic of the Philippines  
Cebu City Solid Waste Management Board**

**The Republic of the Philippines  
Collaboration Program with the Private  
Sector for Disseminating Japanese  
Technology for Electronic Waste  
Recycling System in Philippines**

**Final Report**

**July, 2017**

**Japan International Cooperation Agency (JICA)**

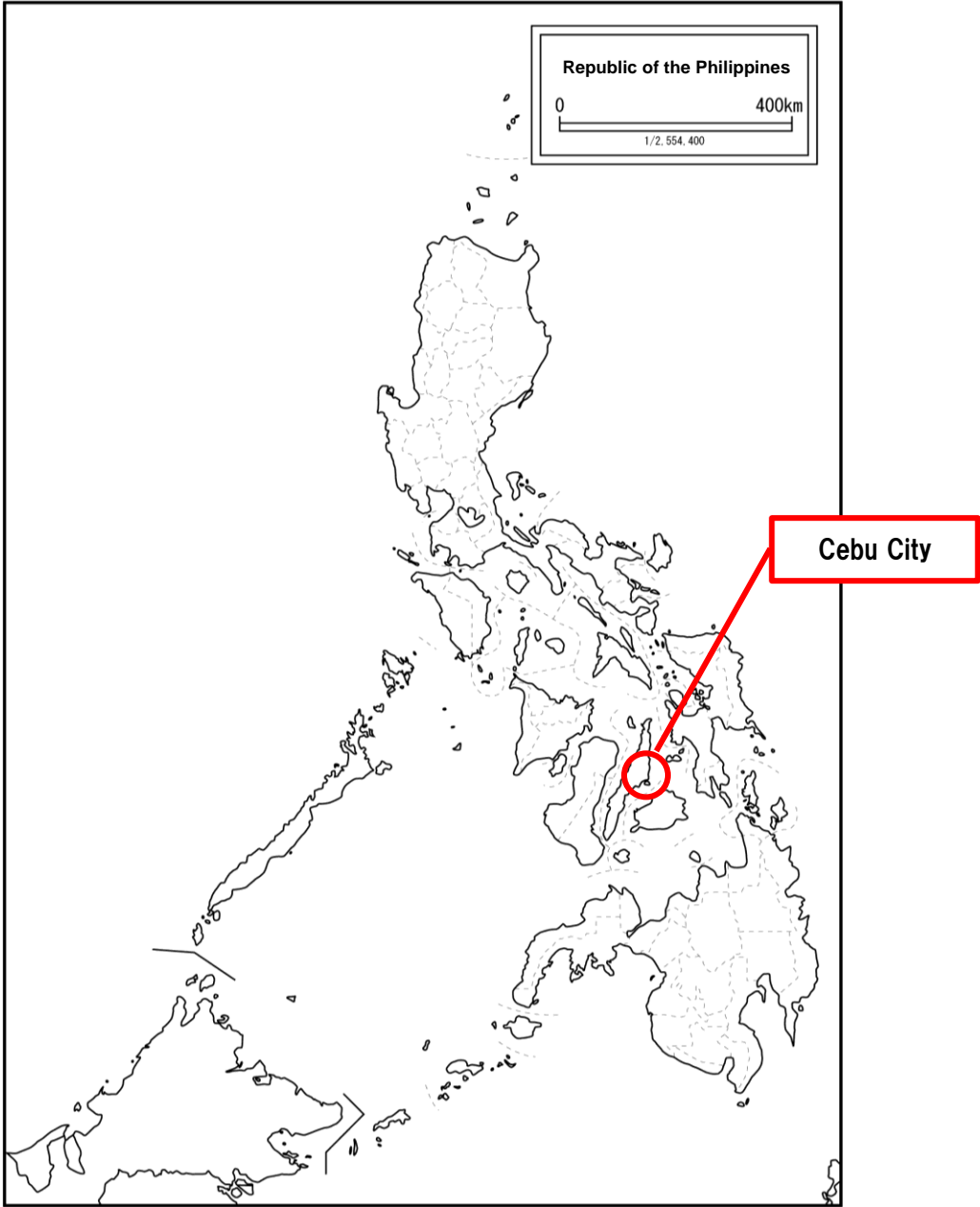
**Nippon Magnetic Dressing Co., Ltd**

OS
JR
17-062

Program Location .....	i
Abbreviations table .....	ii
1. Program Outline .....	1
1.1. Background .....	1
1.2. Target Technology .....	1
1.3. Program Objective.....	2
1.4. Implementation Contents .....	2
1.4.1. Schedule .....	2
1.4.2. Implementation Structure.....	3
1.4.3. Implementation Contents.....	4
2. Achievement and Business Development .....	6
2.1. Program Achievement.....	6
2.2. Business Development Prospect .....	14
2.3. Reason for Business Development.....	14
2.4. Remaining Challenges and counterplan for Business Development .....	15
3. Collaboration Possibility with ODA .....	15

# Program Location

This program was conducted in Cebu City, Philippines. Figure 1 shows the program location in the Visaya Region.



**Figure 1: Program Location**

Source: Writing on map by "Hakuchizu senmonten"  
(<http://www.freemap.jp/itemFreeDIPage.php?b=asia&s=phillipines>)

## Abbreviations table

Abbreviation	Definition
BPM	Business Process Management
CCENRO	Cebu City Environment And Natural Resources Office
CCSWMB	Cebu City Solid Waste Management Board
DENR	Department of Environment and Natural Resources
DILG	Department of the Interior and Local Government
DPS	Department of Public Services
EPR	Extended Producer Responsibility
EMB	Environmental Management Bureau
E-waste	Electronic Waste
FS	Feasibility Study
IGES	Institute for Global Environmental Strategies
IRR	Implementation Rule & Regulation
IRR	Internal Rate of Return
JICA	Japan International Cooperation Agency
JV	Joint Venture
LGU	Local Government Unit
MRF	Material Recovery Facility
NMD	Nippon Magnetic Dressing Co.,Ltd
ODA	Official Development Assistance
PCB	Printed Circuit Board
TSD	Treatment/Storage/Disposal
WEEE	Waste Electrical and Electronic Equipment

## **1. Program Outline**

### **1.1. Background**

The volume of E-waste generation is growing rapidly in the Philippines due to the economic growth and the problem of E-waste disposal has become apparent. In general, E-waste disposal in developing countries including the Philippines is conducted by the informal sector, which is represented by the individual or small business players doing business outside the law or regulations. It is common understanding that the operation of informal sector causes environmental pollution and health issues because these informal operators usually buy E-waste from their clients and conduct inappropriate treatment by manually using cheap labor cost.

Following these conditions, the Department of Environment and Natural Resources (DENR) in the Philippines promulgated a new E-waste management law that is called DAO 2013-22 in December 2013. An important point of DAO 2013-22 is that it was enacted covering all E-waste producers including industries, commerce, business establishments, educational institutions, and households. Conventionally, regulation of hazardous waste including E-waste was imposed for the companies, but it was not subject to regulation when it occurred from households. According to the DAO 2013-22, local governments are responsible to collect E-waste from households and small commercial facilities through the establishment of MRF at Barangays. However, it is very challenging for local government to collect the E-waste from households in the current situation because informal sector usually buys E-waste from them. Although DAO 2013-22 gives the policy in the large framework for E-waste, details of implementation must be decided by each local government. Thus, establishment of an effective ordinance within the local government is indispensable to promote appropriate E-waste recycling under DAO 2013-22.

In response to these circumstances, we have supported the formulation of ordinances based on DAO 2013-22 in Cebu City, based on the experience of Kitakyushu City and its good relationship with the city of Cebu in the environmental field. We conducted a pilot project to collect discarded cellphones generated from households in 2014 under the cooperation with the Environmental Councilor of Cebu City. Base on the result of this pilot project, Cebu City has enacted and officially announced a unique ordinance called "AN ORDINANCE PROVIDING FOR THE MANAGEMENT OF SPECIAL WASTES IN THE CITY OF CEBU, PROVIDING FEES AND IMPOSING PENALTIES FOR NON-COMPLIANCE THEROF (No. 2459)" in 2016. The purpose of this ordinance is to manage special waste including E-waste appropriately based on DAO 201-22. This ordinance has a possibility to change current E-waste flow because it has penalty article for the informal sector. As a next challenge, there is not appropriate recycling system and treatment infrastructure in Cebu City. Therefore, building an appropriate recycling system has been required by Cebu City under Ordinance No. 2450. The Nippon Magnetic Dressing Co., Ltd, which has enough experience and technology about E-waste recycling based on the Japanese E-waste recycling law, therefore have a great opportunity to contribute to building appropriate E-waste recycling system and technology in Cebu City. Based on the above background, this program was implemented aiming to build appropriate E-waste recycling business model in Cebu City.

### **1.2. Target Technology**

The technology for this program is to collect precious and rare metal recovery facility from E-waste and PCB. In the target country of this program, the Philippines, rare metal recovery from E-waste is mainly carried out by manual dismantling. There is no appropriate technology at present without our technology.



**Figure 2: NMD metallurgy recovery facility on Hibiki plant at Kitakyushu City**

### **1.3. Program Objective**

The main objective of this program is to promote understanding on the importance of establishing an E-waste recycling system that directly contributes to the reduction of Philippine's environmental pollution and to expand NMD's E-waste recycling business opportunities in Cebu, Philippines.

### **1.4. Implementation Contents**

#### **1.4.1. Schedule**

The implementation schedule of this program is shown in Figure 3. Under the program, we conducted the field activities in Cebu five times and an activity in Japan.

The first field activity was conducted in September 2016. During the fieldwork, we presented the program outline, implementation plan, and schedule to local stakeholders such as Cebu City, some Barangays, and local recycling company. We established an agreement successfully with them about our program implementation.

The second and third field activities were conducted in October and November 2016. We conducted a survey on how the Ordinance of Cebu City was implemented and how they operated. We also conducted a survey on the status of current E-waste operation by the informal sector.

An activity in Japan was conducted in February 2017. We invited twelve members including Cebu Mayor, councilors, city officials, Barangay captains and the representatives of the recycling company to Kitakyushu City and provided knowledge and learning about the history of Japanese environmental problems, Japanese E-waste law, Japanese E-waste recycling system, Japanese recycling technology and the role of local government under Japanese E-waste law. Especially, in the field observation, we introduced our E-waste recycling facility of Hibiki factory that is located in Kitakyushu City Eco Town and deepened the understanding of technology. In addition, we assisted to conclude an environmental technology cooperation agreement between Kitakyushu City and Cebu City to jointly work for hazardous waste including E-waste management in Cebu City.

The fourth field activity was conducted in February 2017 after the Japanese study visit of the Cebu delegates. We organized the workshop with Cebu City aiming to operate the ordinance more effectively.

The fifth field activity was conducted in April 2017. During this field work, we held a workshop with DENR aiming to establish an appropriate E-waste recycling system and expansion Ordinance of Cebu to others cities.

**Step①: Kickoff meeting with the members of relevant organizations [ September 2016 @Cebu ]**

- The objectives of the project and project implementation plan were introduced to local stakeholders, such as Cebu City, barangays and local recyclers to establish an agreement on the activity plans.

**Step②: Study for current condition of E-waste recycle in Cebu [ October and November 2016 @Cebu ]**

- A study was conducted to understand the operational conditions of special waste management ordinance in Cebu.
- A study was conducted regarding the current situation of E-waste recycle by the informal sector.

**Step③: Training program in Kitakyushu, Japan [ February 2017 @Kitakyushu ]**

- The knowledge transfer for the city's role within Japanese legal system and recycling technology was conducted, in which 12 people among the E-waste recycle organizations, such as Cebu City councilor, waste-related organizations, Barangay leaders, and local recycling companies etc, were invited to Kitakyushu.

**Step④: Workshop to solve the problems through the comparative study [ February 2017 @Cebu ]**

- Based on the issues identified Step② and the result of training program Step③, an effective way to operate recycle system was discussed through the comparison with the operation of various Home Appliance Recycling Law in Japan.

**Step⑤: Workshop for development action plan and proper treatment [ April 2017 @Cebu ]**

- Based on the discussion results of step④, the workshop aimed for constructing appropriate E-waste recycling system and sharing case studies with other local governments was held.

**Figure 3: Program Schedule**

#### **1.4.2. Implementation Structure**

In this program, Cebu City Solid Waste Management Board (CCSWMB) and Local partner candidate recycling company (Since then, it is called a “candidate partner”) were selected as the counter partners in Cebu. CCSWMB has the authority to operate and manage the Cebu City Ordinance No. 2450 and is a key organization in this program. Candidate partner is a well-known recycling company established by the Cebu City Chamber of Commerce and only recycling company that has the license for hazardous waste collection and treatment including E-waste in Cebu City. We had a past experience in implementing pilot program for collecting waste cellphone in Cebu 3 years ago. Based on the past experience and the legal capacity, Candidate partner is now the strongest candidate partner in Cebu for conducting this program with NMD.

On the other hand, Kitakyushu Asian Center for Low Carbon Society, which is one of Kitakyushu City departments, Institute for Global Environmental Strategies (IGES) and NTT Data Institute of Management Consulting, joined this program as external professionals. In addition, the President of Japanese Association Cebu, Ms. Sakurai joined our program as interpreter and coordinator. The implementation structure is shown in Figure 4.

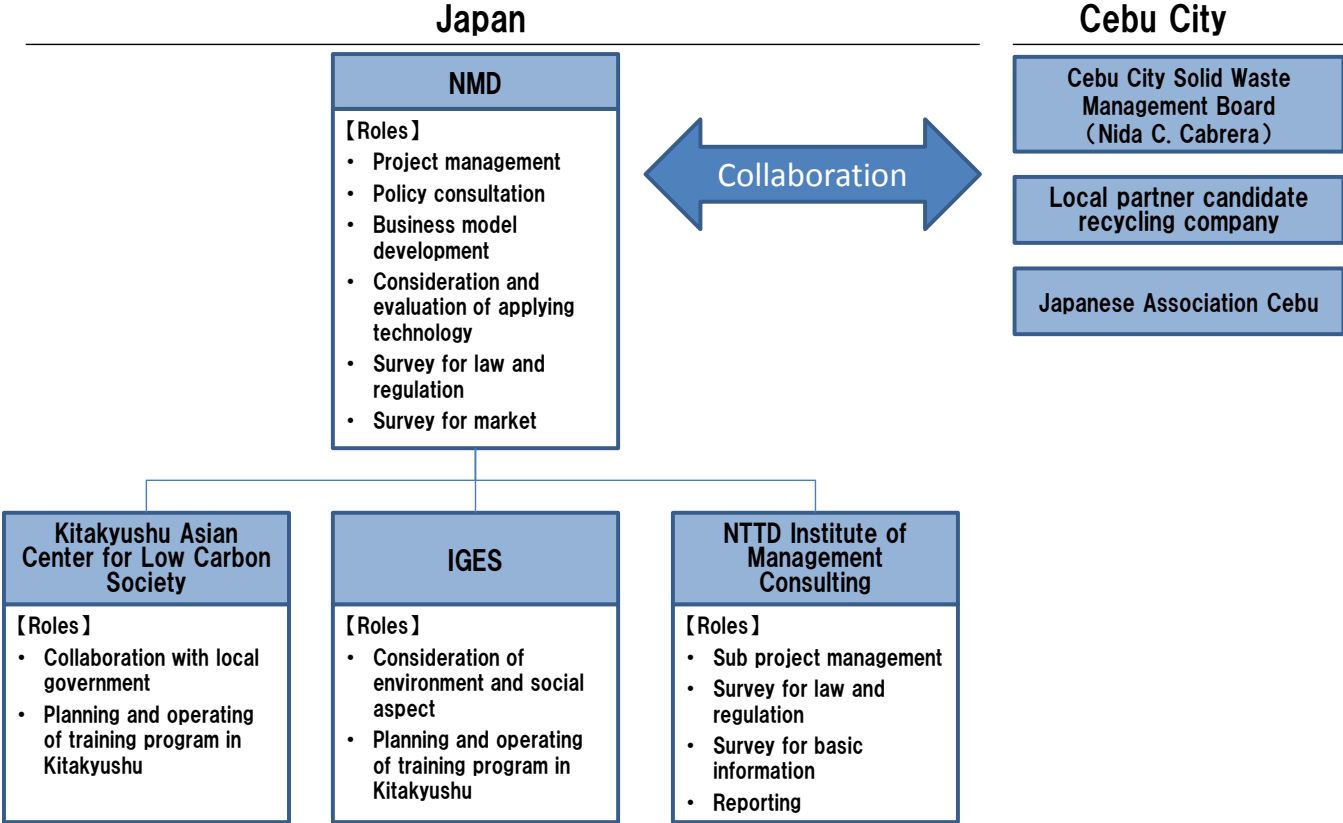


Figure 4: Implementation structure and Roles

1.4.3. Implementation Contents

The tasks, activity plan, implementation contents and goals of this program are shown in Figure 5.

#	Tasks	Activity Plan					Implementation contents	Goals
		1st Site Visit	2nd Site Visit	3rd Site Visit	Training in Japan	4th Site Visit		
1	Survey for current flow and estimated amount of E-waste		■ ■ ■ ■ ■				<ul style="list-style-type: none"> <li>Waste landfill site inspection</li> <li>Junk shop inspection</li> <li>Exchange of opinions at research institutes</li> </ul>	<ul style="list-style-type: none"> <li>Understand current E-waste flow</li> <li>Understand estimated amount of E-waste</li> </ul>
2	Building collaboration between Kitakyushu City			■ ■ ■ ■ ■			<ul style="list-style-type: none"> <li>Setting meeting for mayor of Kitakyushu and mayor of Cebu</li> <li>Conclusion of environmental technology agreement</li> </ul>	<ul style="list-style-type: none"> <li>Concluding the agreement about cooperation for E-waste recycling between Kitakyushu City with Cebu City</li> </ul>



	and Cebu City							
3	Building E-waste collection system	■	■	■	■	■	<ul style="list-style-type: none"> <li>• Consultation for building E-waste recycling system</li> <li>• Comparing Cebu's ordinance with Japanese E-waste recycling law</li> <li>• Holding workshop</li> </ul>	<ul style="list-style-type: none"> <li>• E-waste collecting system at MRF based on Cebu City Ordinance No. 2450 starts actually</li> </ul>
4	Expansion of E-waste collection system to other cities					■	<ul style="list-style-type: none"> <li>• Holding workshop aimed at expansion E-waste recycling system to other cities</li> </ul>	<ul style="list-style-type: none"> <li>• E-waste collecting system at MRF based on Cebu City Ordinance No. 2450 could be deployed in other cities</li> </ul>
5	Construction of E-waste collection channel from company	■	■	■	■		<ul style="list-style-type: none"> <li>• Building relationship with Japanese chamber of commerce Cebu</li> </ul>	<ul style="list-style-type: none"> <li>• Some member companies from Japanese chamber of commerce in Cebu would entrust to Candidate Partner for treatment of their E-waste from office and plants</li> </ul>
6	Providing knowledge about Japanese E-waste recycling system			■	■	■	<ul style="list-style-type: none"> <li>• Providing lecture about Japanese E-waste recycling law</li> </ul>	<ul style="list-style-type: none"> <li>• Candidate partner and Cebu City would understand the detail of Japanese E-waste recycling law and importance of tipping fee in case of appropriate treatment of low value and hazardous E-waste</li> </ul>
7	Providing knowledge about Japanese E-waste recycling technology			■	■	■	<ul style="list-style-type: none"> <li>• Providing lecture about Japanese E-waste recycling technology</li> <li>• Japanese E-waste recycling plant inspection</li> </ul>	<ul style="list-style-type: none"> <li>• Candidate partner and Cebu City would understand the detail and benefit of NMD technology</li> <li>• Candidate partner and Cebu City would show their intention to adopt NMD technology</li> </ul>
8	Capacity building for operator					■	<ul style="list-style-type: none"> <li>• Educating about E-waste hand dismantling and separation</li> </ul>	<ul style="list-style-type: none"> <li>• Candidate Partner operators would be able to dismantle and separate E-waste without any NMD supports</li> </ul>
9	Business model development					■	<ul style="list-style-type: none"> <li>• Evaluation of collected E-waste</li> <li>• Confirming license</li> <li>• Consideration counterplan for informal sector</li> <li>• Discussion about business development plan</li> </ul>	<ul style="list-style-type: none"> <li>• Deciding the E-waste transaction price between candidate partner with NMD</li> <li>• Confirming the each role of NMD and candidate partner in E-waste recycling business</li> <li>• Confirming policy for the informal sector at business implementation.</li> <li>• Development of technology transfer plan.</li> </ul>

Figure 5: Outline of implementation contents and program goals



							<ul style="list-style-type: none"> <li>about their tipping fee for treatment</li> <li>(Time) After August 2017 (Target Cebu City, candidate partner (Action) Kitakyushu City try to build a structure with Cebu City that candidate partner could continue its E-waste recycling business in Cebu based on the cooperation agreement between Kitakyushu City with Cebu City,</li> </ul>
4	Expansion of E-waste collection system to other cities					<ul style="list-style-type: none"> <li>Held workshop with DENR aimed for expansion E-waste recycling system to other cities</li> <li>It is requested that other local government should also implement ordinances of Cebu City.</li> </ul>	<p>Not Fin</p> <p>【Remaining challenges②】</p> <ul style="list-style-type: none"> <li>Candidate partner and NMD should implement the recycling business in the other city which made the same recycling ordinance as Cebu City</li> </ul> <p>【Counterplan②】</p> <ul style="list-style-type: none"> <li>(Time) After August 2017 (Target) Cebu City, candidate partner, DENR (Action) Checking the progress of other cities through Cebu City, CCTF, and DENR.</li> </ul>
5	Construction of E-waste collection channel from company					<ul style="list-style-type: none"> <li>E-waste recycling system conducted by Candidate partner and NMD was introduced to Japanese chamber of commerce</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
6	Providing knowledge about Japanese E-waste recycling system					<ul style="list-style-type: none"> <li>Candidate partner and Cebu City understood the detail of Japanese E-waste recycling law and importance of tipping fee in case of appropriate treatment of low value and hazardous E-waste</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
7	Providing knowledge about Japanese E-waste recycling technology					<ul style="list-style-type: none"> <li>Candidate partner and Cebu City understood the detail and benefit of NMD technology</li> <li>Candidate partner and Cebu City showed their intention to adopt NMD technology</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
8	Capacity building for operator					<ul style="list-style-type: none"> <li>Candidate partner operators are able to dismantle and separate E-waste without any NMD supports</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
9	Business model development					<ul style="list-style-type: none"> <li>Decided the E-waste transaction price between candidate partner with NMD</li> <li>Confirmed the each role of NMD and candidate partner in E-waste recycling business</li> <li>Confirming policy for informal sector at business implementation</li> <li>Developed of technology transfer plan.</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>

Figure 6: Program achievements and remaining challenges

## ① **Survey for current flow and estimated amount of E-waste**

### **【Current E-waste flow】**

We visited and conducted an interview with the University of San Carlos to understand the current situation of E-waste flow and treatment system at households. The E-waste flow and treatment system at households became clearer after this interview and discussions.

It was identified that the main player for E-waste flow in Cebu City is junk shops. In general, Junk shops buy and collect E-waste from households because E-waste has value. However, if the E-waste would be harmful for environment and health condition and difficult to treat such as Lithium-ion battery, or not have valuable materials in it, even junk shops do not buy such E-waste. The junk shops usually buy E-waste, which is collected from households or visiting each house directly and collecting E-waste by handcart, motorbike or truck. In case where the junk shops, which do not mainly deal E-waste, would still collect E-waste because they usually sell E-waste to other junk shops, which deal with E-waste. Collected E-wastes are generally dismantled by hand and sorted by large categories such as plastics, irons, aluminum, printed circuit boards (PCB) and so on. These works, which cause pollution around the area, were conducted on the soil without any consideration for the environment in junk shops. Although there was such a treatment situation in junk shops, Barangay administration seemed not to conduct any crackdown because junk shop worked out of law before.

### **【Estimated amount of E-waste】**

We visited University of San Carlos, which continually conducts study of E-waste and obtained research result of estimated amount of E-waste which was done in 2010. We estimated the amount of E-waste in 2017 using data from San Carlos University and Philippine Bureau of Statistics. Our results are shown in Figure 7.

(Unit per year)

Categories	Unit per household	years of usage	Central Visayas	Bohol	Cebu*	Cebu City	Lapu-Lapu City	Mandaue City	Siquijor
<b>Large household equipment</b>									
Refrigerator	1.5	7.3	282,156	61,364	137,251	43,104	19,053	16,952	4,483
Air conditioning	1.5	3.2	643,668	139,986	313,103	98,331	43,466	38,672	10,227
Television	1.5	6.9	298,513	64,921	145,207	45,603	20,158	17,935	4,743
Washing Machine	1	4.1	334,917	72,838	162,916	51,164	22,616	20,122	5,321
<b>Small household equipment</b>									
Electric fan	1.5	7.4	278,343	60,534	135,396	42,521	18,796	16,723	4,423
Electric Iron	1	5.7	240,905	52,392	117,185	36,802	16,268	14,474	3,828
Rice cooker	1.25	4	429,112	93,324	208,736	65,554	28,977	25,781	6,818
<b>Electrical water</b>									
dispenser	1.25	2.6	660,173	143,575	321,132	100,852	44,580	39,663	10,489
<b>ICT and consumer equipment</b>									
Cell phone	2.75	3.9	968,253	210,577	470,993	147,916	65,384	58,173	15,384
Computer/monitor	1.25	3.1	553,693	120,418	269,336	84,585	37,390	33,266	8,798
Digital camera	1	4.3	319,339	69,450	155,338	48,784	21,564	19,186	5,074
Laptop	1.25	2.6	660,173	143,575	321,132	100,852	44,580	39,663	10,489
Printer	1.25	2	858,224	186,648	417,471	131,108	57,954	51,563	13,636

\*excluding Cebu City, Lapu-Lapu City, and Mandaue City

**Figure 7: Estimated annual amount of E-waste from households in central Visayas**

Source: Compiled by the NMD, 2017

**② Building collaboration between Kitakyushu City and Cebu City**

In this program, we aimed to build solid cooperation between Cebu City and Kitakyushu City. We conducted activities such as supporting for the ordinance in Cebu City and setting of the Mayor's meeting. As a result, in February 2017, Cebu City and Kitakyushu City signed an environmental technology cooperation agreement for the next three years.

**③ Building E-waste collection system**

Regarding the recycling of household E-waste under Ordinance of Cebu City, the role of each partner including Cebu City, Barangay, candidate partner, and NMD to be played was identified and clarified. The role of each partner is as follows: Cebu City is responsible for operation and monitoring of ordinance and provide technical and financial support to Barangays. Barangays are responsible for implementation of MRF operation and waste collection activities. Candidate partner is responsible for transportation and primary disassembly of E-waste collected by barangays. NMD is responsible for appropriate final treatment and resource recovery of printed circuit board, which is not possible to be processed appropriately in the Philippines at the moment. Although these roles are a model at this stage where the amount of collected E-waste is small, when collected amount of E-waste is going to increase enough to invest, it is also supposed to set up a JV with a local partner company. In that time, the roles of each organization will be changed.

**Table 1: Each roles for E-waste recycling in Cebu City (Initial model)**

Subject	Roles
Cebu City	<ul style="list-style-type: none"> <li>• Considering ordinance and IRR</li> <li>• Monitoring for ordinance operating</li> <li>• Certification or recycling company</li> <li>• Supporting Barangay to conduct activities</li> <li>• Registration MRF as an emission point</li> <li>• E-waste transportation from each MRF to central MRF</li> <li>• Preparing tipping fee</li> <li>• Expand efforts to other regions</li> <li>• Awareness raising activities for citizens etc</li> </ul>
Barangay	<ul style="list-style-type: none"> <li>• Collecting E-waste at MRF</li> <li>• Collecting E-waste from households directly</li> <li>• Awareness raising activities for inhabitants etc</li> </ul>
Candidate partner	<ul style="list-style-type: none"> <li>• E-waste transportation from central MRF to JV facility</li> <li>• Collecting E-waste from company and transportation to JV facility</li> <li>• E-waste primary dismantling</li> <li>• Plastics, irons, aluminum sale</li> <li>• Exporting PCB to Japan</li> <li>• Cooperation for awareness raising activities etc</li> </ul>
NMD	<ul style="list-style-type: none"> <li>• Appropriate treatment of PCB in Japan</li> <li>• Resource sale</li> <li>• Technical support to candidate partner</li> <li>• Supporting City and Barangay to operate ordinance etc</li> </ul>

**④ Expansion of E-waste collection system to other cities**

A workshop aiming to expand the E-waste collection model of Cebu City to other cities in the Cebu Region was held at the 5<sup>th</sup> site activity in cooperation with DENR EMB Region 7, which is responsible for central Visaya. Danao City, Naga City, Talisay City, Mandaue City along with Cebu City participated in the workshop, and they seemed to be very interested in the efforts of Cebu City. They showed a positive attitude to construct E-waste recycling system. In addition, Consolacion City and Rioan City have requested Cebu City to provide its original text of Ordinance No. 2450 to learn on how to establish a similar ordinance in their respective cities.

#### ⑤ **Construction of E-waste collection channel from company**

We held a discussion with the Japan Chamber of Commerce in Cebu during the 2<sup>nd</sup> site activity. We introduced the outline of the laws DAO 2013-22, Ordinance of Cebu City and program outline aiming to establish a collection channel with the Japanese companies in the industrial zone of Lapu Lapu. In addition, in the 3<sup>rd</sup> site activity, president and vice president of the Japanese Chamber of Commerce Cebu participated the meeting between Mayor of Kitakyushu and Cebu City as a Japanese delegate.

#### ⑥ **Providing knowledge about Japanese E-waste recycling system**

In order to provide knowledge about Japanese E-waste recycling law and technology, the following activities were conducted in this program.

##### **【Activity in Japan】**

- Study tour and classroom lectures about various home appliance recycling law in Japan
- Observation and practical training of E-waste collection base training
- E-waste treatment plant inspection and classroom training on each elemental technology
- Introduction of citizen enlightenment method in Kitakyushu City  
(environmental education, environmental museum, etc.)

##### **【Activity in Cebu】**

- Introduction of various household appliance recycling laws in Japan
- Introduction of efforts of local administration in Japan
- Provide problem analysis of ordinance in Cebu City through comparative examination with the Japan Recycling Law
- Guidance on proper storage, disassembly, and sorting of E-waste

#### ⑦ **Providing knowledge about Japanese E-waste recycling technology**

In Japanese training program, the lecture about the role of NMD under Japanese home appliance recycling law and inspection of Hibiki recycling plant were provided. Facilities such as crushing machines and sorting machines seemed to be much interesting for participants because there is no same technology in Cebu.

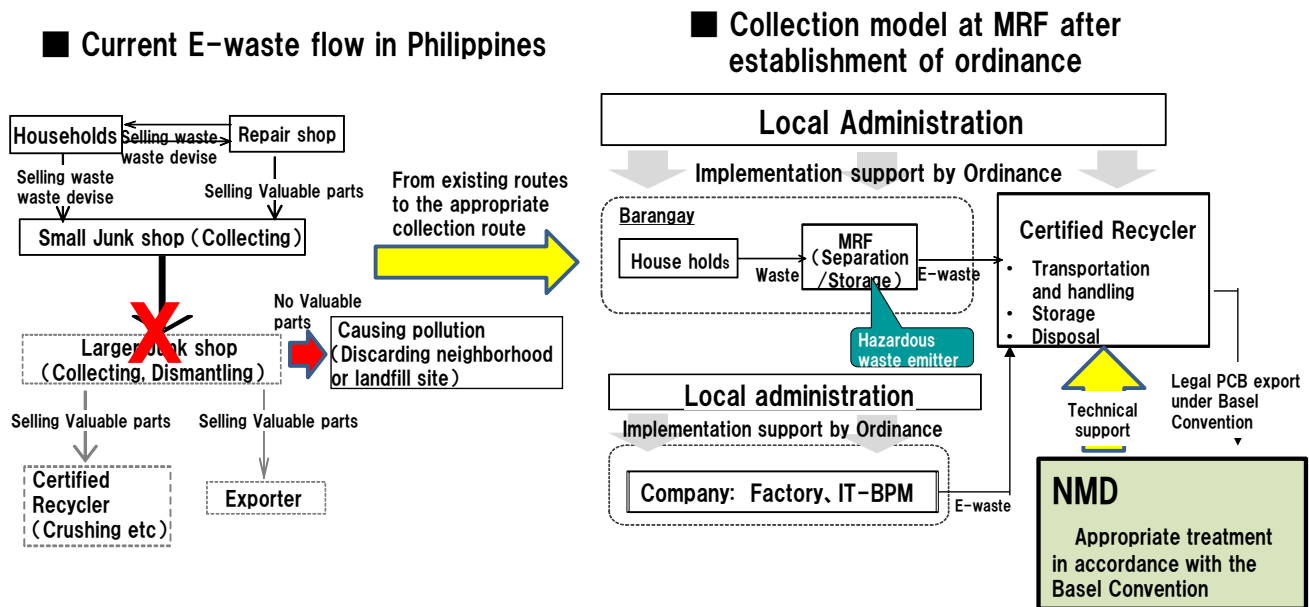
#### ⑧ **Capacity building for operator**

We visited candidate partner's E-waste treatment facility and instructed candidate partner operators about the method of disassembly, sorting and selling aimed at making sure their work safe and enhancing value of their E-waste business. Based on our instruction, candidate partner operator was able to dismantle E-waste, sort and sell appropriately. Implementation of appropriate dismantling and sorting is contributed to improving the business of both Candidate partner and NMD.

⑨ Business model development

**【Initial Model】**

We have constructed an E-waste recycling initial business model in Cebu City with candidate partner. Our business model is described in Figure 8.



**Figure 8: Business scheme for E-waste recycling around Cebu City**

We plan to collect E-waste from both households and business sectors. The collection of E-waste from households will be conducted based on Ordinance, with the cooperation of local administration and Barangay. The collection from business sectors will be conducted based on the DAO 2013-22 which requests business sectors to promote appropriate selection for E-waste recycling company. Candidate partner will store and dismantle the collected E-waste, and sell materials such as iron, aluminum, and plastics that can be reused locally. Waste printed circuit boards that are not able to be properly processed locally are then transported to Japan and conducted appropriate treatment at the NMD's Hibiki Plant in Kitakyushu City. This E-waste recycling model is the initial model at the stage where the collection amount of E-waste is small. In the future, when the E-waste collection volume expands and when it becomes a phase that can be invested locally, Candidate partner and JV will be established and NMD E-waste recycling technology will be introduced to the site.

**【Expansion Model】**

When collected amount of E-waste increase enough to invest facility, we plan to establish JV with a local partner and put our recycling facility in Cebu. For the operation of facilities, the workers of junk shops will be hired as a staff of JV. The future business model and each role after JV establishment and responsibilities in the supply chain are described below.



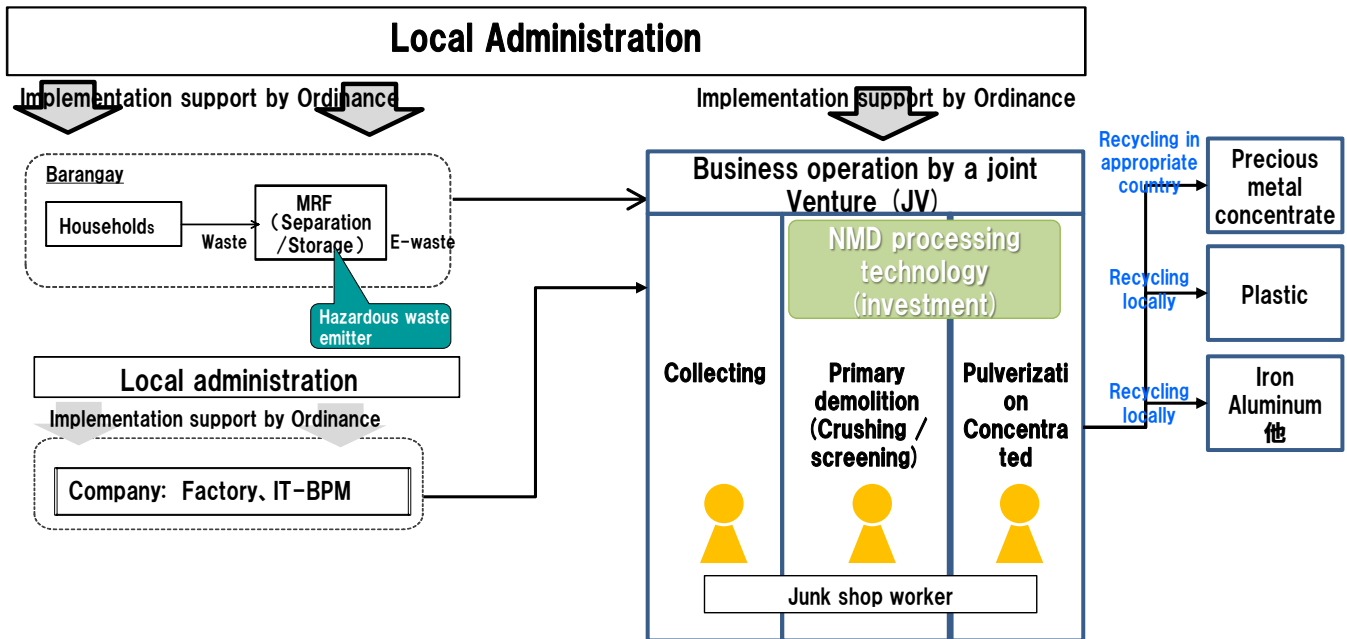
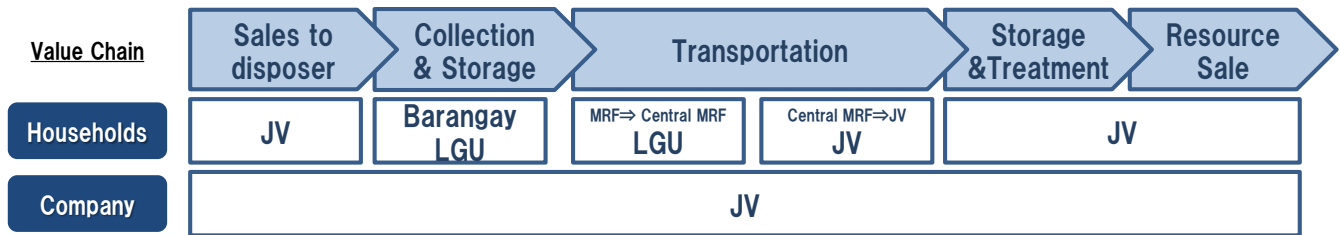


Figure 9: Business scheme for E-waste recycling around Cebu City (Future model)

Table 2: Each role for E-waste recycling after joint venture establishment

Subject	Roles
Local Government (City)	<ul style="list-style-type: none"> <li>Considering ordinance and IRR</li> <li>Monitoring for ordinance operating</li> <li>Certification or recycling company</li> <li>Supporting Barangay to conduct activities</li> <li>Registration MRF as an emission point</li> <li>E-waste transportation from each MRF to central MRF</li> <li>Preparing tipping fee</li> <li>Expand efforts to other regions</li> <li>Awareness raising activities for citizens etc</li> </ul>
Barangay	<ul style="list-style-type: none"> <li>Collecting E-waste at MRF</li> <li>Collecting E-waste from households directly</li> <li>Awareness raising activities for inhabitants etc</li> </ul>
Joint Venture	<ul style="list-style-type: none"> <li>E-waste transportation from central MRF to JV facility</li> <li>Collecting E-waste from company and transportation to JV facility</li> <li>Crushing, separating, fine powder, concentrating</li> <li>Resource sale</li> <li>Cooperation for awareness raising activities</li> <li>Supporting City and Barangay to operate ordinance etc</li> </ul>



**Figure 10: Each role for E-waste recycling on value chain after joint venture establishment**

## 2.2. Business Development Prospect

As a result of this program, each of roles for implementation of E-waste recycling business with Cebu City and local partner candidate partner has been organized, and we have already started collecting E-waste. In addition, printed circuit boards disassembled and sorted in this program have already been transported to Japan as samples. After this, when the amount of E-waste stored in candidate partner will become large, we plan to import PCB from Cebu to Hibiki Plant following procedure under Basel law and implement appropriate treatment.

In E-waste recycling system under Cebu Ordinance, the responsibilities of each organization were confirmed in this program. Cebu City is responsible for the operation and monitoring of the ordinance and Barangay's support. Barangay is responsible for the management MRF and E-waste recovery activities. Candidate partner is responsible for transportation and hand dismantling. NMD is responsible for implementing appropriate treatment and resource recovery.

Regarding E-waste from the company, we introduced our recycling system to the Japan Chamber of Commerce in Cebu through this program and obtained a positive comment on the future possibility of collaboration. Candidate partner is responsible for transportation E-waste from companies to candidate partner facility and implementation hand dismantling. NMD is responsible for implementing appropriate treatment in Japan.

In the future, when the amount of collected E-waste expands enough to invest, we assume that we will shift from initial model to expansion model with combination of manual and some preliminary mechanism.

## 2.3. Reason for Business Development

We decided to start E-waste recycle business in Cebu because each role and responsibility for E-waste recycle could be confirmed in this program. However, we need approximately 40 ton PCB per month in order to invest and introduce our recycling facilities. It was not possible to collect this quantity at soon that we decided to utilize the already available infrastructure without any capital investment and implement the recycling plan to minimize our business risk until a certain amount of recovery volume can be secured in the future. In this initial model, candidate partner conducts hand dismantling and sells resources which are non-hazardous and easy to use such as plastics, irons, and aluminum. Candidate partner exports only PCB which is difficult to treat in Cebu to Hibiki plant in Kitakyushu and NMD implements appropriate PCB treatment. Of course, although it also needs the cost to transport PCB to Japan and implement PCB treatment in Hibiki plant, it is possible to cover the cost by receiving tipping fees.

## **2.4. Remaining Challenges and counterplan for Business Development**

After this program, the biggest challenge to expand E-waste recycle business in Cebu is to collect E-waste on a scale that will make capital investment possible. If the amount of E-waste collected is small, it is difficult to invest and introduce our facilities because it means the same as there are no raw materials for product factory in its business scale.

For the time being, we will focus on expanding E-waste collection from the company as a strategy. We are expecting to receive a stable amount of E-waste from the company because companies are regulated to request certified recycling company, such as candidate partner, to treat their hazardous waste. On the other side, it needs a long time to collect stable amount of E-waste from households for the reason that people must learn about law and ordinance and take environmental education to promote to bring their E-waste to MRF. Although companies have been regulated to request certified recycling company to treat their hazardous waste since before, in general, companies sell their E-waste as second-hand goods to the non-certified company. In response to this situation, DAO 2013-22 decided to separately designate E-waste from the company as M506 and obligate appropriate treatment. As companies-owned E-waste is individually managed with M506, it becomes difficult for companies to sell E-waste, making it easier for certified recyclers to collect E-waste than before. Taking this opportunity, we will aim to secure E-waste quantity by implementing business activities with candidate partner to expand collecting E-waste from companies. With regard to E-waste from households, we intend to expand the collection of E-waste by establishing a better understanding of citizen's awareness, through support activities to Cebu City in parallel with marketing activities to companies.

## **3. Collaboration Possibility with ODA**

As mentioned above, in order to introduce our E-waste treatment facilities locally, it is necessary to secure enough amount of E-waste collection to recover the investment. However, it is not easy to immediately achieve the expected target. On the other hand, as a matter of fact, the informal sectors will keep conducting collection activity and inappropriate treatment of E-waste which occurs environmental pollution and health damage until then. It is a big problem for Cebu City development.

Our E-waste recycling business is the only project that fully complies with the waste management sub-road map of "MEGA CEBU VISION 2050" formulated by Cebu City, Yokohama City, and JICA. Therefore, E-waste recycling project is possible to become a model project in the road map. It can be said that it is desirable to implement the E-waste recycling project with Official Development Assistance Grants or Technical Cooperation scheme. We will introduce our company's E-waste treatment technology to the Cebu early by financial cooperation by ODA. The E-waste treatment technology introduced in Cebu could contribute to promoting understanding of government officials, local administration officials, companies, and people through inspection and provide junk shop workers opportunity to learn how to treat E-waste appropriately through site training. In addition, there is a possibility to collaborate with educational organization or citizen group about providing environmental education at the plant.