

Surabaya city government

Summary Report

Indonesia

Pilot Survey for Disseminating SME's
Technologies for Recycling, Processing and
Composting of Waste in Surabaya

September, 2016

Japan International Cooperation Agency

Nishihara Corporation

1. BACKGROUND

In large cities of Southeast Asian countries, such as Republic of Indonesia (hereafter Indonesia), the capacity of final disposal sites for domestic waste (which refers to waste from household) is insufficient, due mainly to the steep rise in consumption as a result of the synergistic effect of the increase in population and economic development.

In 2012, Nishihara Corporation constructed “Super Depo (intermediate facility for recyclable waste)” and conducted “Pilot Project on Intermediate Waste Treatment / Recycling in Surabaya, Indonesia”. We found that the 60% of the domestic waste was organic. To reduce the amount of waste dumped at the disposal site, the key point will be “utilization of organic waste”.

2. OUTLINE OF THE PILOT SURVEY FOR DISSEMINATING SME’S TECHNOLOGIES

(1) Purpose

Against the challenge mentioned at “1. BACKGROUND”, Nishihara Corporation will introduce and construct composting facility in Surabaya. And we will conduct the pilot survey to produce fertilizer from organic waste in domestic waste. The organic waste for the pilot survey will be supplied by “Super Depo” under the support from Surabaya City.

The purpose of the study is “to reduce the amount of waste by outsourcing waste treatment business from municipality”.

Kitakyushu City, where Nishihara Corporation is based, has promoted inter-city cooperation with Surabaya City, Indonesia. The aim is to reduce waste and build low carbon cities in collaboration. With the cooperation of both cities, Kitakyushu City currently expects that private companies take part in environmental businesses in Surabaya City. Both Surabaya city and Kitakyushu city will support this study.

(2) Activities

1. Constructing composting facility
2. Technical survey of composting
3. Marketing survey of material of organic fertilizer produced from organic waste
4. Proposal of business model for “Outsourcing waste treatment business from municipality”
5. Operation and maintenance of the facilities.

About point 1, 2, and 3 above, Nishihara Corporation will construct composting facility at Wonorejo, and demonstrate the production and sales of compost (material of organic fertilizer).

About point 4 above, Nishihara Corporation will propose the model for “Outsourcing waste treatment business from municipality” to Surabaya city and Indonesian Government.

About point 5 above, Nishihara Corporation will provide electricity, water, operator, gasoline and other operating and maintenance costs.

(3) Information of Product/ Technology to be Provided

Nishihara Corporation will produce organic fertilizer from organic waste at Composting facility which will be constructed at Wonorejo.

Organic waste will be separated at Super Depo and transported to Wonorejo by Surabaya City government.

At the composting factory, we will construct and install these facilities.

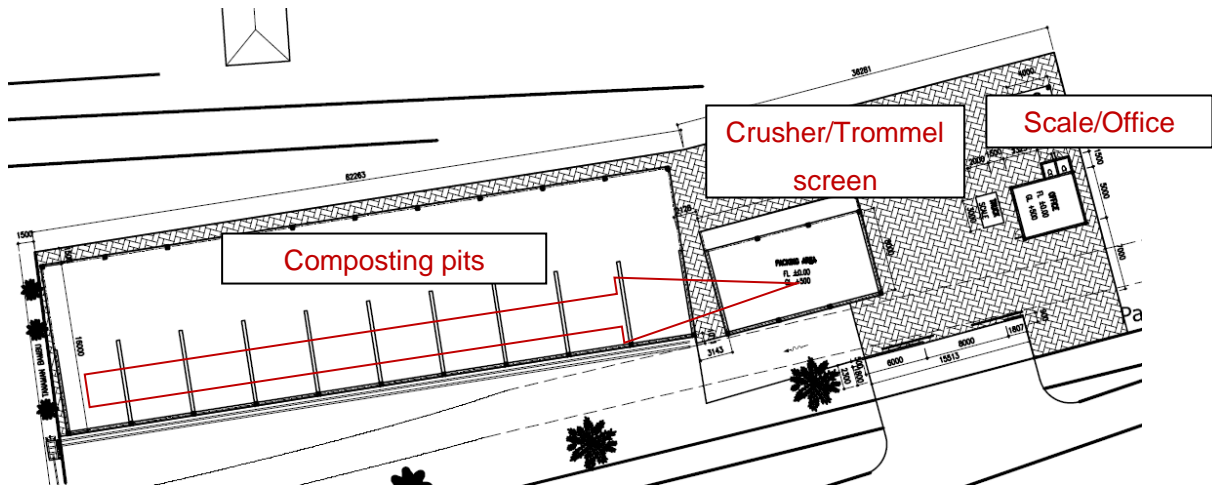


Figure 1 Composting facility

Composting pits

- 10 pits will be constructed at the factory.
- At each pits, the organic waste will ferment at fixed period then transported next pit by Wheel loader.
- Indonesian company will construct these pits as well as factory itself.

Wheel loader (x 1)

- Wheel loader transports the organic waste at the composting facility.
- It will mix and stir the organic waste to accelerate the fermentation process.
- Nishihara Corporation will procure a wheel loader in Indonesia.

Crushers (x1)

- A crusher will be installed.
- Nishihara Corporation will procure a crusher in Indonesia.

Trommel screen (x1)

- A trommel screen will be installed after the fermentation process.
- It will screen the large size of organic waste.

(4) Counterpart Organization

Surabaya city government, Indonesia

(Cleanliness and Landscaping Department of Surabaya city government)

(5) Target Area and Beneficiaries

Public sector of Surabaya city

By utilizing composting system, they can reduce the amount of domestic waste dumped at the existing disposal site. Reduction of waste means saving the cost of treatment of domestic waste.

(6) Duration

From October 2013 to October 2016

(7) Progress Schedule

Items	Period	FY2013												FY2014												FY2015												FY2016											
		9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11									
(1)MM to commence the project																																																	
(2)Design/Layout of composting facility																																																	
(3)Procurement of machineries																																																	
(4)Construction of composting facility																																																	
(5) Installation of machineries																																																	
(6)Operation of SUPER DEPO																																																	
(7)Consideration of technology and business model																																																	
(8)Operating composting facility [1st Phase]																																																	
(9)Composition/quality survey, Marketing by sample from facility																																																	
(10)Preparation for operating composting facility [2nd Phase]																																																	
(11)operating composting facility [2nd Phase]																																																	
(12)Composition/quality survey, Marketing by sample from facility																																																	
(13)Preparation for operating composting facility [3rd Phase]																																																	
(14)operating composting facility [2nd Phase]																																																	
(15)Composition/quality survey, Marketing by sample from facility																																																	
(16)Transfer the facility to Surabaya City																																																	
(17)Reporting and discussion with Surabaya City																																																	
(18)Reporting and discussion with ministries of Indonesia																																																	
(19)Reporting and discussion with Japanese embassy and JICA																																																	
(20)Environmental Impact Assessment																																																	
Reporting																																																	

■ In Indonesia □ In Japan

(9) Implementation System

Japanese Side: Nishihara Corporation
Kitakyushu city
Institute for Global Environmental Strategies (IGES)
NTT Date Institute of Management Consulting, INC.

Indonesian Side: Surabaya City government

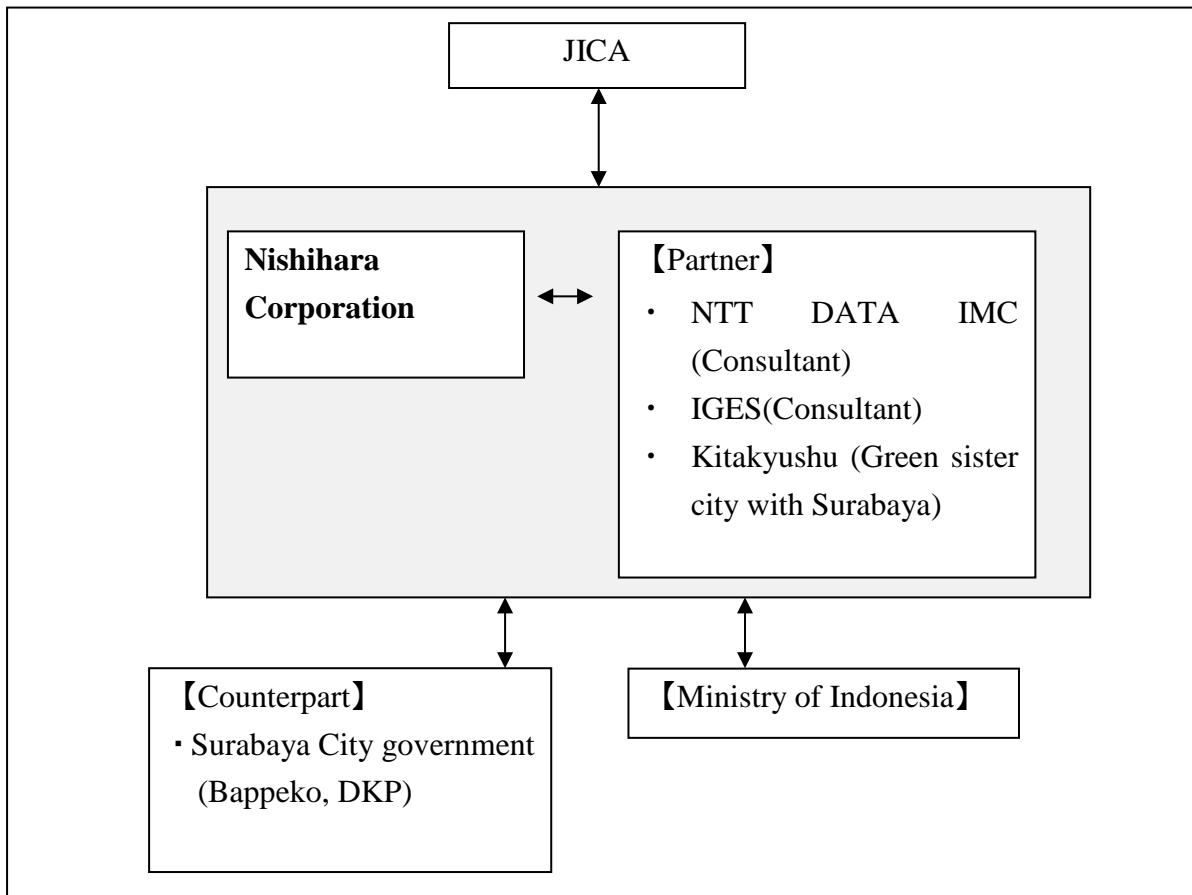


Figure 2 Implementation System

3. ACHIEVEMENT OF THE SURVEY

(1) Constructing composting facility

We have constructed a composting facility in Wonorejo. The construction work was finished in November 2014. The outline of this facility is as follows;

- Ground area : 3,500m²
- Capacity: 2.4t/day of organic waste
- Facilities/Machinery :Building, Composting pits, Wheel loader (x 1), Crusher (x1), Trommel screen (x1)

The function of facilities/machineries are as follows;

Composting pits

- 10 pits were constructed at the factory.
- At each pits, the organic waste is fermented at fixed period then transported next pit by Wheel loader.
- Indonesian company will construct these pits as well as factory itself.

Wheel loader (x 1)

- Wheel loader transports the organic waste at the composting facility.
- It mixes and stirs the organic waste to accelerate the fermentation process.
- Nishihara Corporation procured a wheel loader from Indonesian provider in September, 2014.

Crushers (x1)

- A crusher will be installed.
- Nishihara Corporation procured a crusher from Indonesian constructor, and installed in December 2014.

Trommel screen (x1)

- A trommel screen screens the large size of organic waste.
- Nishihara Corporation procured a trommel screen from Indonesian constructor, and installed in December 2014.



Figure 3 Facility



Figure 4 Left: Scale, Right: Pits



Figure 5 Wheel loader mixing and stirring the organic waste



Figure 6 Left: Crusher, Right; Trommel screen

(2) Technical survey of composting

We started “Technical survey of composting” from May 2015 at Wonorejo. Firstly, we tried to establish the process to product composts which would be utilized as materials to manufacture organic fertilizer.

After several processes to test 1. organic waste from Super Depo, and 2. organic waste from market, we inspected the composition and quality of compost. The result of inspection showed that both of 1. and 2. met the standard of Indonesia as organic fertilizer. And we decided to use 1. organic waste from Super Depo only to produce composts.

Secondly, we established an ideal process to produce composts from organic waste. The following figure shows that Input organic waste needs 9days, Fermentation process needs 14days and Trommel screen and preparation for shipping need 14day. And one process require 44 days. And we found this composting facility could accept 2.4 tons/day of organic waste as material of compost.

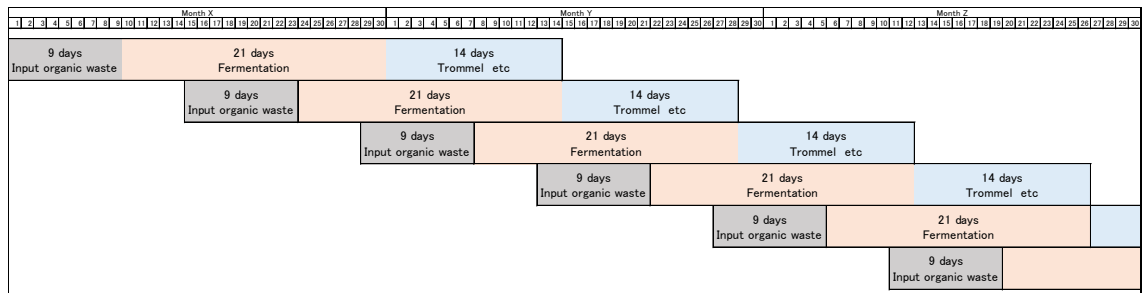


Figure 7 Process and period to produce compost



Figure 8 Input (Organic waste from Super Depo and Fermented compost)



Figure 9 Fermentation in pits



Figure 10 Left : Trommel screen, Right : Compost (final output)

Thirdly, we inspected the material balance of whole process, and operation costs. The table below shows the result of the inspection. The amount of Compost for sale was 26% of total inputs.

Table 1 Input and output per one process

Inputs	total : 66,110kg
(1)Organic waste from Super Depo	33,840kg
(2)Fermented compost (to provide Microorganism for composting)	32,270kg
Output	
(1)Compost for sale	16,910kg (26% of Inputs)
(2)Compost for next process (to provide Microorganism for composting)	25,440kg (38% of Inputs)
▪ Residue	1,990kg (3% of Inputs)
▪ Vaporized water	21,770kg (33% of Inputs)

The next table shows the running cost per one process. The running cost was 106.31IDR/Organic waste- kg from the formula below.

$$\text{Running cost [b]} \div \text{Input of organic waste [a]} = \text{IDR}106.31 / \text{organic waste-kg}$$

Table 2 the running cost per one process

Condition [1] : Inputs	Input total:66,110kg
(1)Organic waste from Super Depo	33,840kg [a]
(2)Fermented compost (to provide Microorganism for composting)	32,270kg
Condition [2] : Period of process	
▪ Period of process per one process	44 days
Running cost	Total : 2,284,945.94 [b]
▪ Gasoline for Wheel Loader	IDR 2,120,640 (300.8L)
▪ Water	IDR 63,449.17 (67.71m ²)
▪ Electricity	IDR 100,856.77 (66.82kWh)

(3) Marketing survey of material of organic fertilizer produced from organic waste

(A)Petro Kimia

At first, we assumed a business model that we would sell the compost to Petro Kimia as materials of their organic fertilizer “Petrorganik”. We had several discussion with Petro Kimia and they introduced us some factories which manufactured “Petrorganik”. Regarding the composition and quality of our compost, the factories showed no issues. On the other hand, they pointed out that we should remove small woods because small woods would affect granulating process.

If we could remove the woods, they could buy our compost at IDR 200-250/kg (delivered to their factory).

(B) Wood products manufacturers/Flower firm

We tried to find customers to sell compost, and two Japanese company showed interest in our proposal. They were manufacturers of wood products, and owned forests to provide materials. These factories tested samples and quoted IDR 500 to 600 (delivered at Wonorejo composting facility) for our compost. They didn’t mentioned about small woods which factories of Petro Kimia asked us to remove.

In addition, an flower firm also showed interest in our compost. They tested samples and presented a price at IDR600 (delivered to their firm).

We made sure that the compost produced in Wonorejo composting facility could sell to some clients in Indonesia.

(4) Proposal of business model for “Outsourcing waste treatment business from municipality”

(A)Feasibility of Wonorejo composting facility

Based upon the result of (3), we consider balance of calculation per month as follows. At the beginning of the project, we assumed that we didn’t need tipping fee for composting activities. However, to achieve profit from the activity, we need tipping fee from public sector as table below shows. The reason we need tipping fee is input of organic waste is less than assumed. Main factor is small plastics included in input affect the efficiency of trommel screen. Because of low efficiency of trommel screen, the facility can accept 2.4tons/day of organic waste.

Table 3 Balance calculation (per Month)

Balance calculation (per Month)			
Income	Sales of Compost (Rp500/kg)	{4,722kg/day × 26%} × 60%(able to sold*) × IDR 500/kg × 30day *40% will be used to produce new compost	IDR 11,049,480
	Tipping fee	2,417kg/day × IDR 152/kg × 30day	IDR11,021,520
Expense	①Running cost (Fuel, Water, and Electricity)	2,417kg/day × IDR106.31/kg × 30day	IDR 7,708,538
	②Labor	IDR340,000/日 × 30day	IDR 10,200,000
	③Maintenance	IDR1,988,431/month *average from April 2013 to March 2015	IDR 1,988,431
	④Land use	IDR 1,023/m ² × 2,115m ²	IDR 2,163,645
Profit	Income – Expense (①+② +③+④)		IDR 10,385/month

(B) Feasibility of 200t/day of large facility

As a future plan, we considered a plan by a large scale facility with capacity of 200t/day of waste.



Figure 11 Image of a large facility in Wonorejo



Figure 12 Function of facility

This facility will contain functions of “sorting waste” and “composting organic waste. We will accept 1. Food waste from business sector (not industrial waste) and 2. Organic waste from markets. 1. will be generated from hotels, shops, malls and so on and contains organic waste (80%) , and valuables (20%, plastics, papers etc). 2. contains only organic waste from markets.

To improve the efficiency raised by this pilot survey, we will try to accept 1. Food waste and 2. Organic waste. And by introducing “Automatic Composting line”, we can utilize the land with functional uses.

Regarding the tipping fee, we will collect the fee from companies and market who will generate Food waste and Organic waste, not from Public sector.

The table below shows the business feasibility of 200t/day facility.

Table 4 Balance calculation of large facility (per Month)

Balance calculation (per Month)			
Income	Sales of Valuables (IDR500,000/t)	$100\text{t/day} \times 20\%$ (Ratio of Valuables) $\times \text{IDR } 500,000/\text{t} \times 30\text{day}$	IDR 300 mil.
	Sales of Compost (IDR200,000/t)	$(100\text{t/day} \times 50\%$ (Ratio of organic waste) $+100\text{t/day}) \times 26\%$ $\times \text{IDR } 200,000/\text{t} \times 30\text{day}$	IDR 234 mil.
	Tipping fee from “Food waste” and “Market waste”	$100\text{t/day} \times 300\text{Rp/kg} \times 30\text{day}$ (Food waste) $100\text{t/day} \times 100\text{Rp/kg} \times 30\text{day}$ (Market waste)	IDR 1200 mil.
Expense	Initial cost	Initial cost per month *Initial cost is IDR 30billion	IDR 250 mil.
	Running cost (Fuel, Water, and Electricity)	IDR 80.0 mil.	IDR 162 mil.
	Land use	IDR 10.2 mil./month	IDR 15 mil.
	Transfer to TPA Benowo (IDR 150,000/t)	{Food($100\text{t/day} \times 30\%$:residue) +Market($100\text{t/day} \times 3\%$:residue)} $\times \text{IDR } 150,000/\text{t} \times 30\text{day}$	IDR 148,5 mil.
	Labor	100 persons \times IDR 3.0 mils	IDR 478 mil.
Profit Income – Expense			Rp680,5 mil./month

4. FUTURE PROSPECTS

[The way forward]

- A) Tipping fee
 - We realized that it is difficult to obtain tipping fee from public sector.
 - And we will propose an idea to collect tipping fee from private sectors who generate waste, such as hotels, shops, shopping malls, markets and so on.

- B) Large scale model with capacity of 200t/day
 - As showed in 3. (4) (B), our goal in Indonesia is to build and operate a large scale facility with capacity of 200t/day.
 - To realize our plan, we will promote this plan to both public and private sectors in Japan and Indonesia.
 - In addition, we will show the result of this pilot project to both public and private sectors in Japan and Indonesia as well.