"Feasiblity Survey and Pilot Project for Disseminating SME's Technologies to Developing Countries" under the Governmental Commission on the Projects for ODA Overseas Economic Cooperation in FY2012

Summary Report

Republic of the Philippines

Pilot Project on Applicability of Dewatering Equipment for Septage Management of Cebu City in the Philippines

March, 2013

Joint Venture of AMCON INC.& EX Research Institute Ltd.

Feasibility Survey and Pilot Project
Republic of the Philippines, Pilot Project on Applicability of Dewatering Equipment for Septage Management of Cebu City in the Philippines

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1. Outline of the Study

1.1 Background and Objective of the study

Background of the study

The City of Cebu and the City of Yokohama have come to an agreement in March 2012 on cooperation on developing a low carbon society. Yokohama city has identified the issue of treatment of sludge (hereafter septage) generated at septic tanks in the inner city of Cebu as a key issue. Yokohama city identified that dewatering machine of AMCON inc. was effective to tackle this issue. Yokohama city encouraged AMCON and EXRI to apply for funding under the scheme of Japanese government assistance to companies that are trying to introduce their products to governments in developing countries. The joint venture of AMCON and EXRI applied for funding under this scheme last August and received the approval from Japan Ministry of Foreign Affairs.

Objectives of the study

- The first objective is to demonstrate the efficacy of direct dewatering septage system by applying AMCON dewatering machine. .

- The second objective is to facilitate Cebu City and relevant government organizations in the field of sewerage and septage management to understand effectiveness of AMCON's equipment through the pilot test.
- The third objective is to grasp market potential of AMCON's equipment in the Philippines.
- The last objective is to seek out opportunity of further cooperation through ODA scheme.

1.2 Technical characteristic and the advantage of AMCON's dewatering machine

The Screw Press type dewatering machine owned by AMCON and proposed under this project, is a innovative technology that has a cylinder containing screw in a characteristic structure consisting of circular plates and multiple fixed and movable components as shown in the following figure (referred to as the 'Volute type'). This dewatering machine has following advantages.

- Clogging free
- Maintenance free
- Unattended operation
- Energy saving type
- Extensive application to a wide variety of sludge
- Low cost

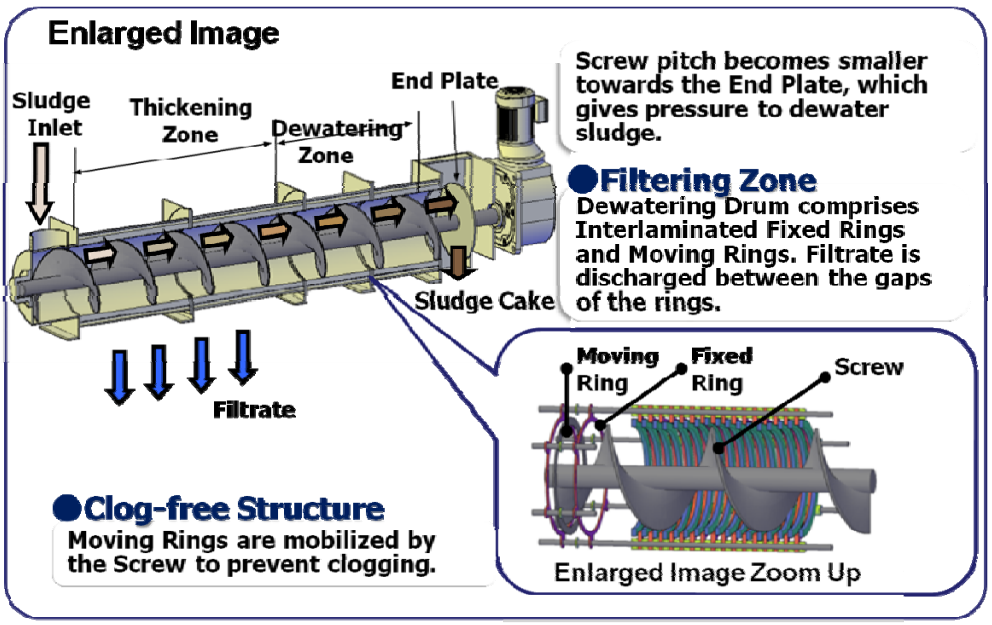

Figure 1.1 Structure of Volute type dewatering machine of AMCON

1.3 Content of the study

a) To gain an understanding of actual status on sewerage and septage management in the Philippines and Cebu City in particular.

b) To conduct a demonstration and pilot test of AMCON dewatering machine and a seminar for dissemination

c) To clarify effectiveness of direct dewatering of septage through the demonstration

d) To confirm that direct dewatering of septage is an appropriate septage treatment technology and to investigate possibility of adapting it in the Philippines.

e) To foresee potential of market of this type of dewatering machine in the Philippines

f) To propose next step actions for spreading this product supported by ODA scheme

2. Current status of septage management in the Philippines and the City of Cebu

2.1 Septage management policy in the Philippines

Local government unit (LGU) has the responsibility for collection, transport and treatment / disposal of domestic sludge and septage according to the Sanitation Code and the Clean Water Act (CWA).

Department of Health (DOH) is the primary competent authority in the field of sewer and septage management. Regulatory framework has been established, Implementation Rule Regulation (IRR) has been developed and the operational manual for enforcing the law and regulation has also been prepared. However, almost all the local governments are still in the preparation stage and only a few septage treatment facilities have been actually built.

To overcome this situation, DOH has formulated the National Sustainable Sanitation Plan (NSSP). However, the situation has not been changed much even after the formulation of NSSP.

The CWA stipulates that Department of Public Works and Highway (DPWH) shall organize and formulate the National Sewerage and Septage Management Program (NSSMP)

to facilitate the development of sewerage and septage treatment facility infrastructure. This program has been completed and approved by NEDA board in 30th May 2012. The program includes a scheme for investment in infrastructure development, but is limited to investment related to sewage treatment and no support has been allocated to investment for septage plants. LGUs and local water districts are required to bear the burden of fund raising for investment of septage facility. The Philippines development bank and other government financial institutions have the responsibility to support LGUs and WD in terms of fund raising. The office of NSSMP of DPWH has just started implementing the NSSMP and it is expected that the construction of the facilities will start nationwide from now on.

2.2 The actual status of septage management in the local revel

Majority of LGUs have not set up the necessary ordinance for implementing septage management. In the case of Cebu city, they do not provide a septage collection service to households. Instead of Cebu city, private haulers provide septage collection service for a price and dispose of it in an improper manner. This action might be against the CWA and the Sanitation Code. Hence it has become urgent to construct a septage treatment facility.

2.3 Present septage treatment facility

Manila water and Maynilad water have constructed and are operating two septage treatment facilities respectively that have employed the direct dewatering method. They add 20% of price of tap water as septage management fee.
Two cities, Dumaguete and San Fernando as pioneers have endeavored to develop a treatment facility by means of lagoon method.

3. Pilot test and demonstration of AMCON's dewatering machine

3.1 Outline of the test and demonstration

AMCON Inc. produced dewatering machine for conducting the pilot test and demonstration and conveyed it to Cebu City. After installing the machine, the pilot test was conducted from mid January to end of January. The team sourced 5m^3 of septage every day from a private hauler and operated the machine for two-three hours. Quality of septage, filtrate and sludge cake were analyzed during the pilot test. Two seminars were held to disseminate information on the effectiveness and appropriateness of the machine. More than fifty persons attended the seminar.

3.2 Achievements and challenges

1) Achievements

AMCON's dewatering machine was verified to be effective and adaptable in dewatering septage through pilot test.

- A stable dewatering ratio of septage was achieved (water content 75%) that is of a lower value than one of conventional type.
- The BOD of filtrate was less than 150mg/L and SS was less than 200mg/L. This performance corresponds to lower value of water content.
- Stable operation performance was verified even when operating with a variation in quality of Septage
- It was confirmed that sludge cake could be converted to compost.

Many relevant persons in the field of septage management participated in the seminar and understood the efficacy of direct dewatering septage by AMCON's machine.

2) Challenges

The pilot test was conducted for a very short period. It could not verify stable operation in long term operation. It also could not verify the efficacy of the total system including septage dewatering, filtrate treatment and composting sludge cake.

Demonstraton of a long term operation is necessary to completely verify the efficacy of the total system of direct septage dewatering by using AMCON's machine.

4. Recommendable treatment system of septage

4.1 Study on adaptable septage treatment system

Effluent standards for septage treatment facilities include BOD and TSS. Effluent standard of these items depend on the condition of water usage at discharging point. Standard value of both BOD and TSS in general is 150mg/L.

We set up a stringent value of 100mg/L of BOD and 100mg/L of TSS of effluent standard as design conditions. We set up conditions of quality of septage as 3,000-4,000 mg/L of BOD and 20,000 mg/L of TSS.

There are four options of treatment systems as shown below.

A Lagoon system (anaerobic pond -facultative anaerobic pond-aerobic pond)
B Mechanical biotreatment system
C Direct dewatering and mechanical bio treatment for filtrate
D Direct dewatering and lagoon or ripening pond for filtrate

The most economical system is the option A. However, this system requires a large space. Therefore this is applicable to a small city which can secure such a large space. Option B requires a high investment cost and O&M cost and is excluded for consideration. In highly urbanized city with a large population, options C and D can be realistic because of difficulty of securing large space for construction of a facility. Between options C and D, option D is much better from economical view point.

This study estimated that about 47 million pesos is required as construction cost for a 100m^3/D capacity facility of option D. The unit construction cost of Php 4,000 thousand/m3 in septage is a very reasonable unit cost according to the NSSMP guideline. O&M cost including depreciation is calculated as Php74/m3. This indicates that households need to pay about 200 pesos/5years. It is assumed that this value is affordable for general households because they currently pay about 5,000 pesos/ year as consumption fee of tap water.

4.2 Proposed septage treatment system that is applied to Cebu city

1) Prerequisite for the study

Collection service target is 60% out of households with septic tank that is 80% out of all households. This means that around half of total households would receive septage collection service. In this condition, amount of septage to be treated is calculated as 150m^3/D. If service is provided to all the households, the amount will be 250m^3/D.

In order to provide the service jointly to the Metro Sebu including other surrounding cities, a capacity of 320m^3/D of septage is necessary.

2) Securing space for constraction of the facility

Around 1,000m^2 of space for construction will be requied. Cebu City can secure existing area for sewer treatment plant or landfill site for the project.

3) Effluent standard to be applied

Applied water area class in possible space of Cebu City is class D or class SD. Effluent standard of septage treatment facility in class D is 120mg/L of BOD and 150mg/L of TSS. Otherwise that in class SD is 150mg/L of BOD and TSS respectively.

4) Proposed septage treatment system in Cebu City

The proposed treatment system is direct dewatering and lagoon (stabilization pond). Sludge cake can be converted into compost as soil conditioner. Lagoon can treat filtrate to meet the standard sufficiently.

5) Implementation scheme

Cebu City needs to take the initiative to realize the facility because RGU is primly responsibility of its management. However Metro Cebu Water District (MCWD) needs to be involved in the project from the view point of fee collection of septage treatment, operation experience and securing experts. It is preferable that MCWD take over the operation of the facility for a stable operation.

5. Marketability of Direct Dewatering Process

5.1 Potential Market Survey and Expectation of Realization

1) Improvement and Preparation of Septage Treatment Administration

LGUs shall promote septage treatment administration simultaneously with sewerage system. Related departments such as Public Service and Water District are expected to make the best combination of administration and business management.

2) Potential need of septage dewatering facility

If a sufficient site is ready for a septage treatment facility, stabilization ponds or lagoon system is the least expensive option. However, to reduce the required site area for bigger cities such as Cebu City where approximately 200m^3/d septage treatment facility is necessary with a broad site, the dewatering and lagoon system is most feasible

The Central Government, especially DPWH, needs to accelerate the implementation of the NSSMP approved by NEDA board on 30th May 2012.

That will help create a new demand of direct dewatering method in the near future.

3) Study on the market potential

The target 1 list of NSSMP contains 17 highly urbanized cities outside Metro Manila including six cities of population larger than 500,000. Further seven cities of population larger than 500,000 exist which are not incuded in the Target 1 list. As a result, 13 to 20 cities have a population larger than 500,000 where it is difficult to find the necessary site area for stabilization ponds. The market potentiality seems to be reasonably high because of the need to reduce the site area.

5.2 Effectiveness and possibility of penetration of dewatering process

1) Confirmation of effectiveness and applicability of dewatering process

The guidline of Philippines for septage treatment recommends (a) water treatment and (b) dewatering and water treatment. The later (b) has been confirmed to be more efficient than (a) by evidential data collected through the pilot test of dewatering.

2) Confirmation of possibility of final treatment and recycle of dewatered sludge

Dewatered sludge cake can be composted and recycled in green fields as done by Manila Water Company, Inc.

3) Confirmation of filtrate treatment

As a pilot test result, dewatering machine used in the test showed filtrate quality of BOD range between 100 to 150 mg/L while SS was less than 200mg/L. Based on many experiences across the world, this water quality can be improved up to an extent of removal rate of BOD of more than 90% of the original quality by carrying out a one week retention in stabilization ponds or lagoons. This combination of dewatering and stabilization is most economical and feasible as aforementioned in 5.2 1.

4) Study on economic efficiencies of septage treatment

The study on economic efficiencies of septage treatment is consistent with the evaluation by NSSP for construction and O&M costs.

5) Spread of septage treatment through Septage Management Program

NSSMP has 17 target cities to be promoted for septage treatment where management administration and facility construction would be planned and implemented in the near future.

5.3 Discussions with related local government and agency

DPWH (Dept. of Public Works and High Ways) will start Septage management programs because NSSMP was approved by NEDA Boad. In Cebu city, Waste Management Committee has issued six priority lists for environment improvement including the construction of septage treatment facility. The city government will establish a septage ordinance and prepare implementation administration. At the same time Metro Cebu Water District has acknowledged the importance and responsibility of sewer and sepatge management.

6. Direction of future projects supported by ODA scheme

6.1 Effectiveness of development and project development by adoption as a ODA project

The proposed ODA project will contribute to the improvement of water pollution and foul sanitation environment caused by domestic sewer and improper septage disposal.
This project will also comply with the goal of “improvement of urban environment” as the priority goal setup for the country assistance plan for the Philippines by the Japanese Government.

6.2 Concrete Proposal for adoption as a ODA project

According to the result of discussion on utilization possibility of ODA scheme, we have chosen demonstration project proposed by private sector among other menus of ODA to foster the result of this study. The concrete plan for ODA is shown in Fig. 6.1.

If our proposal is approved, the project will support Cebu City to develop the septage management system. The project will be composed of capacity building, enhancement of septage management framework and pilot scale facility construction etc.

Non-project grant assistance for small and medium-sized enterprise following the demonstration project proposed by private sector will be expected to work effectively. When a septage treatment facility by proposed dewatering and lagoon process is constructed and operated effectively under Japanese ODA, proposed process will be the de facto standard in the Philippines and Japanese technology will get a competitive position.

Table 6.1 Road map of ODA projects for developing septage management in Cebu City

	2012.12-2013.2	2013.4-2014.3	2014.4-2015.3	2015.4-2016.3	2016.4-2017.3	2017.4-2018.3
Project on expanding use of a technology of SMEs into developing-country government (MOFA)	Pilot Test in Cebu					
Demonstration project proposed by private sector (JICA)		From September 2013 through August 2015 2 years business model supporting item including building of an organization for septage management, enforcement of regulation, implementation planning, man power training in Japan, construction and operation of demonstration treatment facility. Planning Establish Orgnization Facility construction	Strengthen Promotion Man-power training Facility operation	Standardization of the system Nationwide penetration		
Technical cooperation project (JICA)					3 Years PJ from June 2016 Level Up Project of Septage management through Technology support project	
Non-project grant assistance for small and medium-sized enterprise (MOFA)					1 Year fr June 16 Construction and operation of full scale facility	
Business Plan of AMCON	☆Decision Making	☆Establishment of organization ☆Establishment of a local partner in Phlippines	☆Establishment of engineering department of water treatment ☆Sales network in Asia ☆Manufacturing works in ASEAN	☆Sales network and promotion in the Philippines and ASEAN countries ☆Expansion of network in Asian countries	☆De facto standardization of dewatering and support local administration ☆Expanding business network in all the Asian countries	

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SMEs and Counterpart Organization

- Name of SME : Joint Venture of AMCON INC.& EX Research Institute Ltd.
- Location of SME : Yokohama, Japan
- Survey Site・Counterpart Organization : City of Cebu Province of Cebu Republic of the Philippines

Concerned Development Issues

- Septage from septic tank that is very prevalent in households and business buildings shall be properly treated in compliance with the Clean Water Act.. However it is no treatment actuary. It cause water pollution and insalubriousness.
- NSSMP shall enforce 17 highly urbanized cities including Cebu City to develop a septage treatment facility
- Direct dewatering method is effective to treat septage

Products and Technologies of SMEs

- Innovative screw press type of a dewatering machine
- **move freely cylinder type (patent)**
- Compact and high performance and broad utility
- **clogging free , mentenance free , saving energy , continuously operation, unnesesury thickener tank**

Proposed ODA Projects and Expected Impact

- Pilot septage treatment facility will be constructed in the City of Cebu supported by ODA scheme such as JICA/private proposal type & demonstration project. At the same time, the project will provide technical cooperation for building capacity of staff of septage management section and operation of the facility
- A septage treatment facility can improve water pollution and insalubriousness and private sanitation service to citizens. Pilot facility can become exemplary system though demonstration operation and facilitate to construct same type of system nationwide.

Future Business Development of SMEs

- 1st step: AMCO will set up unit of water engineering and business office in main Asian countries.
- 2nd step: AMCON will perform market development in the Philippines and other Asian countries.
- 3rd step: AMCON will invest to secure a factory as a point of supply in a country of ASEAN.
- And AMCON will become water engineering company in moving away from mere supplier of equipments