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CHAPTER 1: INTRODUCTION

Background

The rapid urbanization and economic development in Asia-Pacific has resulted in a corresponding growth in the volume of solid waste generation. Managing solid waste is one of the costliest urban services in developing countries, where local governments spend 20 to 50 per cent of their budget on solid waste management. Despite the high spending on waste management, cities are finding it increasingly difficult to collect, process and dispose solid waste in a cost effective and environmentally friendly manner. The current approach to solid waste management in Asia Pacific focus on end of pipe solutions based on collection and disposal of waste in the landfill, with little or no attention paid to the 3R (reduce, re-use and recycle) principles of waste management. The end of pipe approach is not sustainable in the long run as the landfill soon reaches capacity due to high rates of waste generation and finding new land for disposal is a challenge for the city administration due to scarcity of big parcels of land within city limits. In addition to facing increasing costs for waste collection and disposal, public health and the environment suffer due to the negative externalities associated with poor waste collection and disposal.

In 2009, the United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP) embarked on a regional project "Pro poor and Sustainable Solid Waste Management in Secondary Cities and Small Towns" to tackle the aforementioned challenges. The project aims to implement approaches in solid waste management that would transform waste into resources, improve waste collection services and provide better income and working conditions for waste pickers. The overarching objective of the project is to enable participating towns to develop and execute solid waste management strategies that are decentralized, pro poor, low carbon and financially viable. The project contributes to this goal by setting up Integrated Resource Recovery Centres (IRRCs) in secondary cities and small towns that are run through a combination of partnerships between the local government, NGO's, cooperatives and small and medium enterprises.

Viet Nam is one of the countries targeted in the project supported by UN ESCAP. Based on the outcomes of workshops and consultations with civil society groups, local government officials and other relevant stakeholders, Ha Tinh was selected for a baseline study, as a first step to developing a pilot IRRC project. The baseline study had been conducted by ENDA with support from Ha Tinh People's Committee, URENCO – the state owned Urban Environment Company and UN ESCAP with a view to developing an IRRC in Ha Tinh. The study centered on collecting accurate data on solid waste management in Ha Tinh.

Ha Tinh City

Ha Tinh City is the economic, political and cultural center of Ha Tinh province. The city has been recognized as an urban grade III city and is aiming for grade II status in the period 2010-2015.

Geographical features

Ha Tinh city is located in the central coastal plain of Ha Tinh province at a distance of 360 km from Hanoi and 50 km to the north of Vinh city. The terrain is relatively flat, with the inner city elevation varying between 2 and 3 meters.



Vietnam

Ha Tinh Province is located in the north central climate region and has two distinct seasons; summer and winter. The former lasts from May to October with high levels of humidity and the latter lasts from November to April. Both the seasons receive rainfall with the north east monsoon providing rain in winter and the south west monsoon providing rain in summer.

Table 1:	Land u	ise pa	atterns	in	На	Tinh

Land use in Ha Tinh					
Land type	Hectare				
Agriculture land	3,128				
Forest land	65				
Non agricultural land (housing, public purposes)	2,139				
Unused land	386				
Total	5,654				

Socio economic context

According to the Ha Tinh City annual statistics report, the population of the city in 2010 was 91,288. Out of the total population, 65,720 people lived in the urban area and 25,568 people live in the rural area. The urban area consists of 10 wards and the rural area consists of 6 communes. The density of urban population is unevenly distributed with high concentration in three central wards, namely Bac Ha, Ha Nam and Tan Giang wards.

No	Wards/ communes	Number of sub wards)	Area sq.km	Population in 2009	Population in 2010	Population density in 2010
Wards						
1	Bac Ha	15	0.964	10,367	10523	10,754
2	Ha Nam	10	1.095	7,134	7241	6,515
3	Tan Giang	11	0.990	6,272	6366	6,335
4	Tran Phu	9	1.073	6,195	6288	5,774
5	Ha Huy Tap	9	2.008	4,955	5029	2,468
6	Dai Nai	10	4.264	7,481	7593	1,754
7	Nguyen Du	9	2.203	5,446	5528	2,472
8	Thach Linh	12	6.193	5,634	5719	910
9	Thach Quy	12	3.581	6,873	6976	1,919
10	Van Yen	5	2.536	3,476	3528	1,371
	Communes	·				
1	Thach Trung	13	6.136	7,838	7956	1,277
2	Thach M«n	4	5.530	2,770	2811	501
3	Thach Ha	12	7.691	5,598	5682	728
4	Thach Dong	7	3.357	3,415	3466	1,017
5	Thach Hung	9	5.206	3,321	3371	638
6	Thach Binh	8	3.716	2,458	2495	661

Table 2: A	rea and po	pulation figu	res in ward	s/communes	of Ha	Tinh citv
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Source: Ha Tinh statistical yearbook (2010)

There are a total of 31 schools offering primary and secondary education with a total student population of 16,600. Institutions for higher studies include a university of education, medical school, culture and arts school, primary and secondary level vocational school and a technical college. The city has six hospitals for various types of treatment in addition to a family planning centre, 16 clinics and 15 primary care wards.

The total economic production value in Ha Tinh is estimated to have reached 1164.5 billion vnd by 2010, with an increase of 15 percent in small and medium sized industries, a 20.4 percent increase in construction and a 20.1 percent increase in the services sector. With the creation of the Vung Ang Economic Zone, the city will attract more investors in many different fields and will put increasing pressure on the environment and waste generation. The per capita income in 2010 was of 1000 USD. By 2009, there were a total of 488 enterprises operating in Ha Tinh offering retail, hotels, restaurants and other services to the people. Out of the 488 enterprises registered, 467 are non-state enterprises and 21 are state enterprises.

CHAPTER II: RESEARCH METHODOLOGY

For the purpose of this baseline study, households were selected from two wards and one commune (40 households each) namely Bac Ha ward, Thach Quy ward and Thach Ha commune. In addition, waste was collected from commercial areas including two markets, namely the Bac Ha market of Bac Ha ward and the Province market of Nam Ha ward. Waste was collected and analyzed over a period of seven consecutive days.

The methodology involved: i) surveys ii) waste generation and composition analysis and iii) interviews with waste pickers, farmers, shop owners, households and staff of Ha Tinh People's Committee and URENCO.

Households were randomly selected and semi-structured questionnaires were prepared and tested with respondents from selected households prior to the actual survey. The content included the level of understanding of the current waste management and collection service, preferences for future services and waste disposal practices. A questionnaire survey was also completed by waste pickers to throw light on the informal sector and among farmers and fertilizer shops to understand the market opportunity for compost.

CHAPTER III: OVERVIEW OF THE EXISTING SOLID WASTE MANAGEMENT SYSTEM

URENCO – the state owned Urban Environment Company is in charge of solid waste management in Ha Tinh. Currently URENCO collects and processes the city's waste directly under a service contract with City People's Committee. Every year URENCO renews the contract with the City People's Committee for garbage collection, sanitation and to manage trees in public areas. The responsibility for managing industrial and bio-medical waste is vested directly on the generators and is treated at source.

ORGANIZATIONAL STRUCTURE

Currently URENCO's Management board in Ha Tinh city periodically evaluates the company's activities as a basis for payment. The Management board includes the City People's Committee's Vice Chairman and managers in the offices of Finance and Planning, Urban Management and Natural Resources and Environment.



Figure 1: Organizational structure of URENCO

URENCO has a total workforce of 165 personnel with 37 personnel working in administrative and office sections and 128 personnel working on the field in activities such as cleaning, collecting, transporting and disposing waste.

WASTE COLLECTION AND TRANSPORTATION

Out of the total waste generated in Ha Tinh city, 60-70 percent is collected, with 95 percent of waste collected in the inner city area and 30 percent waste collected in the sub urban area. The following table presents the waste collection rate in the ten urban wards of Ha Tinh.

Wards	Bắc Hà	Nam Hà	Trần Phú	Tân Giang	Nguyễn Du	Văn Yên	Đại Nài	Hà Huy Tập	Thạch Quý	Thạch Linh
Collection rate in 2010	98,5	98,0	97,8	94,6	99,1	75,0	61,0	65,6	65,0	45,0
Collection rate in 2009	98,5	98,0	95,8	88,8	94,0	33,5	40,9	45,8	47,5	35,6

Table	3: Pe	rcentage	of	solid	waste	collection	in	urban	wards
		· · · · · · · · · · · · · · · · · · ·	•••						

The waste generators in the inner city area dispose their waste into public bins installed at different points on the roads. Most of the household waste is collected door to door by trolleys, and then transferred to a meeting point. The waste is transported from the meeting point to the landfill by compactor trucks. The following diagram illustrates the process of waste collection and transportation in Ha Tinh city.



Figure 2: Waste collection and transportation process

The process of waste collection in Ha Tinh is presented below:

- a. Waste in residential areas: households put waste in plastic bags and leave it in front of the house or the waste is taken to the public bin. Compactor trucks collect the waste as per schedule and transport it to the landfill;
- b. Waste in market areas: in market areas many small bins are placed within the premises and, as per regulations, all vendors and shops have to leave their

garbage in the bins, though usually quite a lot of waste is scattered around the bins. The market management board has a collection team that is responsible for cleaning, collecting and transferring the waste to the meeting points. From the meeting points waste is transferred to the main landfill every afternoon on a daily basis;

- c. Waste from companies, office and production facilities is collected and taken to the public bin from where the compactor trucks transports it to the landfill. However, a number of companies and agencies that have a large yard gather waste such as paper, carton and leftover fabric and burn them;
- d. The inner city areas receive waste collection services daily and the suburban areas receive waste collection services on alternate days.

Most solid waste from households, markets and offices are not segregated before been transported to the city landfill. However, the production facilities that have metal or glass waste sort the waste and sell it to the junk shops.

No	Kind of vehicles	Number	Volume
1	Handcarts	384	350L
2	Public bin	1500	240L
3	Nissan compactor truck	01	8m ³
4	Hino compactor truck	06	8m ³
5	Tipper	01	5m ³
6	Tipper	02	3m ³

Table 4: Hardware for collecting and transporting waste

6730 liters of fuel was required to carry out the waste collection and transportation in Ha Tinh during 2010.

Human resources

Table 5: Workforce involved in collection and transportation of waste

Labor	2010	2011 estimated
Indirect labor	17	18
Cleaning, collection and operating	98	113
Management +office staff	5	6
Cleaning and collection	81	92
Driver	12	15
Total	115	131

WASTE TREATMENT AND DISPOSAL

The former landfill has reached full capacity and waste is now being transported to the landfill located in the Cam Quan commune – Cam Xuyen district. The former landfill of the city is located in Van Yen ward and was managed by the Ha Tinh Public

Works Company. The capacity of this landfill was about 20,000 tons of waste/year and the volume of waste collected was 50-60 tons per day.

The new landfill at Cam Quan commune is spread over an area of 2 hectares and has two landfill cells with an area of 1.2 hectares. The waste is loaded and compacted in the cells with intermittent layers of soil. Bio solutions are sprayed to stimulate decomposition and to minimize odors and vectors. Leachate generated in the waste treatment process is treated through a three stage process of sedimentation including anaerobic, aerobic and filtration. The landfill has a biological lake to treat the wastewater from the landfill.

Table 6: Workforce involved in waste treatment and disposal

Waste disposal and treatment	Old landfill	New landfill
Management staff	1	1
Labour	2	3
Total	3	4

With the closing of the landfill at Van Yen ward, there is now high pressure on the newly opened landfill. The current landfill does not have the capacity to dispose all the waste generated in the city. To ensure waste disposal for the city and the surrounding areas, the province is building a compost plant for processing the organic waste into organic fertilizer with a capacity of 120 tons per day in Cam Xuyen District. URENCO is building this plant with Belgium technology with an operational lifetime of 20 years.

The total budget of the plant is 2.286.101 euro, with 70 percent of budget support from the Central Government in addition to a loan of 30 percent of the total budget. The plant will treat all of the waste in Ha Tinh City and surrounding areas such as Cam Xuyen town, Thach Ha town, Cam Xuyen town, Hong Linh town.

The main components of the plant are as follows:

- 1. Waste weighing house: area 18x4 m, 4,5 m high; construction area 72m²
- 2. Primary sorting house: construction area 737m²
- 3. Screening house: construction area 826 m²
- 4. Packing house and warehouse of finished products: construction area 492 m²
- 5. Equipment store: construction area 295m²
- 6. Fermenting yard (27 beds): area 6.000 m²
- 7. Matured compost yard: area 8.000 m²
- 8. Garage
- 9. Guard house

The process involved in converting organic waste into compost is illustrated in the figure below:



Figure 3: Operating procedure of the compost plant

The facility plans to enrich the compost with nitrogen, potassium and phosphorous and pack them into bags of 5 kg, 10 kg, 15 kg and 50 kg.

INCOME AND EXPENDITURE

The estimated budget for cleaning, collecting, transporting and disposing waste in the landfill is 571,901 vnd/ton.

Table 7: Income and expenditure of solid waste management in Ha Tinh

Unit: 1.000 vnd

No	Descriptions	2010
Ι	Income	1.650.000
II	Expenditure	9.145.279
	a) Cleaning and collection activities	3.705.507
	b) Transportation activities	2.848.519
	c) Treatment activities	701.549
	d) Management cost	1.889.704
	Budget subsidies (income-expenditure)	7.495.279

Presently 18 percent of the expenditure is covered through the collection fee charged for waste management services. It is estimated to cover 28 percent of the expenditure in 2011, as the collection fee would be increased 1.5 times as per decree No. 28/2010/QĐ-UBND issued by the Provincial People's Committee. Besides, the

waste collection system will be expanded to communes, thereby increasing of number of households paying for the collection service.

URENCO is in charge of collecting the waste collection fee from households and enterprises on a monthly basis based on Decision No. 28/2010/QD-UBND dated December 29, 2010 by the Ha Tinh People's Committee.

No	Segments	Unit	Price
I.	Households		
1	Households in urban wards	vnd/household/month	15.000
2	Household in suburban commune	vnd/household/month	10.000
I	. Small business		
1	Household business with waste volume <1m ³ /month	vnd/household/month	40.000
2	Household business with waste volume >1m ³ /month	vnd/m ³ /month	100.000
3	Catering business	vnd/m ³ /month	100.000
I	II. Public institutions and administrative offices		
1	School: Elementary, middle school, kindergarten, pre-school.	vnd/unit /month	70.000
2	Secondary school	vnd/unit /month	80.000
3	University, colleges, Technical secondary school, vocational training school	vnd/unit /month	100.000
4	Administration and business office - Number of persons <40 - Number of persons: from 41 to 100 - Number of persons > 100	vnd/unit /month	80.000 100.000 120.000
5	Hospital	vnd/m ³	90.000
6	Health station	vnd/unit /month	40.000
ľ	V. Business		
1	Restaurants, hotels	vnd/m ³	100.000
2	Clinic	vnd/unit /month	70.000
3	Construction waste	vnd/m ³	150.000
4	Business establishment, coach station	vnd/m ³ /month	100.000
5	Market waste (through market management)	vnd/m ³	120.000

Table 8: Waste collection fees in Ha Tinh City

POLICIES AND ONGOING INITIATIVES

The Prime Minister issued Decision No. 2149/QD-TTg dated December 17, 2009 approving the national strategy for integrated solid waste management, Vision 2050, which has clearly defined goals for solid waste management in the future.

According to the National Strategy for integrated solid waste management, by 2020 more than 90% of the total domestic solid waste generation is collected and processed in an environmentally sustainable manner, of which 85% of waste is recycled, reused or converted into organic fertilizer and energy.

In line with the goals of the National strategy, Ha Tinh's Provincial People's Committee has issued a plan for solid waste management from 2011 to 2020:

- Propagate and raise public awareness on 3R principles of reduce, re-use and recycle of solid waste at the community level;
- Promote waste separation at source to increase recycling and reuse;
- Recover organic waste from the municipal solid waste stream and convert it into organic fertilizer and reduce waste disposed at the landfill;
- Collect, transport and process 95 percent of waste generated in Ha Tinh;
- Formation of meeting points in all wards and communes for waste collection;
- Pilot waste sorting in three units of wards/commune including Thach Linh ward, Thach Quy ward and Thach Ha commune, the sorting of waste to be linked with the formation of decentralized compost plants;
- Collect and treat 100 percent of hazardous waste generated and invest in the construction of medical waste incinerators in all hospitals.

CHAPTER IV: ESTIMATION OF WASTE GENERATION AND COMPOSITION

To determine the volume and composition of waste generated in the city, 3 wards were selected, namely Bac Ha ward, Thach Quy Ward and Thach Ha commune. Thirty households in each of the three wards/communes were taken as sample for this study. In addition, 2 commercial markets and 10 commercial units were included in the sample to calculate the volume and composition of waste generated daily. Waste samples were collected and analyzed during a period of 7 days.

Waste generation

Wards/commune	Waste Generation kg/capita/day		
	Domestic Non-domestic		Domestic +
	waste	waste	Non-domestic
Bac Ha	0.56	0.39	0.95
Thac Ha	0.76	0.53	1.29
Thac Quy	0.48	0.34	0.82
Average	0.60	0.42	1.02

Table 9: Waste generation rates in Ha Tinh

Source: Field survey 2011

Per capita waste generated in Ha Tinh is 1.02 kg per day and the total volume of solid waste generated in the city is 94 tons per day, of which only 52-60 tons per day is collected by URENCO. The amount of waste generated in the market is about 4 tons/day which accounts for 4.3% of the total waste generated in the city.

Waste generation projection based on population growth

Ha Tinh has a population growth of 2.06 percent per year and the projected population till 2020 is calculated based on this rate, keeping 2009 as base year, based on data obtained from Statistical yearbook of the city 2010.

Table 10: Estimation of waste generation up to 2020

	Projections		
Year	Population	Waste (ton/day)	
2009	91288	93114	
2010	93169	95032	
2011	95088	96990	
2012	97047	98988	
2013	99046	101027	
2014	101086	103108	
2015	103168	105232	
2016	105294	107400	

The waste generation volume/day in Ha Tinh for the years from 2009 to 2020 is calculated by applying the per capita daily waste generation volume of 1.02 kg.

Table 11: Waste density

Density in kg/m ³			
Domestic waste	Non-domestic waste	Market waste	
156	120	320	

Source: Field survey 2011

Waste composition

To determine the composition of waste, ten samples (households) each were randomly selected and analyzed in the three wards in addition to the sample collected from the two markets and commercial units.

Table 12: Waste composition in Ha Tinh

Composition	Household waste (%)	Market waste (%)	Non- domestic waste (%)	Average (%)	
Food waste	21.1	42.4	10.5	24.6	
Grass/wood (coconut cover,					
durian cover, leaves,	31.5	37.5	28.9	32.6	
sugarcane dregs)					
Bone (snail shell)	1.3	2.45	0.0	1.2	
Paper	7	2.05	31.3	13.5	
Scraps of fabric	5.5	1.4	10.9	5.9	
Plastic	13.9	0.65	8.0	7.5	
Leather/rubber	1.3	2.05	0.8	1.4	
Metal	0.8	0.3	0.2	0.4	
Glass/ceramic	4.5	0.6	0.5	1.9	
Others (sand, coal residue,	10	10.45	0.0	11 1	
napkin, water)	13	10.40	9.9	11.1	
Total (%)	100	100	100	100	

Source: Field survey 2011

An average of 57.2 percent of the waste analyzed is organic in nature and can be converted into compost for use in agriculture. The markets generate the highest quantity of organic waste (80%), followed by households (52.6%) and non-domestic units (39.4%). In addition to the organic waste that can be recovered, 30 percent of the total waste analyzed can be recycled or reused, whereas only about 12 percent of waste needs to be sent to the landfill for disposal.

CHAPTER V: INFORMAL SECTOR ACTIVITIES AND RECYCLING

There is an active informal sector in Ha Tinh that derives its livelihood from collecting and recycling waste. Two main groups have been identified that engage in activities aimed at recovering value from waste:

- 1. Waste pickers
- 2. Waste pickers and buyers

The waste pickers mostly belong to the age group over 60 years old and children under 15 years old. They do not engage in any other work and in total about 10 persons have been identified. In addition 20 persons work near the landfill on a part-time basis to recover valuable recyclable waste. The average monthly income of waste pickers is between 300,000 and 700,000 vnd a month. The persons who do not work near the landfill engage in waste collection activities mainly in the inner city wards and they use a bicycle to carry out their activities.

The category who is both waste pickers and waste buyers are mostly women workers in the sub-urban area with an average monthly income between 1 and 1.5 million vnd. A total of 100 persons were identified in this category. When interviewed the waste pickers and waste buyers said they chose this work as they have not found another stream of work with flexible hours and most of them have been working in this field for 10-15 years. About 67% of respondents said they would like to change jobs if there are better working conditions and better income.

In addition to the above categories, the labourers of URENCO that engage in daily waste collection also recover valuable recyclable waste which they sell to junkshops for extra income.

Most of the recyclable waste collected in the area is sold to junk shops which are managed by couples, of which 50 percent come from the Northern provinces such as Hung Yen and Thanh Hoa, and the remaining are managed by locals from Ha Tinh. A total of 20 junkshop were identified in Ha Tinh, big and small, with an average income between 2 and 4 million per month. All respondents interviewed did not want to change jobs, as the present activity does not require any qualifications and is relatively independent. However they face challenges in sustaining a regular source of income and experience seasonal variations in the quantity of recyclables recovered and market fluctuations resulting in price instability for recyclable waste.

After buying the recyclable materials from waste pickers and waste buyers, the junk shops sells it to recycling facilities in and outside the province. Currently in Ha Tinh city, there are 2 recycling facilities, one involved in recycling plastic in Thach Dong ward, and another recycling paper in Thach Quy ward. These facilities operate on a small scale basis with a capacity to process limited amounts of recyclable waste. Most of the recyclable waste after purchase is sorted and transported to large recycling facilities in other provinces of Vietnam. The recyclable waste recovered and sent to other provinces for recycling include mainly plastic, iron, aluminum, paper and cardboard; the market and demand for glass is currently quite low.

A survey conducted in 20 junk shops in Ha Tinh on the daily business activity revealed the following results:

	Plastic	Nylon	Aluminum	Glass	Iron	Hard cover	Paper
Quantity kg/day	52	4	12	5	410	460	605
Purchase price/kg vnd	3000 – 9000	1000 – 2500	25000	2500	6000	2000	3000
Sale price/kg vnd	3200 – 9500	1200 – 4000	27000	3000	6500	2500	3200

Table 13: Quantity and price of recyclables recovered per shop

CHAPTER VI: ASSESSMET OF COMMUNITY NEEDS

To determine the needs of the community on solid waste management system, a questionnaire survey was carried out at the household level. Currently waste is being collected only in the urban wards, while sub-urban communes receive waste collection services only along the main roads. The results of the survey substantiated high levels of awareness about the present waste collection system offered by URENCO, including the type and point of collection.

The key findings of the survey are as follows:

- Households in the inner city wards registered about 95% of waste collection coverage;
- Households in inner city wards receive daily waste collection, but households in sub-urban wards receive waste collection only once in two days;
- 85% of respondents said that the current waste collection fee is acceptable, and 69% of respondents said any increase in the collection fee should be accompanied by an improvement in waste collection services;
- 77% of households want to have door to door waste collection at a specific time, another 33% want to dispose their waste at designated collection points;
- 90% of respondents are aware that kitchen and garden waste can be converted into organic fertilizer and expressed willingness to separate waste into organic and inorganic fractions, so that waste can be recovered and recycled.

When asked about the satisfaction levels of the current waste collection system, all respondents in the inner city wards said they were satisfied with the services offered by URENCO, whereas the respondents in the sub-urban communes were not satisfied with the waste collection services. The places that do not receive regular and no waste collection services have resulted in deteriorated urban environment due to waste scattered by the wayside.

CHAPTER VII: MARKET OF COMPOST AND ITS USE IN AGRICULTURE

Questionnaire survey and interviews were carried out among forty farmers and thirty fertilizer shops to understand the market for compost and its current and potential use in agriculture. The land area for agriculture has been increasing in Ha Tinh over the past years.

75 percent of all farmers interviewed are aware that the application of compost can improve soil fertility by returning organic matter to the soil. However, only about 5 percent of farmers are currently using compost for agricultural purposes. The main reason cited for the lack of compost usage in Ha Tinh is the lack of knowledge on the production processes of compost. As of now, 50 percent of farmers use their kitchen waste in the gardens and another 37 percent use it for feeding poultry. Another reason for the reduced application of compost is the easy access of cow dung as manure for agriculture. The 5 percent of farmers who produce compost use it only for their own small holding of cultivable land.

Most farmers rely on chemical fertilizers for agriculture production and 95 percent of farmers said there has been a gradual deterioration in productivity due to the loss of nutrients and reduced organic matter in the soil. Manure (from cow and pig) has helped to address, to some extent, the disadvantages caused by the heavy use of chemical fertilizers. Given these conditions, farmers are eager to use organic fertilizers to improve the quality of the soil and to increase soil fertility.

The survey conducted among thirty fertilizer shops, including seventeen wholesale and eleven retail stores revealed the presence of only four shops that presently sell bio fertilizers, and none selling compost. The quantity and price of fertilizers sold on average among the thirty shops surveyed are presented in the table below:

Eortilizor namo	Number of sales in the	Price
rennizer name	previous year (ton)	vnd/bag (2 kg)
Urea fertilizer	457	10.000
MoP (Potassium fertilizer)	308	11.000
TSP (phosphate)	232	4.500
Bio fertilizers	15	4.200

Table 14: Price and average quantity of fertilizer sold per shop in one year

The average amount of fertilizer sold in 2010 was 1012 tons per shop, with no sales registered for compost due to lack of production.

CHAPTER VIII: CONCLUSIONS AND RECOMMENDATIONS

There has been a paradigm shift in the waste management approach in Ha Tinh with a departure from solely relying on landfill for waste disposal to initiating new technology and approaches in converting waste into resources, demonstrated by the construction of the large scale compost plant in Cam Xuyen District with a capacity to treat 120 tons of waste per day. Such an approach is being tried as the previous landfill has reached capacity and the present landfill does not have the capacity to dispose all the waste generated in Ha Tinh.

Experience in developing countries of Asia-Pacific has documented significant challenges in running large sale plants that are technology intensive and process mixed waste due to poor source separation of waste. The compost plant in Ha Tinh would do well to put systems in place to enable source separation of waste by working closely with the communities in changing their attitudes and behavior towards waste. In addition, it would be vital to coordinate with the waste collection team of URENCO to ensure that the organic waste transported to the compost plant is not contaminated with inorganic and hazardous waste.

In order to sell the compost produced at the plant, it would be beneficial to initiate appropriate marketing strategies to ensure the continuous sale of compost. The results of the survey conducted among farmers registered only 5 percent of farmers that use compost for agriculture. Marketing strategies must adequately factor in these gaps and promote the benefits and advantages of using compost to the farmers and simultaneously work with the fertilizer shops to make the product available through its distribution channels.

The plans for solid waste management issued by Ha Tinh Provincial People's Committee, in line with the National Strategy on solid waste management, aim to promote pilot waste sorting in selected wards and promote decentralized composting to manage their waste at source. Initiating decentralized compost plants in select wards with substantial quantities of waste can reduce transportation cost and can serve as a demonstration unit to increase the awareness of the community on sustainable solid waste management practices.