PROJECT *"ISTEAC"*

Integration of solid waste management tools into specific settings of European and Asian Communities

Common Applied Research
Under the ASEAN-EU University Network Programme

Project Documentation

Related to

Activity 23: "Research on recycling market and schemes"

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INTRODUCTION

According to the work plan concluded for the common applied research project ISTEAC, the Department of Chemical Engineering, Hanoi University of Science conducted an overview about the implementation of Activity 23 ***"Research on recycling market and schemes"***.

This research aims to create a view on exploration of paper recycling potential scheme in Vietnam. In addition, an optimal strategy to increase paper recycling will be proposed.

OVERVIEW OF WASTE GENERATION/RECYCLING IN VIETNAM

According Vietnam Environment Monitor, which is published every year, growth rate is over 7%. 24 % of the population of the country in the urban areas produces 50 % of the country's municipal waste. By the year 2010 the waste generation is expected to increase by over 60 %. The data gave us therefore a prediction that recycling activities will develop rapidly. Until now paper recycling is the strongest among other recycling activities such as metal -, glass -, plastic recycling. This fact is reflected by the waste composition in Hanoi which is shown in following table (table 1).

Table 1 Waste composition in Hanoi

Waste component	Percent of total	
	1995	2003
Organic	51.9	49.1
Paper and textiles	4.2	1.9
Plastic, rubber, leather, wood, hair, feathers	4.3	16.5 (Plastics 15.6)
Metal	0.9	6.0
Glass	0.5	7.2
Inert matter	38.0	18·4
Others	0.2	0.9

Source: 1995 data from M. Digregorio 1997. East-West Center, Hawaii; 2003 data from CEETIA monitoring data, 2003

In 1995, paper and textiles were 4.2% but in the year 2003 they were 1.9%. This data present a sign of recycle activity.

The waste generation in the 2003 in Vietnam was reported in table 2 and figure 1. In table 2 the waste generation was calculated in tons/year. From this table it is easily to know that the municipal waste quantity of urban and rural areas is the same (50/50).

Table 2 Waste generation in Vietnam

	Sources	Types	Waste Generation (tons/yr)		
			Urban	Rural	Total
Municipal Waste	Residential Commercial Markets	Kitchen waste plastic paper glass	6,400,000	6,400,000	**12,800,000**
Industrial Non-Hazardous Waste	Industries	metals wood	1,740,000	770,000	**2,510,000**
Industrial Hazardous Waste	Industries	fuel oil waste sludge organic chemicals	126,000	2,400	**128,400**
Hazardous healthcare Waste	Hospitals	tissue samples blood syringes	–	–	**21,500**
Total-non agricultural waste			**8,266,000**	**7,172,400**	**15,459,900**
Agricultural	Cultivation Livestock	Plant matter	NA	64,560,000	64,560,000

Note: Industrial waste excludes mining waste, Rural industrial waste derives from craft villages,

Source: Consultant Data Group survey 2004, SOE report 2002, MOH 2004, NEA 1999, MOI 2002-2003

Figure 1 Waste generation Vietnam 2003

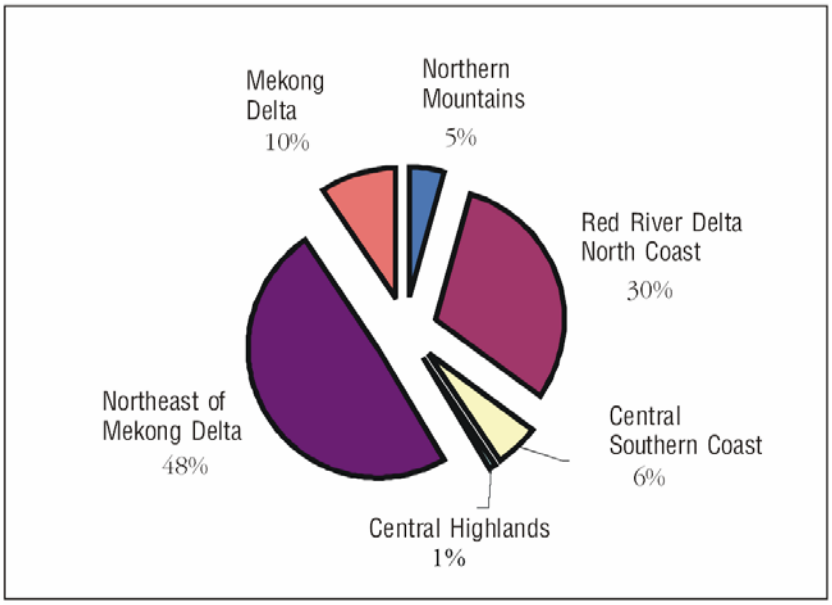
Through only 24% of the population is living in the urban areas. Therefore the source for paper recycling is situated mainly in the urban areas. However the generation of municipal solid waste is different between cities and areas as presented in table 3 and figure 2 (the data in 2003 and 2004).

Table 3 The generation of municipal solid waste in some cities of Vietnam

	Generation Rate (kg/person/day)	Waste Gen (% of total)	% organic
Urban Areas (national)	**0.7**	**50**	**55**
Ho Chi Minh City	1.3	9	
Ha Noi	1.0	6	
Da Nang	0.9	2	
Rural Areas (national)	**0.3**	**50**	**60-65**

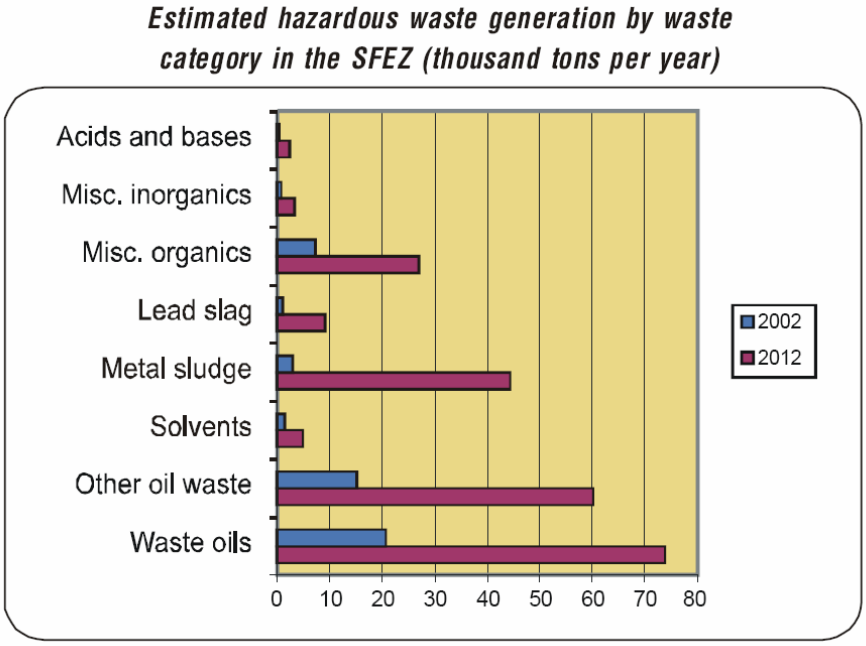
Source: Urban data by Consulting Data Group survey 2004; Rural data calculated using studies by NEA (2000) and Agriculture University No.1 (2003)

Figure 2 and figure 3 resulted the generation and amounts of hazardous waste in different parts of Vietnam which come from the survey 2000 - 2003.



Source: MOI, Survey 2000-2003

Figure 2



Source: NORAD, 2003, Masterplan for hazardous waste management in HCMC, Dong Nai, Binh Duong and Ba Ria - Vung Tau (excludes packaging and container waste)

Figure 3

Red river delta and the Northeast of Mekong Delta occupy two main sources of waste. Recycling activities are developed in the areas. The recycling activity will develop more if we look at figure 3 whenever hazardous waste generation rapidly increase by the year 2012.

On the way to study waste management of municipal solid waste we have compared the composition of waste between districts in Hanoi. From the former report (2nd QU) we have found percentage of paper in municipal solid waste of 4 districts. There are the data on paper as follows: 10% in Ba Dinh district; 10% in Hai Ba Trung district; 9% in Hoan Kiem district; 5% in Dong Da district. These 4 districts belong to the inner city where people have the high paper consumption. But if we look at the composition of the household waste of district Gia Lam (figure 4) we see only 3.25% paper waste. We find out the reason as follows: Gia Lam is a new district. Population density is lower in comparison with it of the others. The living level of people is also lower therefore it reflected on paper consumption.

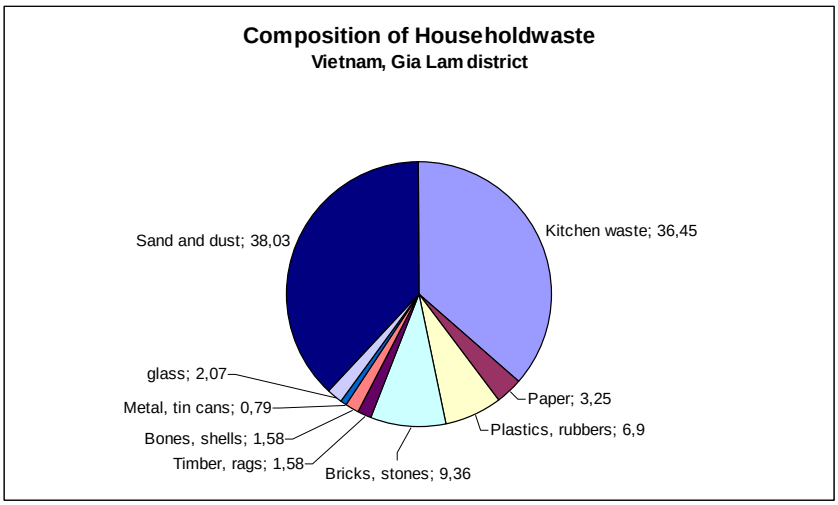
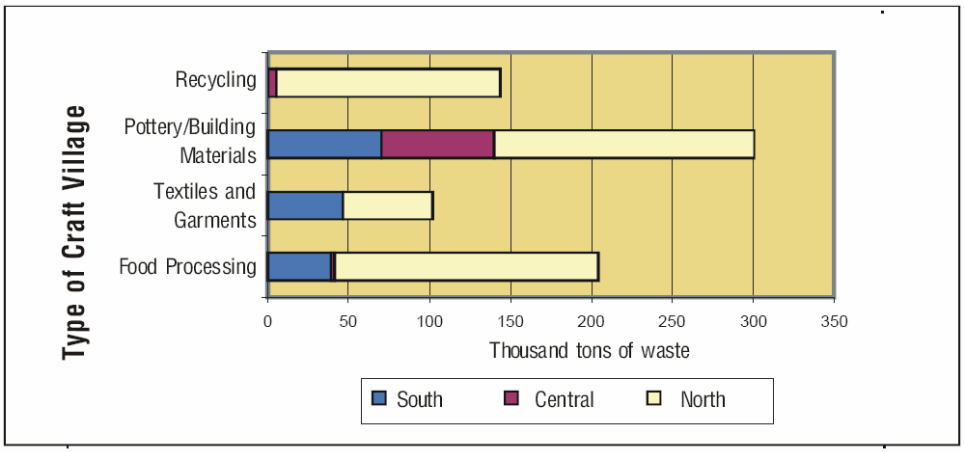


Figure 4 Composition of Household waste in Gia Lam district, Vietnam

The waste generation usually connects to the population density, industrial development and also recycling activities. Recyclable waste is treated only by private sector that will be seen in figure 5. This is the amount of large waste was generated in craft villages by region. In the North of the country exist more craft villages than in other parts of the country therefore the waste generation is correspondent. The recycling potential in the North is also higher.



Notes: Excludes 23,000 tons of waste generated a year by a variety of other types of craft villages.

Figure 5 Waste generation in craft villages

There are substances which are contained in material fractions (table 4 and table 5). With this investigation it is interesting to know also newspaper and cardboard whenever they are recycled.

Table 4

	DS [%]	OS [%]	Heating value [Mj / kg TS]	C [%] of DS	H [%] of DS	N [%] of DS	O [%] of DS	P [%] of DS	S [%] of DS
Food waste: plant-based	22-55	85 - 90	20	43-44	6	1-3	25-38	0.3-0.7	0.2-0.3
Food waste: animal-based	35-?	75-85	28	44	10	1-3	25-38	0.3-0.7	0.2-0.3
Newspaper	85-95	90-98	20	49	6	0.4	39-47	<0.1	0.2-0.3
Cardboard	80-95	80-95	16-18	44-48	6	0.1-0.3	44	<0.1	0.1-0.3
Plastic, packaging	85-98	92-99	36-40	66-87	9	0.1-1	1-10	<0.1	0-0.3
Glass	95-100	<3	0	0	0	0	0	0	0
Metals	95-100	<3	0	0	0	0	0	0	0
Textiles	80-90	85-97	17-20	45-54	6-7	3.5-4.5	32-36	0-0.2	0.1-0.4
Wood	80-90	70-98	17-20	46-50	6	0.2-1.8	41-42	0	<0.1
Vacuum cleaner bags	88-95	55-70	13-15	44	5	4-6	20	0.1	1

Table 5

	Cd mg/kg	Cu mg/kg	Cr mg/kg	Co mg/kg	Ni mg/kg	Pb mg/kg	Zn mg/kg	Hg mg/kg	Sn mg/kg	As mg/kg
Food waste: plant-based	0.2-2	10-100	10-70	1.5	5-60	2-160	30-270	0.05	15	8
Newspaper	-	30	-	-	-	2	10	-	-	-
Cardboard	0.2	60	8	<0.5	5	10-15	5-20	0.04	1.3	9
Plastic, Packaging	0.4-45	100-400	10-90	8	2-20	130-210	300-1000	0.01	<5	7
Glass	0.1-2	1-25	20-900	2	10-300	150-430	100-300	0.01	9	50
Ferrous metal, steel cans etc.	0.5-5	5-60	200-1100	35	200-500	-	1000	-	1600	30
Aluminium (cans, tray, foil)	0.2	45000	1200	-	<1	1	50000	0.005	-	140
Textiles	2	40-60	70-120	2	5-12	40-100	170-260	0.3-0.7	2.5	8
Shoes, leather, rubber	10-40	40-130	800-7000	4	10-300	65-250	3000-3500	0.2	<10	7
Wood	1-3	30-50	15-60	1.5	4-7	40-100	160-300	0.5	1.2	7
Vacuum cleaner bags	4	120	200	-	30	150	680	0.7	-	6
Electronic waste	230	20000	750	-	1500	2700	4500	1.7	-	11

REVIEW OF THE VIETNAM PAPER INDUSTRY

In Vietnam, there are technologies are available such as composting technology, plastic recycling technology, paper recycling technology, ... Recycling material and their products are assumed in table 6. Used papers are recycled for books, toilet paper, newspaper, tissues, …

Table 6 Recycling materials and their products

Wastes	Products
Organic matters	Organic fertilizers, biogas…
Plastic	Plastic bags, sandals, cloth peg…
Paper	Books, toilet paper, newspaper, tissues …
Glass	Bottles, glass, bulb…
Metals	Hinges, bolts…

Recycling activities are usually organized in craft villages. For example: some plastic-recycling areas in Vietnam are Minh Khai village, Nhu Quynh commune, Van Lam district, Hung Yen province; Tien Tu enterprise of Hanoi.

Some paper recycling areas are paper plant of Bai Bang , Viet Tri, Phu Tho; Duong O paper recycling village of Phong Khe, Bac Ninh,... These areas apply the following paper recycling technology as shown in figure 6.

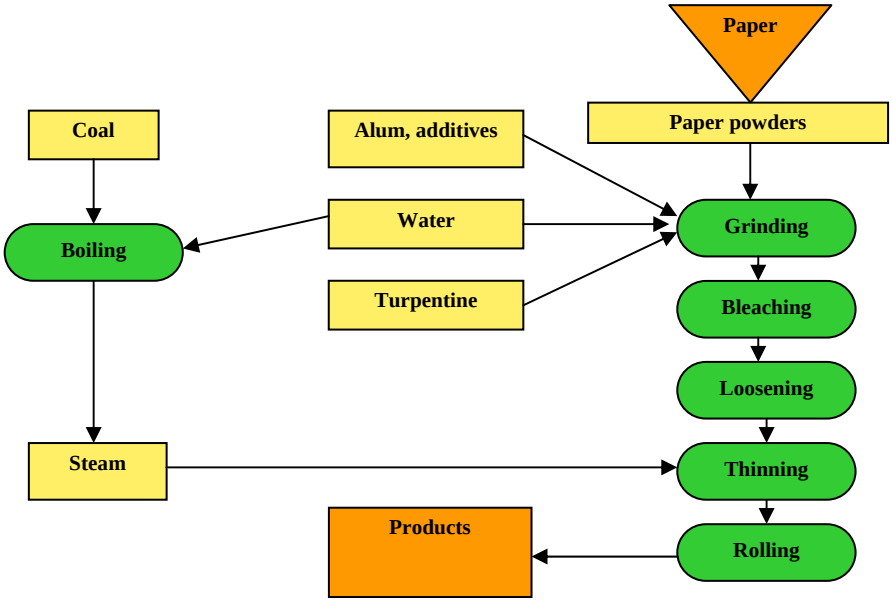


Figure 6

There are over 300 large and small - scale paper producing mills dispersed throughout the country. Most of the mills have a capacity of about 500 - 20,000 tonnes/year. Among them only 20 mills have the capacity of over 20,000 tonnes/year and 3 of over 50,000 tonnes/year. The following table described the paper production, import and export situation in recent years (table 7).

Table 7

	2003 (10^3 tonne)	2004 (10^3 tonne)	2005 (Schedule) (10^3 tonne)
Production	642	753.791	980
Export	96.426	117.1	135.5
Import	425	484	523.85

Source: http://www.moi.gov.vn/News/detail.asp?Sub=71&id=14030

According to the statistic data of 2004, the paper production was 753,720 tonnes (occupying 70.48% of the total equipment capacity). The pulp production was 218,968 tonnes (occupying 69% of the total equipment capacity). The mass flow of paper for 2004 was satisfied 54.44% the domestic demand and export.

In the first seven months of 2005, Vietnam Paper Corporation imported 325,000 tonnes types of paper. In comparison with those at the same period last year this reveals an increase of 32%. In the same time, domestic paper production reached over 480,000 tonnes. This is a rise of 7.5% over the corresponding period of 2004.

At present, that many enterprises only concentrate investment in paper production pushed the capacity increase, from 350,000 tonnes/year to 750,000 tonnes/year whereas the capacity of pulp only rises from 94,000 tonnes/year to 175,000 tonnes/year. Vietnam Paper Association has just declared that the supply exceeded the demand. Therefore, the enterprises should not invest in production of office white paper and computer print out paper. It is necessary that the paper producing mills must concentrate to produce pulp, packing paper, especially high quality paper.

According to the experts, this situation will let the paper industry face prolonged difficulties if it does not have steps in the right direction. The Government development strategy has had an approval that by 2010 Vietnam paper industry will reach a capacity of 1.2 million tonnes of paper and 1 million tonnes of pulp annually.

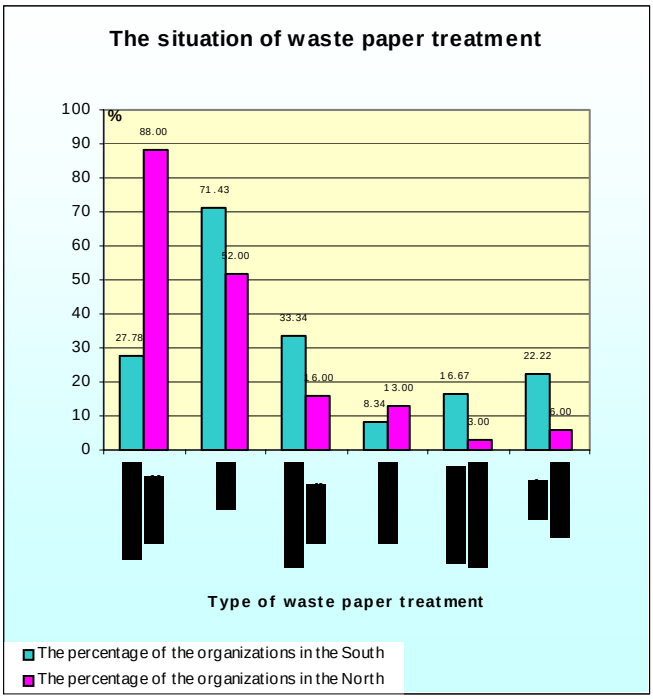
Table 8 summarized the situation of using paper and waste paper in the North and the South of Vietnam. These results showed that each organization of the South used double scale in quantity in comparison with those of the North. However, in the North the annual demand on capita was 1.5 kg higher than the other.

Table 8

Comparative index	Total paper quantities (kg/month)		Average (kg/capita/month)	
	The South	The North	The South	The North
Average using paper quantities per month	154.24	72.88	0.58	0.72
Average waste paper quantities per month	15.50	11.00	0.36	0.19

Source: NEA, 10/2002 and 10/2003

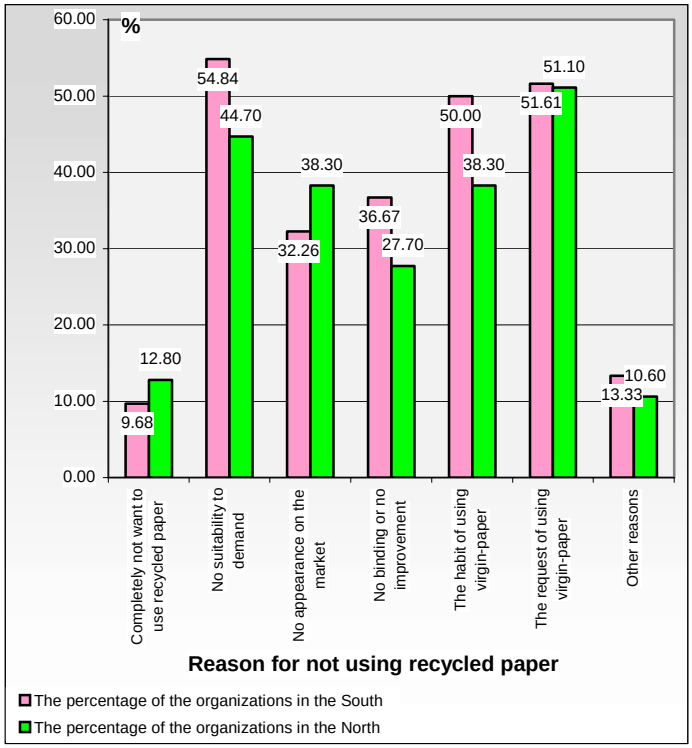
The situation of waste paper treatment in these both areas is assumed in figure 6.



Source: NEA, 10/2002 and 10/2003

Figure 6

Planning for using recovered paper in the South was 40,48 % and in the North was only 34 %. Most of organizations were highly appreciated by using recycled paper even though they still expressed the reasons why they did not use (figure 7).



Source: NEA, 10/2003

Figure 7

It is known that:

For every tonne of paper used for recycling savings =
o At least 30000 litres of water o 3000 - 4000 KWh electricity (enough for an average 3 bedroom house for one year) o 95% air pollution

An optimal strategy to increase recycling of papers therefore proposed some solutions in priority as follows:

1. **Urgent need legal agreements and framework of law for environment-closed products and recycled paper.**
2. **Enhance knowledge of community about the environment-closed products and recycled paper.**
3. **Develop the ability and enhance the co-operation to improve the production and the demand of using recycled paper.**
4. **Support for using environment-closed products and recycled paper.**
5. **Support in financial aspect for production of environment-closed products and recycled paper.**
6. **Creating market and network for collection and distribution.**

Since paper recycling activities remain more in private sectors without environmental care and properly management it is necessary to have a systematic investigation. These activities need to be reorganized. They may be constructed in different levels, from state in to province, where paper recycling potential is available.