



TA KHMAO

SOLID WASTE MANAGEMENT BASELINE SURVEY



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1 Introduction



Current solid waste management systems in Asia are strained, and landfill space is fast becoming a rare commodity. Governments face increasing costs for disposal, while public health and the environment suffer from the damaging effects of untreated solid waste. In 2009, the United Nations Economic and Social Commission for Asia and the Pacific embarked on a regional project, Pro-poor and Sustainable Solid Waste Management in Secondary Cities and Small Towns, to find appropriate approaches to waste management that would transform waste products into valuable 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, particularly benefit the urban poor, contribute to low-carbon development priorities and can be partly financed through the sale of carbon credits. Cambodia is one of the countries targeted in the project. Based on the outcomes of workshops and consultations with civil society groups, local government representatives and other United Nations organizations, Ta Khmao municipality, the capital of Kandal Province, was selected for a baseline study, the first step in developing the pilot project. The study centred on collecting accurate information on solid waste management in Ta Khmao.



2 Study methodology



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Ta Khmao is located around 11 km from the country capital of Phnom Penh. It comprises six sangkats (communes): Doeum Mean, Ta Khmao, Preak Russei, Preak Hor, Ta Khdol and Kampong Samlanh. A random sampling method was used, and three of the six sangkats were selected – Doeum Mean (the centre), Preak Russei and Ta Khdol.

The methodology involved: i) a household survey, ii) interviews with waste pickers, recycling shop owners and staff within the Kandal provincial and municipal authorities and iii) a waste generation and composition analysis carried out by the Community Sanitation and Recycling Organization (CSARO).

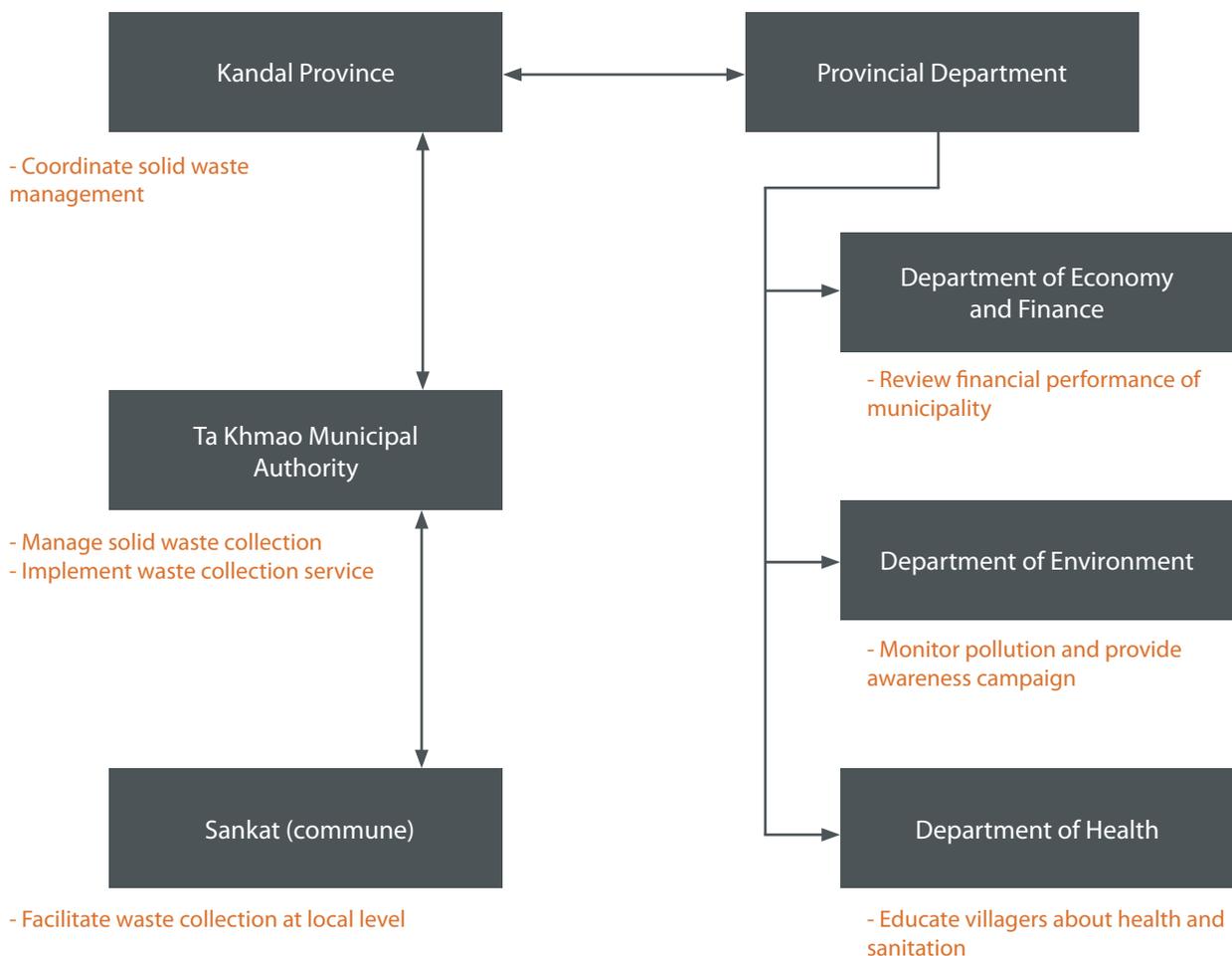
The household survey, also conducted by CSARO researchers, covered a total of 120 households within the three sangkats. Households were randomly selected and categorized into “low income” and “high income”, with the classification based on visual assets, such as house structure (materials) and size and assets (modes of transport). 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, waste disposal practices and opinions on environmental impacts.

Individuals operating in the informal sector (waste recycling activities) were also interviewed to learn about the informal recycling system and practices in the municipality. For the waste composition analysis, 96 households were categorized into three levels: high-income, medium-income and low-income households (again based on visual assets). A total of 32 households from each category were selected for interviewing. In addition, waste was collected and analysed from 27 local shops, three offices, three markets and three restaurants over a period of seven consecutive days.

3 Overview: Solid Waste Management in Ta Khmao

STRUCTURE FOR SOLID WASTE MANAGEMENT

In 2009, the Ta Khmao Municipal Authority and the Provincial Cabinet (provincial governor's office) of Kandal created a committee for addressing the issues of waste collection and disposal in the city. The committee consists of representatives from three municipal offices (environment, economy and finance, and health); the Provincial Department of Environment, the Provincial Department of Economy and Finance, the Provincial Department of Health, heads of relevant commune councils and representatives of the provincial government.



WASTE COLLECTION AND DISPOSAL SYSTEM

Unlike other cities (such as Battambang and Kampot), waste collection service and disposal in Ta Khmao is provided by the public sector, the Ta Khmao municipal authority. While waste is collected on a daily basis from all the markets in the city, household waste is collected once every two or three days. According to municipal officials, approximately 68 m³ of household waste is collected daily and disposed in the local dumpsite.

In addition, 36.5 m³ of market waste is collected daily from five markets (Doeum Mean, Ta Khmao, Preak Hor, Preak Russei and Rong Chak). Of them, waste is mainly generated from the Ta Khmao market, which is the largest (generating 24–28 m³ of waste per day). Every day, five truckloads of waste are brought from the Ta Khmao market. Collection containers are installed around two of the markets (Ta Khmao and Doeum Mean). Market cleaners dispose of waste twice a day into the containers (morning at 11 a.m. and in the afternoon at 5 p.m.).

A private company (subcontractor) is responsible for collecting waste from garment factories and transporting it to the dumpsite. There is no separate dumpsite for hazardous waste. The private company collects hazardous waste from health clinics and the hospital and disposes it in the city dump.

What waste collection service exists is limited. The analysis suggests that households in the urban communes have a higher level of coverage. The limitation of the collection service, according to the municipal officials, is attributed to poor or narrow access roads that lead to smaller communities within the city. A large portion of the population does not receive any collection service. This encourages, together with the absence or limited public awareness of environmental pollution, the illegal disposal of waste.

The illegal dumping of waste has become a major concern among municipal leaders.

HOUSEHOLDS RECEIVING WASTE COLLECTION SERVICE

Sangkat	Total households	Households receiving waste collection service	Percentage of household receiving waste collection service
Ta Khmao	3847	1867	49%
Doeum Mean	2648	394	15%
Kampong Samianh	2322	264	11%
Ta Khdol	1152	74	6%
Preak Russei	1988	261	13%
Preak Hor	1671	20	1%
Total	13628	2880	21%

Source: Ta Khmao Municipality, 2011

HUMAN RESOURCES AND EQUIPMENT

There are 61 staff members involved in collection, transport and disposal of waste in the municipality. Of them, 31 workers engage in waste collection and transport, and 30 workers engage in street cleaning. The work day starts at 4:30 a.m. every day of the week.

For collection, transport and disposal, the municipality has a total of three trucks and a backhoe, all of which were provided by the provincial government. The equipment is old and frequently breaks down. That fees collected cover only the operating and minor maintenance expenses. The service is very dependent on external sources of funding (the provincial government).

LABOUR AND EQUIPMENT FOR WASTE COLLECTION WORK

Item	Load volume	Quantity
Truck	14 m ³	1
Truck	7 m ³	1
Truck	5 m ³	4
Backhoe	-	1
Bulldozer	-	1
Cart	-	5

Source: Ta Khmao Municipality, 2011

FEE COLLECTION

Service fees range from 2,000 to 50,000 riel (\$0.5–\$12.5), depending on the type of establishment, with a higher fee applied to shops, hotels, restaurants and public institutions. Households are charged between the equivalent of \$0.50 and \$1 per month.

The Ta Khmao municipality relies on the financial support provided by the provincial government because what is collected from users of the service is not sufficient to cover the operating expenses. On a monthly basis, apart from the fees collected from the households, the Kandal Provincial Cabinet provides between 3 and 6 million riel (\$750–\$1,500) to support the waste collection service. The revenue derives from the Provincial Department of Economy and Finance and the Ta Khmao provincial government.

MONTHLY MUNICIPAL INCOME FOR WASTE COLLECTION SERVICE

Sangkat (commune)		Collected income (Riel/month)	Collected income (USD/month)
	Ta Khmao	9 694000	2424
	Doeum Mean	1 885000	471
	Kampong Samianh	1 358000	340
	Ta Khdol	365000	91
	Preak Russei	1 333000	333
	Preak Hor	227000	57
Subtotal		14 862000	3716
	5 markets	10 994980	2749
Grand total		25 856980	6464

EXPENDITURE FOR WASTE COLLECTION SERVICE

Item			Expenditure (Riel/month)	Expenditure (USD/month)
Worker (waste collector + road cleaning fee)	Person	61	12 125000	3031
Diesel	Litre	2500	12 125000	3031
Gasoline	Litre	100	520000	130
Oil	Litre	180	1 800000	450
Repairing	-	-	20 552000	5138
Total expenditure (14000 riel = 1 USD)			47 122000	11780
Balance			-21 265020	-5316

Source: Ta Khmao Municipality, 2011

OPERATION OF THE DUMPSITE

The dumpsite is located 8 km from the urban area, in Sangkat Preak Hor, and has been operating since 2001. Situated next to a small dam, the dumpsite covers an area of approximately 20,000 m², with a depth of 6 m. The dumpsite is provincial property, while the management and operation of the dump is under the Ta Khmao municipal authority.

There is no management plan, however. The dumpsite operates daily. Fires break out frequently. According to municipal officials, it receives approximately 70 m³ of waste per day, and they estimate that based on that waste load it can operate for 20 more years.

4 Findings from the waste composition and generation analysis

HOUSEHOLD WASTE

According to the survey findings, an average of 0.586 kg waste is generated per person each day. With a total population of 66,565 persons in 2011, the total household waste generated per day in Ta Khmao is estimated to be around 39 tons.

TOTAL QUANTITY OF WASTE GENERATED BY HOUSEHOLDS

Domestic waste (kg/person)	0.586
Total population in 2011 (person)	66565
Total household waste generated per day (kg)	39007

Source: Field Survey, July 2011

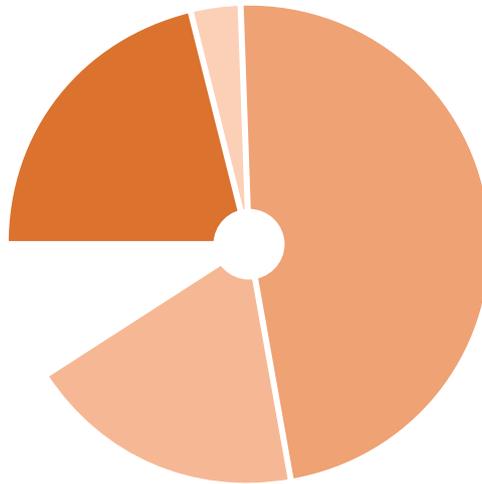
According to the analysis, as reflected in the following table, the better off economically a household is the more waste it generates.

ESTIMATION OF TOTAL WASTE GENERATION IN KAMPOT

Category	Total Person	Total Kg	Average (domestic waste) Person/day
High-income households	169	694.72	0.587
Medium- income households	164	901.63	0.785
Low-income households	170	465.99	0.392
Grand Total	503	2062	0.586

Source: Field Survey, 2011

About 22 per cent of the waste generated by the households in the analysis was kitchen and vegetable waste, as the follow table shows; nearly 50 per cent of the waste was grass or wood. The remainder was largely plastic material.



COMPOSITION OF HOUSEHOLD WASTE

Vegetables and kitchen waste	Paper	Grass and wood	Plastic	Others
21.36%	3.29%	47.83%	18.6%	8.92%

Others includes bone, textile, metal, rubber, leather, glass and ceramic / Source: Field Survey, September July 2011

SHOP AND OFFICE WASTE

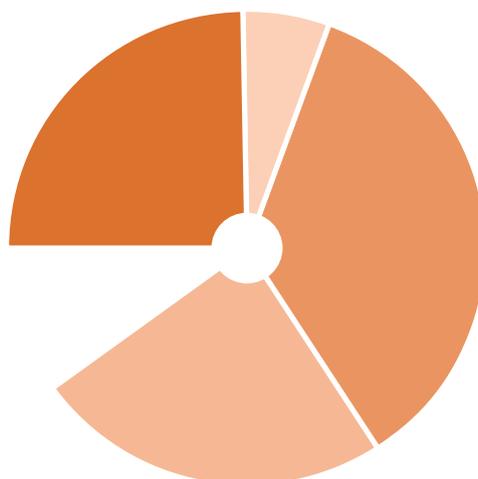
According to information from Ta Khmao municipal officials, around 4,755 shops (small to large; size was not indicated) and 35 offices operate in Ta Khmao. The waste from 27 shops and three offices was collected during the seven-day analysis to calculate the daily waste generation rate. The minimum of waste generation from those 30 shops and offices was 89 kg and the maximum was 139.2 kg, with the average daily rate at 106 kg (offices are closed on Sundays, which lowered the amount of waste that day).

AVERAGE OF WASTE WEIGTH GENERATED FROM SHOPS AND OFFICES

Total 30 shops and offices	742
Average (kg)	106
Average of a shops and office/day (kg)	3,5

Source: Field Survey, July 2011

According to the analysis, organic waste accounted for 60 per cent of the waste from shops and offices: 25 per cent was vegetable and 35 per cent was grass and wood, as shown in table 8. Some shops sold coconuts or sugarcane, which generates large amount of waste in terms of weight and volume (the sugarcane was categorized as grass or wood). The proportion of plastic waste generated from shops is comparatively higher than the plastic waste generated from households.



COMPOSITION OF SHOPS AND OFFICES WASTE

Vegetables and kitchen waste	Paper	Grass and wood	Plastic	Others
24.92%	5.73%	35.38%	24.16%	9.81%

Others includes bone, textile, metal, rubber, leather, glass and ceramic / Source: Field Survey, September July 2011

A large component of the waste was plastic (around 20 per cent), largely because most products are packed in plastic bags. The use of plastic bags for packing is common in many Cambodian cities, and this practice has triggered the concern of local authorities as well as officials with the Ministry of Environment. However, there is still limited education directed at the local population on the consequences.

SUMMARY OF WASTE COMPOSITION FROM SHOPS AND OFFICES

Organic waste	60%
Recyclable waste	30%
Non-compostable waste	10%
Total	100%
Density	153 kg/m ³

Source: Field Survey, July 2011

GUESTHOUSES AND RESTAURANTS WASTE

According to municipal data, there are 14 guesthouses (no hotels) and 83 restaurants and food shops (18 restaurants and 65 food shops) operating in the six communes of Ta Khmao. However, the analysis covered only three communes and they were ones with few guesthouses and restaurants. Thus waste was collected and analysed only from four guesthouses (63 rooms with 74 beds) and three restaurants. The analysis found that a guesthouse generates about 7 kg of waste per day, while a restaurant generates about 12 kg per day.

SUMMARY OF WASTE COMPOSITION FROM GUESTHOUSES

Organic waste	40%
Recyclable waste	39%
Non-compostable waste	21%
Total	100%
Density	171 kg/m ³

Source: Field Survey, July 2011

As expected, the share of organic waste generated from restaurants was as high as 78 per cent, followed by 14 per cent of recyclable waste and only 7 per cent of non-compostable waste. This tends to reflect the function of the establishment. Nearly all the surveyed guesthouses did not serve food.

SUMMARY OF WASTE COMPOSITION FROM RESTAURANTS

Organic waste	78%
Recyclable waste	14%
Non-compostable waste	7%
Total	100%
Density	232 kg/m ³

Source: Field Survey, July 2011

MARKET WASTE

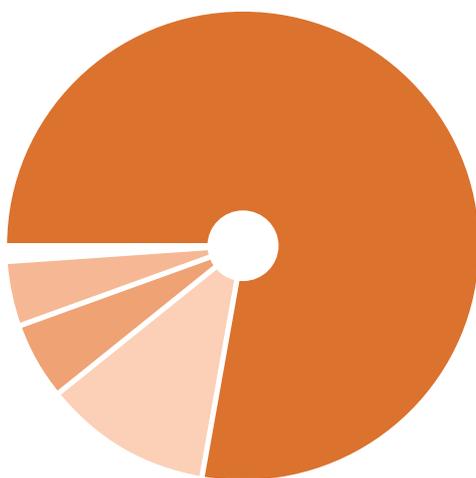
The data on the level of waste that the three surveyed markets generate derives from the Municipal Solid Waste Management Committee.

VOLUME OF MARKET WASTE IN TA KHMAO

Market	Doeum Mean	Ta Khmao	Preak Hor	Rong Chak	Preak Russei	Total (m ³)
Volume (m ³ /day)	6	24	5	1	0.5	36.5

Source: Ta Khmao Municipality, 2011

According to the analysis of market waste generated, nearly 80 per cent of waste was vegetable and other kitchen-related content. The second-largest share of waste composition was paper, accounting for about 12 per cent of the market waste.



COMPOSITION OF MARKET WASTE

Vegetables and kitchen waste	Paper	Grass and wood	Plastic	Others
77.81%	11.49%	5.42%	4.17%	1.11%

Others includes bone, textile, metal, rubber, leather, glass and ceramic / Source: Field Survey, September July 2011

To maximize the accuracy of results, 210 litres of market waste were examined (from the three markets of Doeum Mean, Ta Khmao and Preak Hor); 70 litres of waste from each market was used for the composition analysis.

SUMMARY OF WASTE COMPOSITION FROM MARKET

Organic waste	83%
Recyclable waste	16%
Non-compostable waste	1%
Total	100%
Density	278 kg/m ³

Source: Field Survey, July 2011

WEIGHT OF MARKET WASTE IN TA KHMAO

Waste type	Average weight (kg/market)	Daily % of waste type per market	Doeum Mean	Ta Khmao	Preak Hor	Rong Chak	Preak Russei	Total weight (kg/day)
Organic	16.176	83.23	1 386535	5 546139	1 155446	231089	115545	8 434753
Waste type	3.052	15.70	261571	1 046286	217976	43595	21798	1 591226
Non-com postable	0.207	1.07	17763	71053	14803	2961	1480	108060
Total	-	-	1 665869	6 663478	1 388224	277645	138822	10 134039
Density								278 m ³

Source: Ta Khmao Municipality and field survey, 2011

TOTAL WASTE GENERATION

Based on the analysis, the following table indicates an approximated waste level in Ta Khmao.

SUMMARY OF WASTE GENERATION IN TA KHMAO

Places	Formula for calculation	kg/day	% Organic	Organic Waste (kg/day)
Domestic Waste	$0.586 \times 66,565$	39007	69	26915
Shops/Offices and Institutions	3.5×4790	16765	60	10059
Restaurants and Food shops	12×83	996	78	777
Hotel/Guesthouses	7×14	98	40	39
Markets	Ta Khmao	$6\,663.478 \times 1$		
	Doeum Mean	$1\,665.869 \times 1$		
	Preak Hor	$1\,388.224 \times 1$	83	8435
	Rong Chak	277.645×1		
	Preak Russei	138.822×1		
Total		67000		46225

Source: Field Survey, July 2011

5 Findings from household survey and interviews with informal sector parties

WASTE COLLECTION AND DISPOSAL PRACTICES

Of the 120 surveyed households, 73 per cent reported that they did not have access to waste collection service. They expressed strong willingness to have the service expanded into their community. A majority of households that received collection appeared to be satisfied with the service, but some expressed dissatisfaction due to the irregularity of the service.

Households located along the main road or in the urban centre receive more reliable service; the majority of households in poor areas or off the main roads do not receive any service. They resort to burning or burying their waste in vacant land or dropping it into a nearby water body. Some of the high-income households who do not have access to waste collection service hire a motorbike taxi to transport their waste to a disposal site.

In terms of household responsibility for waste management, 67 per cent of the interviewed households said that female household members were directly in charge of waste disposal.

PREFERENCES FOR WASTE COLLECTION

The analysis on the preferred system for waste collection from households indicates that 88 per cent of the interviewed households would prefer to have door-to-door collection; only 6 per cent of the surveyed households preferred that waste be collected from a designated location. Another 6 per cent of the surveyed households were content to dispose their waste in a public bin. All the surveyed households expressed support for having the collection service expanded to non-served areas of the city.

Regarding frequency of collection, 36 per cent of the surveyed households wanted the service once every two days, 34 per cent preferred a daily collection and 28 per cent requested once every three days. A majority, at 66 per cent, of the households preferred a morning collection time.

ENVIRONMENTAL CONCERN AND AWARENESS

A total of 98 per cent of the household respondents indicated concern for the current environmental issues in their community as a result of the limited collection service. Waste is often piled in vacant land close to their home and burned, many pointed out.

Many respondents commented that there are not enough bins or waste containers provided by the municipal authority; 98 per cent of the surveyed households indicated dissatisfaction with the location and accessibility of the communal bins. Bins or waste containers are only available at markets or the town centre, they explained.

Some 78 per cent of households admitted to engaging in improper waste disposal practices, such as burning, dumping haphazardly or discarding into the street or a nearby waterway. These households were largely those

with no access to the collection service.

And 79 per cent of the households said they would separate their waste if it is required by government. A minority of respondents wanted the collection company or the municipal authority to provide bins for the separating process.

Interestingly, 100 per cent of the respondents agreed that community participation is necessary for the efficient functioning of a local waste collection system and the improvement of environmental conditions; cooperation was considered an essential component of environmental management. There was full support for cooperation with a community-based organization, with many people agreeing that this would contribute to an overall improvement of waste management locally.

INFORMAL RECYCLING SYSTEM

Based on the interviews with the six recycling shop owners (the research found ten recycling shops and selected six for interviewing), more than 2 tonnes of waste are recycled daily through the informal sector (waste pickers). Waste pickers sell the collected recyclable waste at the recycling shops on a daily basis. Typically, they start around 4 a.m. to pick up recyclable waste along the main roads and in the business area (especially around the markets) and work until 3 or 4 p.m. Most work without any cart, and thus carry what they find.



RECYCLING SHOPS BY QUANTITY AND PRICE OF RECYCLABLE WASTE (KG/DAY)

Shop	Paper (kg)	Fe (kg)	Cu (kg)	Al (kg)	Plastic (hard) (kg)	Glass (number)
1	66	335	1	17	13	10
2	0.5	1	0.5	0	50	5
3	500	67	0.5	1.5	16	30
4	10	7	0.1	7	10	10
5	10	16	0.5	1.5	24	7
6	27	17	0.5	1.5	10	40
Total	613.5	443	3.1	28.5	123	-
Daily average weight of total (kg)				2018		
Average	201	74	0.5	5	20.5	17
Price (USD) per kg and bottle	0.125	0.3	1.375	1.375	0.45	0.0125

Source: Field Survey, July 2011

The researchers calculated a total of 44 waste pickers working in waste recycling; 32 males and 12 females. In the interviews, 15 waste pickers (11 of them did not have a cart and four did) reported income ranging from 8,000 to 25,000 riel (\$2–\$6.25) per day. The waste pickers with a cart earned more than those without one. The responses did not indicate a significant difference of income between the men and women. Waste pickers who own a cart collect or purchase recyclable waste from households for selling in bulk to the recycling shops. This method enables them to earn more income than those who did not have capital for investing in a cart. The level of income also depends on the time they spent picking recyclable material.

At the dumpsite, there were about 25 people picking waste each day: seven men, ten women and eight children. The number of children involved in waste picking increases on the weekend when they are not in school.

6 Conclusions and a way forward

Through the establishment of the Solid Waste Management Committee, the Ta Khmao municipal authority has increased the local knowledge about and responsibility for solid waste management. Although there is lack of official data on waste collection, awareness on income and expenditures in the sector among the municipal officials is comparatively good.

As in other towns/cities in Cambodia, the collection rate in Ta Khmao is low and covers mainly the central area and markets. The local government has managed to increase the amount of income from collection fees by improving its services and working more closely with the commune leaders. This approach could be of interest for other towns that are keen to increase the income from the collection of fees. Because of its responsibility for collection and the direct involvement in fee collection, the local government also has opportunity to set up a transparent system that allows for close monitoring of income and expenditures.

A large portion of the waste in Ta Khmao is organic and suitable for composting. A good start for composting would be the market waste, which represents a considerable load disposed into the local dump; composting market waste would prolong the life of the dump considerably. Another major portion of the waste is recyclable material. Considering the town already has an active informal recycling sector, working with the waste pickers to improve the recycling system as well as their working conditions would be beneficial for both the town and the waste pickers.

The positive response among households regarding the willingness to separate waste is encouraging. Greater interest in separating waste at the source could be achieved most likely through an educational programme and the regulation of waste management. Villagers expressed openness to participate in waste management and willingness to pay for service expansion to their village; they also suggested they would support waste-separating activities but that bins or plastic bags should be provided for this purpose. On a final note, they truly wanted to see changes in their communities.

A WAY FORWARD

With a Solid Waste Management Committee that is working to improve its service to its residents and a dumpsite that the local government owns, Ta Khmao has good potential for improving its solid waste management.

Waste from the large central market in Ta Khmao is ideal for composting. A well-managed compost plant centrally located could save transportation costs for the local government while also prolonging the life of the dumpsite. A main constraint to developing an integrated resource recovery centre, however, is the pressure on the land market, which poses difficulty for allocating suitable land.

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