THE STUDY OF LANDFILL SITUATIONS IN THAILAND

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Abstract

Waste is a major problem in many countries around the world. Thailand, as a developing country, is also facing an increasing trend of waste throughout the decades. Managing waste requires a large number of landfills, which means that it would affect the living standards of people in that area, and that environmental concern should be taken into consideration. This study gathers information of current landfill-related situations in Thailand, including amount of available landfills, amount of waste, related regulations, and case studies, to be used for further landfill-related studies. The study reveals that the increased wastes lead to a severe impact of landfill spaces, representing that the unsustainable landfills will not be able to meet the standard of 20 years. Recommendations for future improvement should be enforced as regulations, such as 3Rs and Service Charge Act to increase landfill lifetime.

Keywords: Municipal solid waste, landfill, Thailand, waste

Introduction

In the age of globalization, advanced technology has an impact on human civilization, which leads to economic growth, excessive consumption, and urbanization around the world. Currently, the world generates around 3.5 million tons of waste per day or 1.3 billion tons per year. Among those, 54.02% come from developing countries (Hoornweg and Bhada-Tata, 2012). For example, Spain generated 72,137 tons of waste per day. Malaysia, Thailand's neighbor, generates half of the wastes generated in Thailand, which takes up to 1.12% of the world's total waste or 2.07% of wastes in developing countries (Hoornweg and Bhada-Tata, 2012). The more wastes created, the more landfills required for disposal. This, in turn, affects the environment and the health of ecosystems and biodiversity. In many countries, laws and regulations have been implemented by government and authorities to manage and reduce the impact of waste to the environment. In Thailand, however, there are some existing laws related to waste management and recycling, but are yet effectively implemented.

Waste is defined as any garbage or refuse, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities that most people are still unaware of (US Environmental Protection Agency, 2012). Based on Hoornweg and Bhada-Tata (2012), a person generates 1.2 kilograms of waste per day. In 2025, the figure is expected to be almost double. Countries with high income tend to generate the highest amount of waste, follow by lower middle income, upper middle income, and lower income countries, respectively (see Figure 1). China, as a part of lower middle income countries, creates the biggest amount of waste in the world.

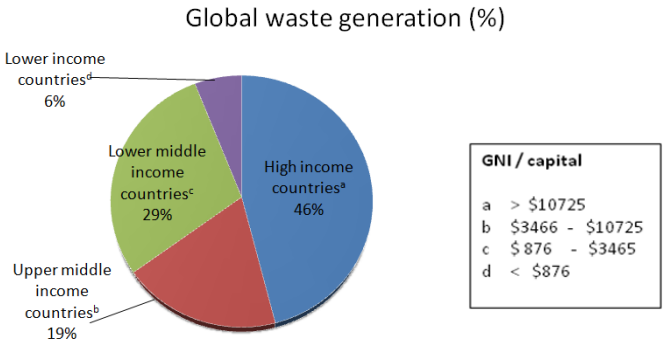

Figure 1 Income and waste generation

According to US Environmental Protection Agency (2012), waste can be divided into two types: 1) municipal solid waste (MSW) and 2) construction and demolition (C&D) waste.

1) Municipal solid waste (MSW) is commonly known as trash, everyday items that we use and dispose. Almost half of the global MSW component is organic waste (see Figure 2). Apart from organic waste, around 30% of the waste is paper, plastic, glass, and metal. These wastes, if properly managed, can lead to waste reduction.

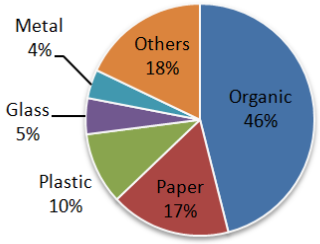

Figure 2 Components of waste

In 2007, Thailand is in the top ranks in generating huge amount of organic waste in the developing countries. 48% of the components are organic waste, and around 40% is plastic, paper, metal, and glass, as shown in Figure 3 (Kaosol, 2007). These figures are quite different from those in developed countries. It might be because of different life styles, as countries with more income are likely to produce more packaging materials, thus creating more paper and plastic wastes (Idris et al., 2004).

Bangkok, as a capital city and the center of Thailand's economy, has a population of 5.7 million people from 64 million people in Thailand (i.e. 9% of total population) (Department for Environment Food and Rural Affairs, 2010). On top of that, there are 38 million visitors (tourist and excursionist) yearly (Statistical Forecasting Bureau, 2010). This leads the city the biggest waste creator in Thailand (one fourth of total waste in Thailand). It is observed that four major components of those wastes can be recycled, but less than 20% is now recycled (PCD, 2011).

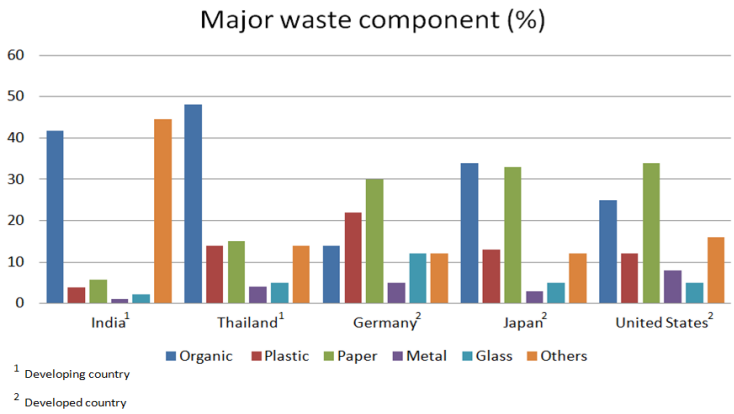

Figure 3 Waste components in developed and developing countries

2) Construction and demolition waste (C&D waste) and another type of solid waste, consists of debris generated during the construction, renovation, and demolition of buildings, roads, and bridges (US Environmental Protection Agency, 2012). This type of waste generates up to 10-30% of the total waste from many landfill sites around the world (Fishbein, 1998). Japan, for example, generated 18.2% of C&D waste; 71.2% of illegal waste dumping was related to C&D waste (Ministry of the Environment, 2005). In Hong Kong, one-fourth of the total waste generated in Hong Kong was considered C&D waste, while in USA, one-third of the volume of landfills is considered C&D waste (Chan, 2011).

In Thailand, C&D waste accounts for 7% of solid waste; components are as illustrated in Figure 4 (Kofoworola and Gheewala, 2009). A major proportion of C&D waste emerges in Bangkok due to a crowded population, leading to an increase in the needs of residential buildings and infrastructures for businesses to serve a better life quality.

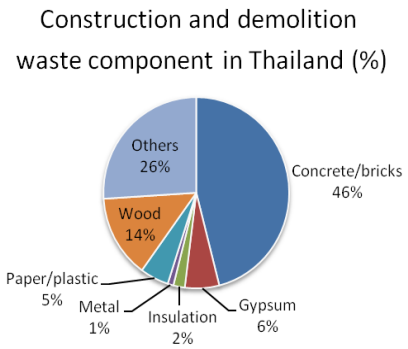

Figure 4 Components of C&D waste

Ineffective waste management causes excessive wastes, and, as a result, more landfills are required.

Landfills in Thailand

Thailand has a total of 127 waste disposal sites (see Figure 5); 112 of them (88%) are landfills, three and 12 of them are incinerator and integrated systems. Out of 112 landfills, 96 of them are currently operated; half of them locate in the central part of Thailand. It is noted that 90% of the total wastes in the disposal sites are disposed legally in landfills.

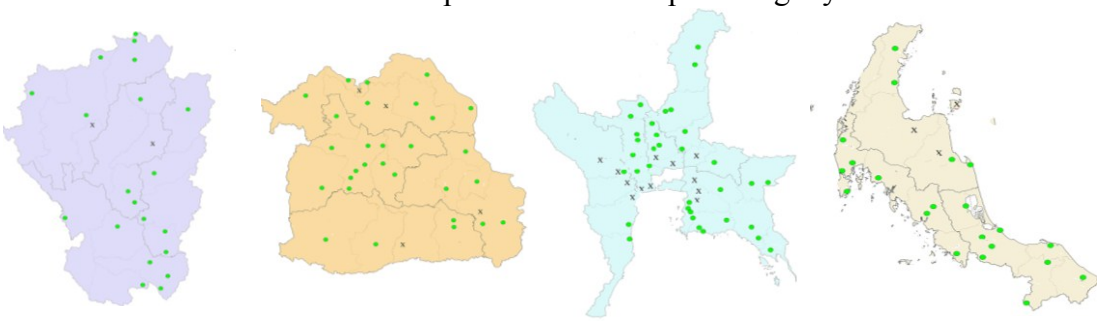

Figure 5 Disposal sites in Thailand (PCD, 2011)

Landfill is the final disposal site for waste, designed to minimize the impact of solid waste on environment and human health (Johannessen and Boyer, 1999). It consists of liner systems to prevent leachate and harmful substances to the neighborhood (Hoornweg and Bhada-Tata, 2012). Landfill classification varies by different regions, nations, sites, population, and amount of wastes generated. According to Johannessen and Boyer (1999), landfills are classified into six major types: 1) semi-controlled dump, 2) controlled dump, 3) engineered landfill, 4) sanitary landfill, 5) sanitary landfill with top seal, and 6) controlled contaminant release landfill. Apart from that, transferred station is another type of landfills currently used in Bangkok (Bangkok Metropolitan Administration, 2007).

Transferred stations in Bangkok

Bangkok generates one fourth of the waste in the country. However, there is no permanent landfill but transferred station. As shown in Figure 6, wastes at Nongkham and Saimai transferred stations, which are around 5,420 tons per day, are transferred to Khampangsan landfill in Nakornpathom province. On the other hand, wastes at On-nuch transferred station, which is around 2,200 tons per day, are transferred to Phanomsarakham landfill in Chacheongsao province. On-nuch transferred station is also considered a compositing plant that manages 1,000 tons of waste per day (Bangkok Metropolitan Administration, 2007).

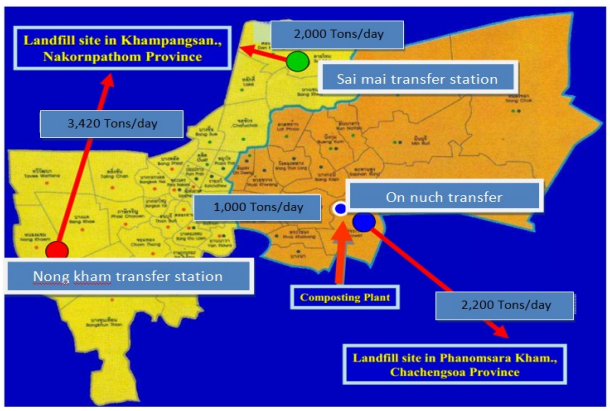

Figure 6 Transferred stations in Bangkok

Current situation of landfills

Table 2 shows the guideline of land requirement for various landfill capacities (with 20 year design period). It is found that 11 of them now face with the overloaded capacities (see Table 3). These landfills will have a shorter life time than expected. Tak landfill, for example, has wastes coming in almost double as the capacity could have. One solution that might be implemented is that the landfill can transferred some of the wastes to nearby provinces, such as Nakhonsawan or Kamphaengphet that have larger sizes and still have capacity of holding more wastes. Tradeoff with transportation cost must, however, be considered. The only landfill with excessive wastes in the northeast region is Loei, but those wastes can be transferred to a larger landfill in Udonthani, which has almost a half of the capacity left. Three landfills in the south that exceed the capacity can also be transferred to the nearby provinces.

Table 2 Guideline of land requirement for various landfill capacities (with 20 year design period) (PCD, 1998)

Tons/day	Require (rai)
10-50	15-70
50-100	70-130
100-300	130-380
300-500	380-620

Table 3 Amount of landfills with overloaded capacity (PCD, 2011)

Region	Location of landfill	Province	Area (Rai)	Amount of waste transferred into the system (tons/day)
North	Maesot	Tak	27.2	70-90
Central	Town municipality	Ayutthaya	30	80-100
	Provincial administrative organization	Nonthaburi	186	1,000-1,200
Northeast	Town municipality	Loei	52	70-90
East	Pattaya	Chonburi	140	330-400
	Maptaphut	Rayong	33	100-120
	Town municipality	Chanthaburi	117	100-200
	Aranyaprathet	Sakaeo	8	20-35
South	Town municipality	Chumphon	56	60-80
	City municipality	Nakhon Sithammarat	200	300-400
	Town municipality	Phatthalung	65	40-60

Currently the majority of landfill capacity overloaded is in the central and east regions. Rayong, for example, is an industrial area, and that the wastes disposed to landfill are large compared with its small landfill sized. Chonburi and Ayutthaya are tourist destinations that lead to high amount of wastes (Statistical Forecasting Bureau, 2010).

It is cleared that the most critical landfill is in Nonthaburi. The wastes transferred into the system should be 100 – 300 tons per day, but the real figure is 1,000 – 1,200 tons per day. One of the major reasons is urbanization of population that expands from Bangkok as a capital city (Department of Provincial Administration, 2011). If the landfill cannot handle more wastes, it will be shut down. Most people misunderstand that building a new landfill solves the problem. On the other hand, with the high rate of people moving in, in a short period of time, new landfill will be full again. The waste decomposition may also be considered; however, this could take three months (organic wastes, for example) or up to 500 or million years (e.g. plastic and metal).

Related regulations

Situations of landfill are critical and many countries around the world attempt to reduce wastes in order to expand the landfill life cycle. Hong Kong, for example, is now filled with its landfill capacities (Environmental Protection Department, 2010). It is a challenge for the country to find more landfill spaces due to the limited land. UK also has a serious issue about landfills. UK decided to ship recyclable waste to China, although they are 10,000 miles apart. This is to reduce the environmental impact, and empty the landfill space for less carbon emission wastes.

To effectively manage wastes and expand landfill life cycle, a number of regulations are encouraged. 3 Rs is one of the effective regulations. It stands for reduce waste generating, reuse for the utilization of the product, and recycle. This aims to save natural resource, energy savings, and the health of ecosystems. This regulation is found the most effective practice around the world (Pollution Control Department, 2011). In 2011, Thailand recycled 4.10 from 15.98 million tons of waste (26% of the total waste). Based on the amount of wastes recycled, 83% come from local public and private businesses, 14% from composting and producing bio gas, and 3% from electric energy, bio fuel, and alternative energy (Pollution Control Department, 2011). If the recycle rate increases, the amount of wastes dumped into landfill will be decreased. This expands landfill life cycle in the future, and creates a sustainable environment.

Recycling protects and expands manufacturing jobs and increases competitiveness. Green manufacturing is emerging in Thailand by the introduction of Siam Cement Group (SCG) and Petroleum Authority of Thailand. These companies use recycle components as raw materials for productions. These create image, reduce cost, and increase revenue. Recycling also reduces the need for landfills and incineration. Preventing pollution caused by the manufacturing of products from virgin materials is another beneficial. Recycling also saves energy and decreases emissions of greenhouse gases.

An example of 3Rs implementation at the landfill in Thailand is in Rayong. The landfill size is 55 rais. In year 2005, half of the landfill space was used. If no action is taken, the site will be full within a few years. The city then created one of the most effective modern waste management systems, with the concept of green city. “Waste separation” is used; wastes will be separated using belt machine, which is faster and easier. This reduces the number of garbage trucks to landfill, from five to three trucks. “Waste not waste” is also utilized in a way that organic wastes are composted and fed the animals. The city also encourages schools to separate milk boxes from other wastes to be used to make green boards, roofs, and

furniture. These recycled activities help the city reduce wastes from 25-30 tons per day to 16-21 tons per day (Green Environment in Rayong, 2012).

This success starts from the municipality, not only giving knowledge, but also doing it as a role model. Good participation with the community is also needed. Everybody needs to aware that wastes will affect the whole environment, and if the action is done, this would create a better standard of living without having to invest a lot of money (Office of Environment, 2005).

The BMA Ordinance on Service Charge B.E.2543 is another regulation set specifically for Bangkok. This regulation helps to set charges for collection, transportation, and disposal of C&D waste to reduce the amount of wastes to landfills. Other regulations are:

- The Notification of the Ministry of Industry, No. 1 (B.E. 2541) and the Notification on Disposal of Industrial Waste or Industrial waste (Additional) B.E. 2547: this regulation identifies the characteristics and qualifications of industrial waste and appropriate disposal criteria and method.
- The BMA Regulation on criteria from MSW and night soil from building, places, and public services places B.E.2545: property owners have to separate C&D from MSW, and store them in their own properties until collection by BMA on request
- Polluter Pays Principle as a part of the National Environment Act B.E.2535: this regulation forces the polluting factories to pay environmental damage and it will encourage the factories to install treatment devices and hence pollute less.

These regulations, if well implemented, will help reduce landfill requirement. This, in turn, leads to a healthy ecosystem and biodiversity, and creates a sustainable environment as a long run benefit for Thailand.

Discussion and Conclusion

From the studies, large amount of waste from population and economic growth has created environmental problems, and affects the health of ecosystems and human being in many countries around the world. As wastes increased every year, if recycling and other practices are not effectively performed, a severe situation of landfills will occur as wastes will become excessive around the world. In Thailand, a number of landfills are found filled with full capacity, especially in the central and east regions. Conducting an efficient waste management is still inconveniently due to: 1) there are no clear and direct regulations for residents to follow, 2) people in the community create a large amount of improper dumps, 3) amount of waste disposal is less than that generated, 4) lack of cooperation between the community and government (Department of Alternative Energy Development and Efficiency, 2012). Without one of any parties, accomplishing effective waste management will be abortive. It is recommended that government and authorities should educate the community. It can be initiated from children at schools and university students by having teachers advising the bad effects of improper waste disposal, the proper methods of waste disposal and the benefits to individuals and the country in the long run, and show that inappropriate waste disposal creates a critical issue to the environment and the neighborhood. Government should also implement regulations for both public and private companies to set up an ethic code conduct for waste disposal within the company, such as recycle and so forth. Penalties regulated from governments should be noticed on posts and signs in public. Activities or carnival should be set up every year to motivate residents for efficient waste management method. The outcomes would possibly results in waste reduction, minimize the needs of new

landfills and landfill areas, and increase the landfill lifetime, and leads to a healthy and a sustainable environment.

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References

1. Chan, E. (2011). Waste Statistics for 2010. Monitoring of Solid Waste in Hong Kong.
2. Fishbein, B. K. (1998). Strategies to Reduce Construction and Demolition Waste in Municipal Projects. Building for the Future.
3. Hoornweg, D., Thomas, L., & Varma, K. (1999). Solid Waste Management in Asia. What a Waste.
4. Hoornweg, D., & Bhada-Tata, P. (2012). A Global Review of Solid Waste Management,.What a Waste, 15.
5. Idris, A., Inanc , B., & Hassan, M. N. (2004). Development of a Database of Landfills and Dump Sites in Asian Countries. Material Cycles and Waste Management, 6(2).
6. Johannessen , L. M., & Boyer , G. (1999). Africa, Asia, and Latin America. Observations of Solid Waste Landfills in Developing Countries.
7. Kaosol, T. (2007). Sustainable Solutions for Municipal Solid Waste Management in Thailand.World Academy of Science, Engineering and Technology, 60.
8. Kofoworola, O. F., & Gheewala, S. H. (2009). Estimation of Construction Waste Generation and Management in Thailand. Waste Management.
9. Pollution Control Department (1998). Regulation and Guideline of Municipal Solid Waste Management.
10. Pollution Control Department (2011). Report of Pollution Situation in Thailand (outlined).