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RESEARCH

# Comparison of Recycling Activities at Landfills in Indonesia and Malaysia

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The situation of on-site recycling at landfills in Malaysia was investigated. Although Malaysia's per capita GDP is three times that of Indonesia, waste picking at landfills is still economically feasible. The reason for this is that in Indonesia, the main recovered item is plastic bags as more valuable items are removed before the waste arrives to the landfill, while in Malaysia items such as PET bottles and metal cans are abundant in landfills, thus the waste pickers can earn a higher income. The authorities should make active efforts in supporting recycling at more upstream of the material flow so that recovering of materials at landfills will be unnecessary.

**Keywords:** dumpsite scavenger; informal sector; economic feasibility; Southeast Asia

## 1. Introduction

We can infer that as an economy develops in a society, the feasibility of recycling under a market economy would decrease. This is because labour wages increase with economic development, while the price of secondary materials is more or less universal, following the world market price. Eventually the labour cost for material recovery may exceed the revenue from recovered materials.[1]

As a thought experiment, it could be hypothesised that the relationship between economic development and the recycling rate would follow an "inverse Kuznets curve" as shown in **Figure 1**.[2] The aim of this paper is not to test this hypothesis. GDP may not be the best measure for "economic development", and as in the case of discussion about the original Kuznets curve, we cannot assume that all nations go through a similar development trajectory, but probably we can grasp it as a general tendency.

In the early stage of development, resource prices are relatively high compared to labour wages, and recycling happens "naturally" under a market economy. As an economy develops, labour costs would increase and make certain recycling operations economically unattractive, thus recycling rate drops. With the further development of an economy, increased environmental awareness of the public leads to higher environmental standards and higher costs of disposal as well as subsidies for recycling. This would cause the recycling rate to rise again. Indonesia and Vietnam mentioned below can be hypothesised to be towards the left edge of the diagram, while Malaysia can be located around the centre, and Europe, North America and Japan at the right edge.

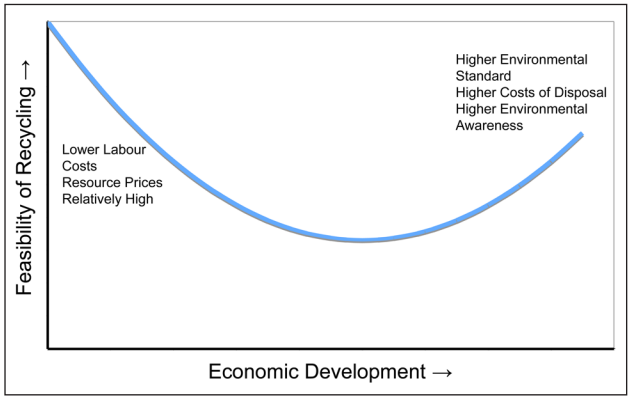


**Figure 1:** The Recycling Inverse Kuznets Curve.

For example, Futamatsu et al (2011) conducted an economic analysis of the recycling of PET bottles by junk buyers in Hanoi, Vietnam. Assuming that the prices of materials remain the same, they concluded that when wages increase by two-fold, the currently functioning system will come to an end. Sasaki et al (2014) investigated in detail the situation of waste pickers in Bantar Gebang landfill in the outskirts of Jakarta, Indonesia, and expressed doubts about the future of this activity; in the past waste pickers earned much more than the wages of manual labourers in town, but now their wages have caught up with those of the waste pickers.

On the other hand, despite the abovementioned "recycling inverse Kuznets curve" hypothesis, the presence of landfill waste pickers is notable in Malaysia (Watanabe et al 2015, Teik 2011, Thevadass 2014), where the wages exceed by far those of Hanoi or Jakarta. Obviously, recycling does not only happen at final disposal sites, but it is interesting to analyse how the economic feasibility of

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recycling activities at dumpsites in Malaysia is maintained in the context of the increase in average wages and living costs that occurs in parallel with economic growth and development.

There are many articles comparing or reviewing informal recycling activities across countries (e.g. Linzner and Lange 2012, Aparcana 2017, Ezeah et al 2013). They often pay attention to the livelihood of informal workers, but not to the amount and type of materials that are collected at dumpsites. For example, only individual case studies from 20 years ago report that the majority (85%) of dumpsite waste pickers in Nuevo Laredo, Mexico specialised in Aluminium cans, on average collecting 25 kg/day and earning 225% the minimum wage (Medina 1998). Brazil and Mexico belong to the upper middle income countries as well as Malaysia (World Bank 2017). Scavengers do exist in landfills in Brazil (Gutberlet 2008, Tirado-Soto and Zambarlan 2013), however we could not find information on is the quantities and materials collected or what income is obtained. Also in studies from countries with a lower GDP/capita, this information is rarely described in detail (e.g. Paul et al 2012, Sandhu et al 2017). We have not found any academic journal articles looking into the materials collected and the livelihood of dumpsite waste pickers/ scavengers in Malaysia in the past 20 years.

This paper investigates how the feasibility of waste picking at landfills is maintained over the course of economic development, by comparing the situation of on-site recycling activities at the landfills of Malaysia with its GDP per capita of $10,538, with that of Indonesia which has a GDP per capita three times lower of $3,475 (World Bank 2016). The two countries are located in the same region and share similar cultural backgrounds.

## 2. Case Studies

### *2.1. Methodology*

We gathered information identifying landfills that have on-site recycling activities from Malaysian waste operators and local authority officers, and we made site visits to three of them. By on-site recycling we mean extracting recyclable materials from mixed waste that has been delivered to the landfill.

Visits were made in February (landfills A, B, and C)[3] and August 2016 (landfills A and B). Each site visit lasted one day. We observed the operation of the site and picking of recyclables by the waste pickers, composition of waste in the landfill, and stockpiled materials on site. Interviews were held in Bahasa (local language) and occasionally in English through a translator, with the site managers and staff, waste pickers operating on site, and secondary material dealers that buy the materials from the waste pickers. At landfill C, the site manager was reluctant about us getting in contact with the waste pickers, so we could only talk to the formal workers. At landfill A and B, 5–6 waste pickers were interviewed at each site while they were at work, or resting in makeshift huts. In the first visit, we conducted semi-structured interviews. In the second visit, unstructured interviews were conducted to confirm the findings from the first interviews. In the second visit, half of the interviewees were the same from the first one (availability dictated by who were present on the day at the landfill). All waste pickers that we approached responded to our enquiries. Regarding the secondary material dealers, we conducted interviews at landfill A and also at a nearby stockyard in the first visit, and at landfill B at the baling and stockyard facility adjacent to the site in the second visit.

### *2.2. Landfill A*

Landfill A was constructed amidst an oil palm plantation in 1996 as an "interim landfill" by the local authority. The landfill is owned by the local authority, but now the operation is managed by the regional concessionaire. The landfill is equipped with a leachate pond and treatment facility. In addition to the local administrative unit in which the landfill is located, waste collected from two neighbouring local administration areas is also sent to this landfill. 600t/day of municipal waste is delivered. The landfill is nearing its capacity, but the authorities plan to use this until 2019.

Every day around 10–20 waste pickers operate in this landfill (**Figure 2**). There were two "leaders" who connect the waste pickers to the secondary material dealers. The site managers allow them to come into the site with their lorries twice a week and they carry out the materials they have bought from the waste pickers. The main items collected are hard plastics such as PET bottles (**Figure 3**) and metal items such as aluminium cans.

**Figure 2:** Waste picker at landfill A.

**Figure 3:** The main item collected is PET bottles.

About 30t per month of items are carried out from the landfill and recycled. There is a depot located a few kilometres from the landfill where the items are temporarily stocked, and a larger vehicle comes regularly to transport them further.

The access to landfill is free. There is no perimeter fence and one does not need to go through the main gate to access the landfill. The managers prohibit children from scavenging activities, and that is well enforced. The managers maintain a good relationship with the waste pickers, and the waste pickers cooperate with the management, for example by detecting potentially hazardous waste brought into the landfill.

Hard plastics are sorted into PET and others, and each fetch about MYR0.5/kg (US$ 0.15). According to the landfill managers, waste pickers can earn as much as MYR100 (US$ 30) per day. Together with the information from waste pickers and recyclables dealers, we estimated that on average, each waste picker collects about 100 kg/day of hard plastics as well as some amounts of other materials (e.g. metal) and earn $15–20 per day. Many of the waste pickers stated that they work 5–6 days a week, which was also the case in our studies in Indonesia (see below). So we can estimate that they earn $400–500 per month.

**Figure 4:** Landfill C.

**Figure 5:** Sorting facility at landfill C.

### *2.3. Landfill B*

Although registered as a landfill, this is close to an open dump without leachate collection. The site was established in 1997, owned by the local authority and operated by the regional concessionaire. It was planned to operate until 2010, but as of 2017 it was still accepting 250 t/day of municipal waste and waste from light industries. here are about 10–15 waste pickers operating daily, and the total number is about 30. Although we did not see any at the time of our visits, children sometimes visit this site to conduct waste picking after school, according to the waste pickers. One of our interviewee owns a motorbike and commutes from a nearby village. She collects about 100–120 kg of hard plastics and metals per day and sells them to a dealer located just outside the dump site, earning about MYR 60–70 (US$ 20) per day. The dealer has a roofed storage space, and is equipped with a baling machine.

Based on information gathered from other waste pickers, site operator staff, and the recyclables dealer, we could judge that the amount collected and earned by this informant is typical, constituting the average for this site.

### *2.4. Landfill C*

Landfill C qualifies as Level 3 Sanitary Landfill, which means that proper measures are taken to prevent leachates from polluting surface water or penetrating into groundwater. Landfill gas management and soil cover is conducted as well (overall view of the landfill on **Figure 4**). It was originally constructed in the 1980s and accepts 1700–1800 t/day of municipal waste. It is owned by the local authority, and operated by a private company. The current company took over the operation in 2012. 200 waste pickers have been operating since the time before the current company took over, and their vested privilege is respected. Landfill C has a perimeter fence, and access is controlled at the main gate. The site operator registers the waste pickers, and only those who are registered are allowed to enter the landfill for picking. The managing company charges the waste pickers for entry to the landfill, and also receives some concession from the secondary material dealers that come in to purchase the recyclables from the waste pickers. Currently there are about 100–120 registered pickers, and around 40–50 of them can be seen in daily operation. These pickers commute by motorcycles from villages nearby.

In addition to waste picking activities at the site, there is a recycling pilot plant where about 50t/day of waste is run through a belt conveyor, and employed workers extract recyclable materials by hand (**Figure 5**). The initial plan was to hire the waste pickers at this plant, but none of the waste pickers came for the job. Apparently the wages were not on par with their current earnings, and the waste pickers did not like the idea of being controlled with fixed working hours. Hence the operators had to recruit immigrant labourers in order to be able to run the plant. As the operator wanted to demonstrate the plant's effect on reducing the amount of waste ending up in the landfill, items that are not economically attractive are also extracted for recycling, such as soft plastics and

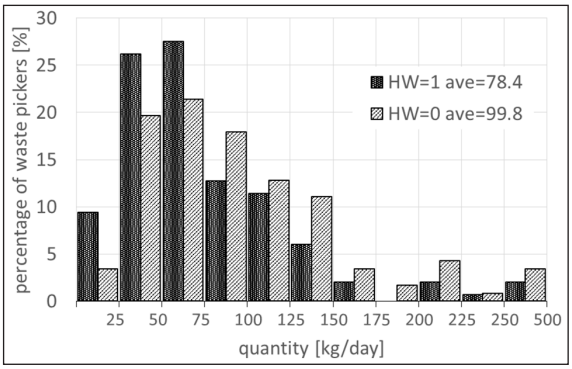


**Figure 6:** Amounts collected by waste pickers in Bantar Gebang.

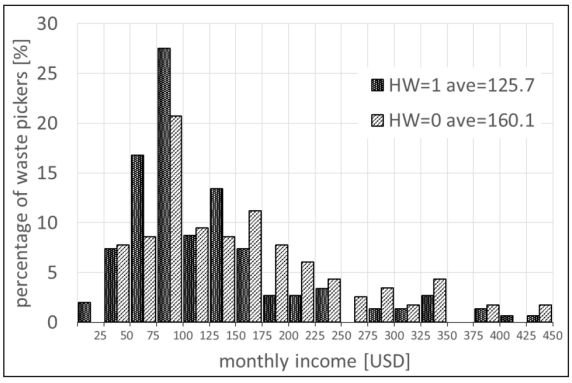


**Figure 7:** Amounts earned by waste pickers in Bantar Gebang (HW = 1 indicates that family helper at home is counted as a waste picker, HW = 0 only those that work in the landfill is counted).

soiled cardboard. Therefore the current economic viability of this facility is not high. At this landfill, there is also a facility to wash and pelletise soft plastics made of polyethylene (plastic shopping bags), by doing so they manage to sell the pellets derived from soft plastics to secondary plastics dealers (untreated plastic bags have such a low value that they are not considered to be a commodity).

## 3. Comparison With Bantar Gebang Landfill, Indonesia

The cases in Malaysia are compared with that of Bantar Gebang landfill in Indonesia, where Sasaki and Araki (2013, 2014) conducted an intensive study on waste picker activities. We performed an analysis to learn why informal on-site recycling at landfill is still feasible in Malaysia where living costs and wages are significantly higher.

In Indonesia, items with higher value such as PET bottles and metals are picked out of the waste stream at various stages before the waste ends up at the landfill. As these items are not abundantly present in the landfilled waste materials and it is therefore arduous and inefficient to search for them in the landfill, the waste pickers concentrate on picking soft plastics that are abundant although lower priced (IDR750 = ca.US$ 0.06/kg).

Depending on the waste picker, the average amount of plastics they collect in a day varies from less than 25 kg to as much as 500 kg, but in average it was about 100 kg/day (**Figure 6**). Accordingly their income from waste picking varies widely but the average was ca. IDR2Mil (ca. US$ 160) per month. The earning per waste picker will be $125, if the family members who help with the sorting of collected recyclables at home (home workers) is also counted as a waste picker (**Figure 7**). At Bantar Gebang landfill, waste pickers usually bring home what they have picked on-site and sort them out into various categories, whereas in Malaysia all activities from picking to selling are completed on site. This may be due to the fact that thin pieces of soft plastics require more efforts with sorting compared to hard plastics.

Abovementioned calculation of income per waste picker is based on data from 51 households by Sasaki et al (2014) and data from an additional 27 households obtained by the same methodology after the publication. Similarly, the calculation for amounts collected per waste picker is based on data from Sasaki and Araki (2014) and additional data collected subsequently, for a total of 78 households. In essence, these data are obtained from collating the sales ledger records of several waste picker bosses with receipt slips kept by the pickers, complemented and confirmed with interviews and observations.

The income level income is similar to that of the wages from other employment opportunities in the Jakarta area. Considering that one can have total control over one's working practice and there is no risk of being laid off from work, it is understandable that dumpsite waste picking is an attractive means to make a living for some, despite the unpleasant labour conditions.

In Malaysia recyclables are not extracted before reaching the landfill as intensively as in Indonesia. Unlike the case of Bantar Gebang, we could observe an abundant quantity of PET bottles amongst other plastic and organic waste in the landfills in Malaysia. There are private recyclers and street pickers in Malaysia, but they focus mainly on waste paper and metals.[4] Plastics, including PET bottles, are less attractive to them, as they are bulkier and cheaper. Official source separation schemes sanctioned by the authorities have started in some places, but they have not been fully taken up yet. In the past, municipal waste collectors made additional income from loading recyclables separately during routine collection and selling them to private dealers on the way to the landfill, but this practise is now strictly forbidden, as it is considered detrimental to collection efficiency.

Due to these factors stated above that could be considered side effects of economic development, more items with a relatively high value reach the landfill, and the waste pickers in Malaysia can earn almost three times more than waste pickers in Indonesia, while collecting a similar amount (ca. 100 kg/day) of different items (hard plastics are three times more worth per kg compared to soft plastics). Hence waste picking in landfills in Malaysia is still economically attractive. The situation is summarised in **Table 1**. The minimum wage in Malaysia is MYR900 per month (US$ 250), and the landfill waste pickers appear to be earning much more than that. The minimum wage in Malaysia is only marginally higher than that of the Jakarta

**Table 1:** Comparison of income from dumpsite waste picking in Malaysia and Indonesia. (Unit price and daily collection indicate those for the main items collected. Monthly income includes income from other materials).

| | Main items collected | Unit price | Daily collection | Monthly income | Minimum wage | GDP/capita |
|---|---|---|---|---|---|---|
| Malaysia | PET bottles | $0.15–0.20 | 100–120 kg | $400–500 | $250 | $10,538 |
| Jakarta | Plastic bags | $0.05–0.06 | 100–120 kg | $120–160 | $200 | $3,475 |

area, however the implication of minimum wage figures appears to be different in the two countries (Indonesia allows for more exceptions, and enforcement is weaker). Many more labourers work below the minimum wage in Jakarta. From the authors' lived experience, the cost of living in Malaysia is about three times that of Indonesia. This corresponds with the difference in GDP/capita, and also with the threefold difference in waste picker earnings.

## 4. Conclusions

As observed in this study, waste picking at landfills is still economically feasible in Malaysia where the GDP is three times that of Indonesia. **Figure 7** indicates that in Indonesia some diligent waste pickers earn more than double the amount earned by other waste pickers on the same site. Also interviews in Malaysia implied that some earned much more than the average income of other waste pickers. This suggests that on-site waste picking potentially offers earnings much higher than the average wage earned by an average waste picker, and will remain feasible as a means to earn a living even after further significant economic development.

In order to establish the economic feasibility of on-site waste picking in Malaysia in more detail, we are planning to conduct more in-depth studies on the income as well as living and working conditions of the waste pickers in Malaysia, as Sasaki et al have done in Indonesia. As the economy develops, there will be more valuable materials arriving in the landfill, in absence of an efficient recycling scheme. The Malaysian on-site recyclers avail themselves of plenty of PET bottles which are difficult to find in Indonesian dumpsites. Medina (1998) reported a case in Mexico where the waste pickers focused on Aluminium cans. In current Malaysian landfills, Aluminium cans are not as abundant as PET bottles. As a further research topic, it is interesting to investigate what factors affect the difference in the materials that waste pickers focus on. This can be due to differences in consumption patterns (e.g. Malaysia does not consume as many aluminium cans as Mexico, or plastic bottles weren't used as much 20 years ago) or market conditions for secondary materials (e.g. existence of buyers of certain materials accessible to street or dumpsite pickers, relative prices of secondary aluminium and plastics).

Our studies showed that there is good reason on-site waste pickers still operate in a higher middle income country such as Malaysia. Often there are arguments for removing waste pickers from the landfill, but it does not seem right to prohibit waste picking, in the presence of these recyclable materials and if many people can and want to make a living from collecting these, both from environmental and social perspectives.

This does not mean that we can or should rely on on-site waste pickers to enhance the resource efficiency of a society. Ideally, in order to enable a more efficient cycle of materials – i.e., obtaining higher quality recyclables with less dirty labour, recyclables should be separated from waste at source or at least much closer to source. Waste management authorities should be more actively involvement in achieving this. Then only the non-recyclable items will reach the landfills, and we will not need to rely on on-site waste pickers for recycling. More specifically, for example, waste management authorities can initiate separate collection schemes, formalise existing private recycling activities through registration etc., and make efforts to expand the markets for secondary materials.

## Notes

[1] This is under assumption that the prices of commodities are stable. There are arguments that in the long run, material prices may rise due to scarcity caused by resources depletion. Also it is important to note that the recovery of some materials is more profitable than others, for example, metals.

[2] Mukhtar et al (2016) show a similar curve regarding the relationship between time and waste management status.

[3] As information on the presence of informal on-site recycling activities at landfills is sometimes considered sensitive by Malaysian authorities, we decided not to name them in this paper.

[4] The typical price in town is about USD0.1/kg for paper and steel, while aluminium cans can fetch as much as USD1/kg. Note that plastics are much bulkier and more cumbersome to handle than these items.

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## Competing Interests

The authors have no competing interests to declare.

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