

Industrialization of the Recycling Industry in Indonesia via a Government-Industry Partnership

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Abstract

Indonesia lacks a unified and effective Solid Waste Management (SWM) system which has perpetuated a massive problem with plastic pollution. A recycling industry is developing to process the plastic but lacks government support, necessitates a cultural relationship change towards waste, and an underutilized Informal Recycling Sector (IRS). This paper argues that Indonesia must integrate the recycling industry with the public SWM in order to overcome its massive plastic pollution crisis. The IRS needs to be organized, provided with capital, and integrated into the SWM for the industry to become industrialized. Through this public-private partnership involving the IRS the recycling collection rates will increase, overall SWM system costs will decrease, and the welfare of the IRS workers will improve.

Introduction

Indonesia is a remarkable country that consists of more than 17,000 islands. This island archipelago, located in Southeast Asia, has incredible diversity in its flora, fauna, and ethnic composition. However, this great biodiversity and vibrant people are at risk from its devastating plastic pollution. Indonesia is the second worst marine polluter in the world, just after China's 8.8 million tons of ocean pollution and the Philippines 1.9 million tons. In 2010, Indonesia was created 3.2 million tons of plastic waste, which resulted in 1.29 tons of that plastic ending up in the oceans (Jakarta Post, 2015). The plastic that enters the environment, both on land and at sea, harms the tourism industry, kills wildlife, and threatens public health. Indonesia lacks an effective nation-wide Solid Waste Management (SWM) system (Global Business Guide, 2017). As a result, a private recycling industry and Informal Recycling Sector (IRS) have emerged to process Indonesia's plastic and other recyclable waste. However, the industry is underdeveloped due poor government support, public relationship with waste, and a stigmatized IRS. This paper argues that Indonesia must integrate the recycling industry with the public SWM in order to overcome its massive plastic pollution crisis. A special focus on plastic recycling efforts, as opposed to all recyclable materials, is due to the overwhelming plastic pollution found in and around Indonesia.

Methodology

This paper will evaluate the feasibility of establishing a mature recycling industry in Indonesia. This research was guided by the assumption that current recycling efforts are sporadic and disjointed; without a clear direction or strategic focus. A literature review was conducted by examining peer reviewed academic journals, business studies, online company data, etc. The

results of the literature review were combined with personal field experience to create a comprehensive understanding of the current recycling initiatives as well as new entrants to the industry. The scope of this research was to investigate ways to reduce plastic waste in Indonesia through the strengthening of the recycling industry. Search terms included: “Indonesian recycling industry,” “recycling initiatives in Indonesia,” “Informal recycling system in developing countries,” etc. I limited my research to methods of enhancing recycling industries via local solutions in developing countries. A set of guidelines and recommendations for the government and industry were drawn from the results of this literature review.

Negative Impacts of Plastic Pollution

Inadequate SWM systems in developing countries lead to massive quantities of waste being littered and dumped into the environment each year. According to the World Bank, as of 2012, up to 30-60% of urban waste is still uncollected in developing nations thus leaving over 50% of the population without a waste collection system (Wilson, Velis, & Rodic, 2013). Without a proper SWM system in place, locals resort to disposal methods such as: open dumps, throwing trash in the street, burn piles, and disposing it directly into waterways (Ezeah, Fazakerley, & Roberts, 2013). Sights such as these are common across rural Indonesia where functional SWM systems are rare. The plastics in the waste discarded in this manner are especially harmful for society and the environment. First, plastic pollution damages public infrastructure. Plastic waste, such as plastic bags, packaging, and disposable cutlery, creates eyesores and blocks drainage systems and causes flooding. Second, plastic pollution creates serious public health crises around the world. Flooded areas, caused by plastic blockages, create

the perfect conditions for dangerous malaria outbreaks and the spread of other waterborne diseases. Furthermore, the contaminated plastic creates unsanitary conditions for the waste-pickers who collect and sell it for a living. The uncollected plastic is generally burned along with other waste and releases toxic fumes that are very dangerous when inhaled. Lastly, plastic pollution has a persistent negative impact on the environment. The decaying plastic makes its way into the waterways and eventually into the ocean. According to a report on ocean pollution by McKinsey and the Ocean Conservancy, over 80% of plastic in the ocean has come from land-based sources – 25% of which escapes from the SWM system and the remaining 75% from uncollected waste (McKinsey, 2015). As it continues to break down into smaller particles, more and more wildlife consumes the plastic. The plastic either kills the animal or enters the food chain and is at risk of human consumption. In addition to making food unhealthy, plastic pollution leaches chemicals into the groundwater and renders it unpotable (Beekmans & Van den Berg, 2016). These three adverse impacts of plastic pollution necessitate government action. The Indonesian government is responsible for maintaining a healthy society, free of threats to public health and environmental sustainability.

Vitality of Indonesian Economy

The current strength of the Indonesian economy will be used for analyzing the possible resources the government has at its disposal to fight plastic pollution and implement stronger SWM systems. For the purposes of exploring the vitality of the Indonesian economy, I will be referring to my previous research concerning the recovery from the Asian Economic Crisis of 1997-98.

The economic effects of the 1997-98 Asian Economic Crisis were devastating in Indonesia. In 1998 the unemployment rate rose to 6%. While this figure may seem low at first, it does not consider the millions of people who were displaced from the formal job sector and took up work in the informal sector to get by. In fact, 9.9 million jobs were lost in the manufacturing sector alone in 1998 because it was not diversified, a decrease of 11%, which was a main source of employment for the lower classes. Overall, the urban centers of Indonesia were the worst affected by the crisis, specifically the island of Java with its high population density and high levels of urban linkage. The major cities were the most intertwined with the internal markets and economic centers while providing the most jobs in the banking and investment sectors, which was the root of the regional crisis. The large corporations also bore most of the economic downfall rather than the smaller businesses. The larger firms had access to the international markets while the smaller ones could not afford to be and could adapt faster to the market fluctuations. Small- and medium-sized businesses lacked the capacity and technology to engage in the global marketplace and focused more on the domestic markets, which allowed them to survive the crisis while larger corporations went bankrupt. After the crisis, the government increased its ownership of large corporations because private citizens were selling them cheaply or because they went bankrupt. The government mismanaged these large firms leading to a supply shortage for manufactured exports from Indonesia. Although small- and medium-

sized businesses represented 90% of the businesses in Indonesia, their ability to increase supply of manufactured products was restricted because of limited access to banking services, lack of capital, and old technology. Indonesia's inability to provide enough product to satisfy global demand resulted in the manufacturing sector suffering much longer than their neighboring countries with more diversified commodity exports (Berry et al, 2001). Indonesia decreased its dependency on exports as a result of the crash and has been slowly increasing its dealings with domestic demand since 2009 (Walker, 2009).

In addition to reinvesting in domestic markets, Indonesia has found much success in selling its natural commodities such as gold, nickel, and copper, and leads the world in palm oil exports. When combined with strict fiscal management and reforms, Indonesia has made a remarkable recovery and has achieved steady growth each year while cutting public debt. However, although this success has led to much economic growth, it has not benefited the country equally. The growth in the commodity sector has made the economic gains appear to be strong on paper, but in actuality the majority of benefits have gone straight to the upper landowning class in resource rich regions. The people who do the physical labor to extract the resources have not seen the same level of economic prosperity. The levels of unemployment have continued to rise since the crisis, peaking at 11.2% in 2005 before gently sloping back down. It is clear that the lower classes have not received the assistance that they have needed to rise out

of the poverty induced by the crisis (Basri et al, 2008). “Despite experiencing some of the world’s fastest economic growth in recent years, nearly 40% of Indonesia’s population live on about \$2 a day, and the gap between the rich and the poor was widening” (Indonesia Country Review, 2015). Income inequality is on the rise in Indonesia with no clear end in sight. The differences are apparent when traveling from island to island within Indonesia. Homes on Java are larger and built with better materials such as tile roofs, while in other islands like Sulawesi homes are made of wood planks and sheet metal. The levels of infrastructure and investment in buildings is also radically different. The majority of the wealth and political power in Indonesia is concentrated on the island of Java, specifically in the capital city of Jakarta. The Java and Bali regions receive the majority of foreign investment funds, one of the reasons income inequality is so high between different islands.

Although the economy stabilized mostly in 2004, Indonesia continues to suffer from a lack of foreign investment (Indonesia Country Review, 2015). Indonesia has a long history of protectionism when it comes to the economy. Issues arise when local businesses and industries demand protections from the government but insist on conducting business in the free market. Indonesia needs to become more willing to reduce the amount of protections in order to significantly expand their economic returns. Evidence of this shift in attitude towards fewer protections comes from Indonesia’s willingness to sign free trade agreements with its neighbors, including China (Soesastro et al, 2005). Another

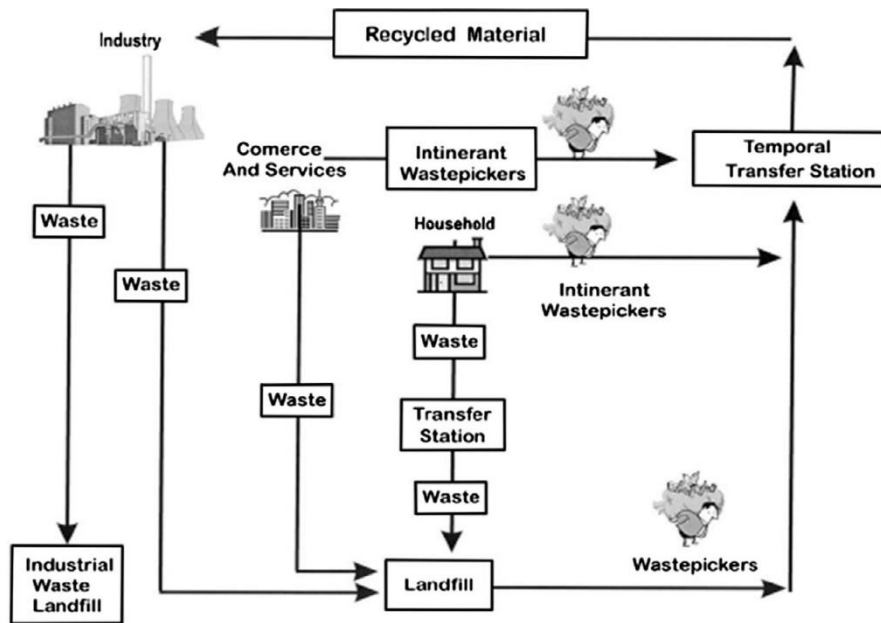
concern for investors is the copious amounts of corruption in the public and private sectors within Indonesia. Indonesia has become synonymous with the word “corruption” to global businesses (Walker, 2009). Corruption has seeped into every level of society. Throughout every strata corruption can be found, from the beggar in the street to the high-ranking government official. For many businesses, it is simply not worth going through the effort of making sure every palm is greased in order to do business. Investors are further agitated by the lack of infrastructure in Indonesia, both political and physical. Roads and physical structures are inadequate for the needs of the local population. In many places, there is not a single paved road for miles at a time. The highway system and roadways are in dire need of care and expansion before more serious investments can be considered by some businesses. Another obstacle to doing business is the poor organization and efficiency of registering businesses by the government. In order to register a business in 2008, a minimum of 80 days was required before the process could be completed, assuming all of the proper bribes were paid (Basri, 2008). Nearly every modern administration in Indonesia has promised to reform the system to facilitate registering new businesses, but most have fallen short. Current President Joko Widodo, “Jokowi” has already made significant progress reforming business registration laws. Jokowi has made it a priority for his administration to increase the amount of foreign direct investment (FDI) in Indonesia. He has passed new regulations bringing the required amount of days to obtain an investment permit down to 221 from the previous astounding 1,125

days. The new regulations have already succeeded in bringing in USD 74.3bn in new investment commitments from China and Japan this past year. Jokowi has also made the historic move of reducing the fuel subsidies paid out by the Indonesian government each year. Indonesia has subsidized the fuel prices within the country for decades providing Indonesians with some of the cheapest gasoline in the world. This luxury came at a massive cost to the government and was unsustainable. By reducing the amount the government will subsidize, Jokowi has saved the government USD17.6 billion every year at current rates to be allocated elsewhere in the economy. This action will spur substantial growth now and in the future. The main beneficiary of the released funds will be the infrastructure which will see a 50% spending increase. Another portion of the funds will be reallocated into social spending to assist the nation's poorest citizens (Indonesia: Country Risk Report, 2015). With Jokowi creating such successful reforms in his first year in office, a new era of investing in Indonesia could begin (Waite, 2015).

The strong recovery of the Indonesian economy has positioned the government well to response the current waste crisis on its hands. Under the leadership of President Jokowi, the government has the capability to inject funding into the fledgling recycling market and SWM systems. With the passing of pro-recycling legislation and the provision of governmental support, a proper recycling industry can begin to take shape in Indonesia.

Recycling Market Snapshot

The Informal Waste System (IRS) is the current backbone of the recycling industry in Indonesia. Ezeah, Fazakerley, and Roberts define the demographic of workers in the IRS in their paper on *Emerging Trends in Informal Sector Recycling in Developing and Transition Countries* as, "...poor, disadvantaged, vulnerable and/or marginalized social groups (for examples gypsies, rural migrants, disabled, elderly, the illiterate and religious minorities) who often resort to scavenging as an adaptive response" (Ezeah, Fazakerley, and Roberts, 2013). In Indonesia, waste-pickers in the IRS sort through waste in search of recyclables that can be sold back to manufactures for a profit. They often live at dumps or landfills and sort through waste brought to the site or roam the streets collecting recyclables from households and businesses. Their association with waste have created a negative stigma against the IRS in Indonesia even though 2% of the population in Asian cities makes their living by scavenging recyclables (Sasaki & Araki, 2013). Despite their small size and difficult circumstances by society, the workers in the IRS have impressive recycling rates. The IRS achieves a recycling rate of 20-30% while saving the municipal SWM system 20% of its operating costs at the same time (Wilson, Velis, & Rodic, 2013). In exchange for their labor, waste-pickers have been known to make up to three to five times the minimum wage in some cases – yet not enough to get out of poverty. The proximity to the best waste deposits also greatly effects the earning potential as well. Waste-pickers in the neighborhoods have first pick at the quality recyclables, meanwhile the waste-pickers at the dump have to try and salvage anything that has already been passed on further upstream (Colombijn & Morbidini, 2017). Figure 1 illustrates the recycling process in the IRS.



Source: Ojeda-Benitez *et al.* (2008)

Figure 1. Source: (Ezeah, Fazakerley, & Roberts, 2013)

Sasaki and Araki describe the seven processing steps of the IRS from their observations at Bantar Gebang, a dump with an IRS slum in Bekasi, Java. They observed the following processing steps: a) collection, b) wheeling, c) sorting, d) processing, e) packaging, f) transportation by truck, and g) selling to recycling factory (Sasaki & Araki, 2013). They further identified the working relationships within the IRS. Rather than each waste-picker working individually, loose relationships are formed to increase efficiency and economic returns. Sasaki and Araki observed the following eight positions: 1) big boss (bos pemulung); 2) small boss (bos kecil); 3) big middleman (bos tengkulak); 4) small middleman (tengkulak kecil); 5) live-in waste picker (anak buah rumah); 6) live out waste picker (anak buah lapangan); 7) independent waste picker (sendiri); and 8) daily worker (buruh) (Sasaki & Araki, 2013). The middlemen provide stability to the IRS at a price. They broker the prices and create the relationships with the plastic buyers that individual waste-pickers would not have access to alone. The middlemen organize

units of waste-pickers in order to meet the quantity demands required by their customers.

Ultimately, the IRS provides a reliable stream of recyclables, mostly plastic, that allow more businesses to join the recycling industry (Ezeah, Fazakerley, and Roberts, 2013).

In recent years the recycling industry has begun to take shape in Indonesia. With the support of the IRS, small, medium, and large businesses have been able to enter the market with customers both international and domestic. Small businesses generally take the form of waste banks where valuable recyclables are brought for either resale or transformation into new products. These waste banks, or bank sampah, operate predominately in neighborhoods and focus their efforts locally (Permana, Towoloe, Aziz, & Ho, 2015). In the summer of 2017, I visited a waste bank in Salatiga, Java. There I learned about their business model and overall operations. The waste bank operated as a cooperative with neighborhood mothers working together and sharing the proceeds. They collect recyclables, such as plastics, bottles, newspaper, cardboard, etc.) from local households and businesses in the local area. Then the recyclables are brought back to the bank for cleaning and processing. The women create art pieces such as: lampshades, flowers, pictures, decorations, etc. and sell them at the waste bank. All the proceeds are spent on buying rice at the end of the month and portions divided out equally to all of the laborers (Personal observations, 2017). Waste banks are the first level of commercial enterprise after the IRS collection of recyclables. These businesses serve as a hub for valuable recyclables and plastics to be gathered and operate as a middleman for medium sized businesses.

Medium sized businesses can serve beyond just their local area and offer differentiated products and services past raw recycled materials. An example of a medium sized business that leverages its size to provide multiple services is KONO. They operate exclusively on the island of Bali and focus on upcycling bottles (or reusing recyclables and creating new products) and selling their creations online. Glass bottles are transformed into items such as glasses, plates, bowls, and more. KONO operates a waste pick up service as well. For a fee, recycling is collected from customers' homes and either made into new products or fully recycled. The current customer base is estimated at 1000 clients for the pickup service (KONO, 2018). Another of example of a medium sized business is Eco Bali. Their business strategy is similar to KONO because they provide monthly pick up services and operate a sorting and material recovery facility. Additionally, Eco Bali provides recycling bins, composters, and purchases recyclables that are brought to their facility per kilo. Eco Bali engages the community by teaching students at local schools about the importance of recycling (Eco Bali, 2018). The services that these two examples of medium sized recycling businesses offer are geared towards wealthier clientele. Their market niche is privatizing a segment of the SWM system by collecting and recycling waste in addition to upcycling products for eco-conscious customers. This strategy currently has limited application across the Indonesian archipelago due to wealth inequality and public education deficiencies concerning environmental issues, such as recycling. Larger recycling businesses receive their plastic from the smaller businesses in the recycling industry. The larger businesses often serve as the final destination for recycled plastic collected throughout the country. "Recycled plastics are mostly traded in the domestic and export markets in the form of plastic chips, dacron for doll filling, geotextiles for road construction, home furnishings and

furniture” according to the Global Business Guide Indonesia (Global Business Guide Indonesia, 2017). The produce such products as recycled pellets for export or industrial plastic products. One company that produces these kinds of products is Langgen Jaya Group. Established in 2006, Langgen Jaya is the leading recycled plastic manufacturer in Indonesia. Their products include: recycled plastic strapping, plastic granules, PET (polyester) flakes, polyester fiber, construction drainage systems, etc. Additionally, the export 10,000 tons of recycled plastics internationally a month at a price of \$0.36 per kilogram. Despite their large size, Langgen Jaya has a program to buy plastic directly from the IRS (Langgen Jaya, 2018). Another example of a large recycling business is Polindo Utama. Polindo is a leading manufacturer of recycled polyester chips and PET flakes in Indonesia. They operate 23 plastic recycling centers across the country. These centers are located next to cities and suburbs to provide the greatest convenience possible to plastic collectors. Their facilities process up to 100 tons of plastic bottles a month. The centers have the capacity to sort discarded plastic products and separate viable recyclables and other waste. Polindo also uses these facilities to educate the public on the importance of recycling, provides jobs, and encourages community engagement. Future plans are to create recycling center franchises to improve entrepreneurship and recycling nationwide (Polindo Utama, 2018). While large firms such as Langgen Jaya Group and Polindo Utama are tackling Indonesia’s industrial recycling needs, some businesses are trying to rethink plastics entirely.

The newest entrant to Indonesia’s recycling industry is the bioplastic sector. This portion of the industry seeks to solve plastic pollution via biodegradable plastic products. According to the Global Business Guide Indonesia, “bioplastic is a polymer made from naturally occurring

materials such as corn, cassava, sugarcane, palm oil biomass, potato, or microbiota” (Global Business Guide Indonesia, 2017). Examples of businesses in the bioplastic sector are Avani and PT Inter Aneka Lestari Kimia, which both produce bioplastics from cassava. The need for bioplastics comes from the fact that out of 4.6 million tons of plastic consumed in Indonesia in 2016, only 600,000 tons were recycled plastics - 1% was biodegradable plastic (Global Business Guide Indonesia, 2017). On one hand, this indicates tremendous growth opportunities for the recycling industry. However, new plastic is being made faster than it can be processed by the recycling industry and more cost efficiently due to low oil prices. Thus, more plastic will escape the loose SWM system and become pollutants in the environment. Bioplastics can bridge that gap while the recycling industry matures and becomes more efficient. The Indonesian government wants to reach its ambitious plastic waste reduction goals with bioplastic. Despite tertiary government support, growth in the bioplastic sector is lethargic. Reasons for the slow growth include: supply issues, costly research and development (R&D), excessive taxation, and a lack of government funding. Most of the current bioplastics are made from cassava, a staple food in Indonesia. The country is currently a net importer of cassava to meet the high demand. Until Indonesia is self-sufficient in its cassava production, bioplastic made from the plant will be too cost prohibitive. The costly R&D creates thin profit margins for the young sector that is further reduced by high government taxes. Current plastic products are being taxed based on the common income tax and a 10% value added tax (VAT), regardless of its recycled or bioplastic content. By removing the VAT tax on recycled plastic and bioplastic products, the sectors will be more price competitive and can increase their market share. The government can further aid the growth of the bioplastic and recycling sectors by requiring supermarkets to use

recycled/biodegradable bags, remove the VAT tax from their products, and improve the SWM system overall (Global Business Guide Indonesia, 2017).

The government's current regulations concerning recycling and SWM systems are sufficient enough to enable more active government support for the recycling industry. For example, Act 18/2008 establishes that the government and local governments are responsible for providing a SWM system, ensuring that it is environmentally responsible, and improving integration between government institutions, industry, and society. Another example is found in the Minister of Environment's Regulation 13/2012 that mandates adoption of reduce, reuse, and recycle nationally (Permana, Towolioe, Aziz, and Ho, 2015). The proof that the legislation is adequate for the implementation of an integrated and sustainable SWM system is seen in the cities of Surabaya, Palembang, and Tangerang. All of the aforementioned cities have successfully created and implemented sustainable SWM systems and have won awards for being the cleanest cities in Indonesia (Permana, Towolioe, Aziz, and Ho, 2015). However, despite the existence of appropriate legislation, more governmental action is required to effectively integrate all the stakeholders (IRS, recycling industry, SWM, and society) into a government-industry partnership.

Integration of the SWM and Recycling Industry

The best way to increase recycling efficiency, capacity, and collection rates is to integrate the public SWM system and the private recycling industry. A sustainable, long-term integration of the SWM and recycling industry cannot be done without the inclusion of the IRS. The IRS is

the backbone of the private recycling industry despite its lack of recognition. Ignoring the IRS while attempting to create a mature recycling industry will further perpetuate the need for an IRS while simultaneously keeping the IRS workers in poverty. Impoverished IRS workers and the squatter villages they live in are bad for society because they drain public resources, create public health concerns, and are an eyesore for the community (Ezeah, Fazakerley, & Roberts, 2013). Critics argue that the IRS can be done away with by providing them other forms of employment and forcing them out of the IRS completely. However, previous attempts to do so have failed with the workers returning to what they know in the IRS (Sembiring & Nitivattananon, 2010). Others will argue that a successful program could exclude the IRS by purchasing new, large-waste recycling machines and processing systems. This idea is flawed because SWM systems in developing countries lack sufficient funding to operate at full capacity, much less having funds to purchase new machinery. Furthermore, replacement parts and repair costs are incredibly expensive and would exacerbate the preexisting funding crisis (Permana, Towolioe, & Ho, 2015). The fact of the matter is that the IRS is the most efficient and cost-effective way to collect and process recycled plastic presently.

In order to begin the integration process into the formal SWM, the IRS must first be organized (Velis et al, 2012). Once organized, the workers can negotiate with municipalities with increased bargaining power as a collective. Co-ops also allow for IRS workers to pool together their recyclables to meet the minimum volume requirements of buyers. Other benefits include: loans, business strategy, improved working conditions, legal assistance, and improved public status (Colombijn & Morbidini, 2017). Surabaya is an example of a city where the IRS was organized into a co-op and worked as a collective for the city in the SWM system. The co-op

was organized on the local level by neighborhood leaders. Each house pays a member of the IRS to collect their waste a few times a week and transport it to a temporary location. From there, city trucks would transport the waste to a landfill. This process has increased the recycling rate because at each transfer point, the IRS can retrieve recyclables and provide economic value (Colombijn & Morbidini, 2017). The positive example of Surabaya illustrates the importance of completing this organization process on the local level. Organizing locally creates buy in from the community to support the integration in addition to the necessary support required from the government (Ezeah, Fazakerley, & Roberts, 2013).

After the IRS is organized, capital needs to be provided so the workers can add more value to the recyclables they collect. With greater access to financial, physical, infrastructure, human, and social capital; the IRS can begin to improve their living conditions and increase the value of the recyclables they collect (Sembiring & Nitivattananon, 2010). If children can be placed in school during the day, better collection carts are provided, and access to public aid institutions expanded, the IRS can become more effective and increase their collection rate with proper support. Once organized and properly supported, the IRS can be integrated into the SWM system. The specific solutions will need to be adapted to each local area based on the availability of resources. A possible integration method could include contracting the IRS with paid stipends while allowing them to sell the recyclables they collect for personal gain (Vorlaufer, Wollni, & Ibañez, 2017). Another solution would be to require major plastic producers to implement plastic collection programs utilizing the IRS and public waste bank facilities. Wilson, Velis, and Rodic

described a tool to aid in developing local integration strategies was in their paper titled *Integrated Sustainable Waste Management in Developing Countries*. The tool (Figure 2) was created with the triple bottom line of environmental, social, and economic concerns in mind (Wilson, Velis, and Rodic, 2013).

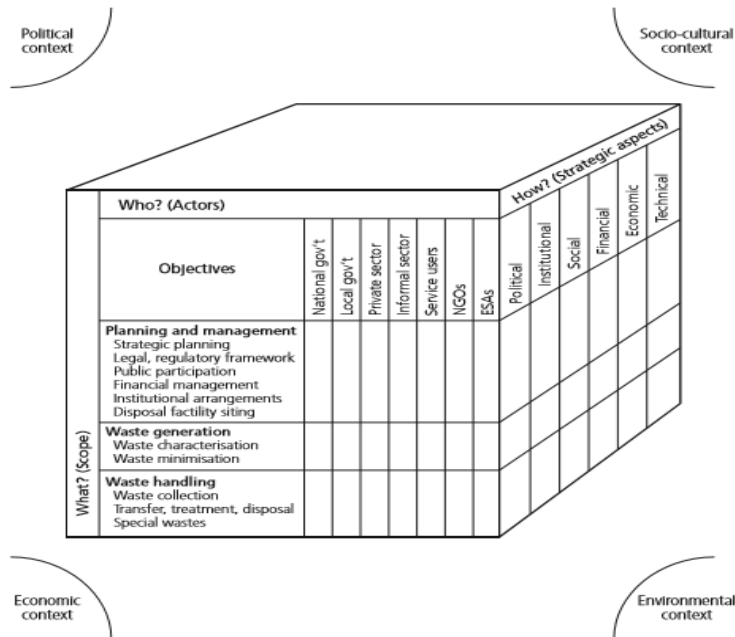


Figure 1. The conceptual framework for integrated municipal solid waste management. Each side of the cube shows one of the three primary dimensions of ISWM, denoted by a question (source: Schübeier *et al.* (1996); reproduced by permission of SKAT). ESAs, external support agencies

Figure 2. Source: (Wilson, Velis, and Rodic, 2013)

After a strategy is developed, another tool, “InteRa,” can be used to evaluate how well the proposed strategy is addressing the four main interfaces between the IRS and the SWM.

We have described three of these as primary *interfaces* between the informal recyclers and the outside world, namely their interfaces with:

- (A) the formal SWM system from which the informal sector obtains materials for recycling;
- (B) the materials and value chain into which those materials are sold and which therefore provides their primary source of income; and
- (C) society as a whole, including various aspects relating to the acceptance of their activities by society.

The fourth category of possible interventions is different from, and underpins, the others, facilitating the conditions which enable actions under the three interfaces to be successful. To emphasise this point, we have used a different nomenclature for the label here:

O) Organisation and empowerment of the informal recyclers.

Within each *category* (A)–(C) and (O), 3 to 4 groupings of similar types of interventions have been identified and, within each of those groups, a series of individual *intervention points*. Typically, when one is considering how to promote informal sector integration/inclusion in a particular city, there will be a number of possible *specific actions* to achieve each *intervention point*. Inevitably, the four categories partly overlap, because some specific intervention points have key elements that fit into more than one interface or into the enabling category (O). However, for clarity and practical functionality of the analytical framework, each intervention has been allocated only to one category, which we judged to be the most appropriate. (Velis et al, 2012)

“InteRa” measures how balanced the integration strategy is at considering each of the four interfaces. The tool can be used before the strategy is implemented to predict its well roundedness or applied to a current implementation to identify ways to improve it.

To apply the tool, use is made of the listings of possible interventions for each of the four categories (Table 2–5). Scores are allocated against each of the *specific actions*, according to the level of attention it has received within this particular intervention case. There are three possible assessment outcomes, depending on whether the *specific action* was treated as a key action (*K*), or considered to a medium degree (*C*) or was ignored (*I*) in the implementation of the intervention scheme. Each assessment outcome is translated into numeric values: $K = 1$, $C = 0.5$ and $I = 0$. If no information is available, a zero score is allocated, as if the *specific action* was ignored.

As a next step, an average score is obtained for each *intervention point* (column 3, Table 2–5), calculated as the arithmetic mean of the values for the *specific actions* relating to this particular *intervention point*. Finally, averaging of the scores of the component *intervention points* within each specific *category* gives the overall score for this *category*. As a result, each *category* is marked with a score from 0.0 to 1.0, which indicates the *importance* of the *category*.

The four average *importance* values obtained, each for one of the (A)–(C) and (O) *intervention categories*, are plotted on a four-side radar diagram on a scale from 0.0 to 1.0. Radar diagrams are an established approach to integrating results of multiple

sustainability indicators. This representation allows for a simple display of the focus (or ‘main aim’) and thoroughness of an integration/formalisation initiative. A well-balanced integration intervention that considers all three *interfaces* (A)–(C) and the enabling/underpinning organisation and empowerment *category* (O), would result in a balanced rombe, with all sides equally distant from the centre; a thorough intervention would result in a rombe with sides well away from the centre and vice versa. A worked example providing step-by-step guidance on applying *InteRa* is provided in Appendix A. (Velis et al, 2012).

The tool does not measure how successful or sustainable a strategy is, rather it displays where the focus is when trying to integrate the IRS. An ideal integration strategy will have balance across all four metrics. A visual example of a balanced strategy evaluated by the “InteRa” can be seen in Figure 3.

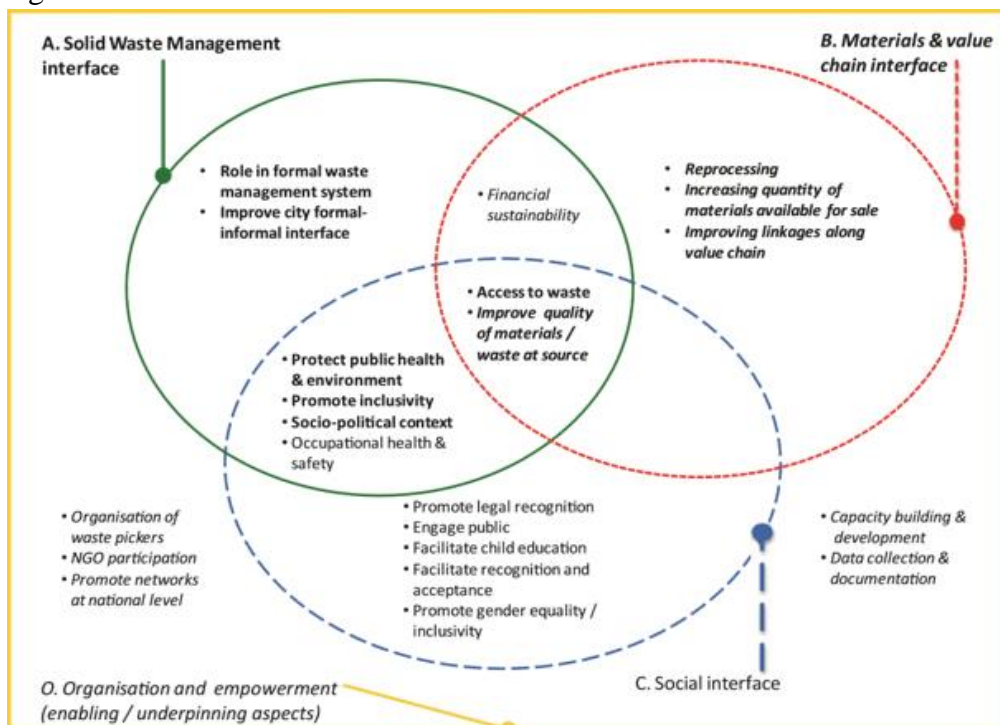


Figure 3. Source: (Velis et al, 2012)

After the IRS has been organized, provided with capital, and an integration strategy has been evaluated with “InteRa,” the steps to integrate the rest of the recycling industry to the SWM system can be taken. The first step needs to reprioritize and increase the funding for the SWM system nationwide (Sembiring & Nitivattananon, 2010). The second step should be to re-evaluate current market based incentives to increase the number of recycling businesses and lower the cost of selling recycled products. The third step should focus on increasing business participation in green initiatives with a specific focus on recycling and waste reduction. The final step should be to increase public investment in the bioplastic sector. Participation in these steps by both private industry and the government will create a shift in private-public practice towards more sustainable practices.

Necessity for a Cultural Shift

In addition to shifts in business culture and government priorities, the culture surrounding waste management needs to change in Indonesian society for a private-public partnership to succeed. Increased public education on recycling efforts and waste reduction in general is needed to begin changing societies perception of waste in general. Methods to increase public awareness include: hosting conferences and workshops, public awareness campaigns, and buy in from businesses, schools, and religious organizations (Ezeah, Fazakerley, and Roberts, 2013). If an emphasis on

education is not realized, the current situation will only worsen as the population grows. Waste reduction programs need to be implemented on a national level as only 20% of plastic waste in developing countries can be recycled (McKinsey, 2015). The public perception of the IRS needs to change along with the relationship to waste overall. There is a stigma against workers in the IRS because they are viewed as unclean for picking through waste. The IRS has been compared to negative actions such as stealing, or even sex work (Colombijn & Morbidini, 2017). Public officials view the IRS as unclean miscreants despite acknowledging the important role the IRS serves in waste collection within the community (Sembiring & Nitivattananon, 2010). A successful integration of the IRS into the SWM and a maturation of the recycling industry overall cannot commence until this negative perception of the IRS is reversed. Society needs to view the IRS as providing tangible and intangible benefits through their services. Methods to correct the stigma include (but are not limited to): new laws that protect the IRS and give them official status and public campaigns emphasizing importance of recycling at all levels of society.

Conclusion

As the world's second largest ocean polluter, Indonesia's plastic waste problem needs immediate action to not only be contained, but to prevent it from worsening. The Indonesian government is responsible for providing a clean, healthy society and environment to its citizens. The government has the resources to combat plastic waste and invest in its SWM system due to positive economic growth since the 1997-98 Asian Economic Crisis. The government must pass pro-recycling legislation and provide more support to the growing recycling industry. The

recycling industry has already begun to take shape with small, medium, and large businesses that serve a variety of customers along the recycling chain. The new bioplastic sector needs more government support as well in order to bridge the gap between an improved recycling system and a cultural shift towards waste disposal. However, none of these businesses would be possible without the IRS. The IRS needs to be organized, provided capital, then integrated into the SWM system for a mature recycling industry to be implemented in Indonesia. Through this public-private partnership involving the IRS, recycling collection rates will increase, overall SWM system costs will decrease, and the welfare of the IRS workers will improve. Solutions to integrate the IRS need to take place on the local level as available resources will differ between provinces and cities. The “InteRa” tool should be used to evaluate each individual strategy to ensure that every key area of the integration has been considered to provide the best chances for success. By integrating the IRS and SWM system, utilizing the “InteRa” tool, and providing more government support for the SWM and recycling industry, Indonesia can conquer their plastic pollution crisis and create a healthier environment and society overall.

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