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DIPLOMOVÁ PRÁCE

Waste management in Indonesia and the role of start-ups

Odpadové hospodářství v Indonésii a role start-upů

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Prohlášení

Prohlašuji, že jsem diplomovou práci vypracovala samostatně, s využitím pouze citovaných literárních pramenů, informací a zdrojů.

Declaration

Hereby I declare that I have worked on this thesis independently, using only the sources listed in the bibliography.

In Olomouc, date .....

Veronika Žďánská

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Annotation

This master thesis deals with an issue of waste management and focuses on startups that deal with waste sorting and spreading awareness of the waste problem in Indonesia.
The aim of this work is to find out why waste in Indonesia is such a huge problem according to the waste management companies that handle it and whether the population is involved in waste management.
The theoretical part focuses on the explanation of concepts related to the topic of waste and startups in this sector. The practical part presents the evaluation of questionnaires filled out by start-up companies.

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Anotace

Tato diplomová práce se zabývá problémem třídění odpadu a soustředí se na startupy, které se zabývají tříděním odpadu a šířením povědomí o problému s odpadem v Indonésii. Cílem této práce je zjistit, proč je odpad v Indonésii tak velkým problémem podle začínajících firem, které s tímto odpadem nakládají a zdali jsou obyvatelé zapojeni do problematiky odpadového hospodářství.
Teoretická část je zaměřena na vysvětlení pojmů souvisejících s tématem odpadů a začínajících firem v tomto odvětví. Praktická část představuje vyhodnocení dotazníků vyplněných začínajícími firmami.

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Acronyms

3R	Reduce, reuse, recycle
5R	Refuse, reduce, reuse, recycle, rot
APBD	Local Government Budget (City or Provincial Government)
APBN	State or National Budget
APEKSI	The Asosiasi Pemerintah Kota Seluruh Indonesia (Indonesia Municipal Government Association)
APKASI	Asosiasi Pemerintah Kabupaten Seluruh Indonesia (Indonesia Regency Government Association)
ASEAN	The Association of Southeast Asian Nations
ATT	Advanced thermal treatment
CBOs	Community organizations
CCBO	Clean Cities, Blue Ocean
CCOF	Circulate Capital Ocean Fund
CE	Circular economy
CVM	The contingent valuation method
DAK	Specific Allocation Fund
DAU	State Budget
DFC	Development Finance Corporation
DID	Local Incentive Fund
ENGOs	Environmental non-governmental organizations
ESCs	Environmental Studies Centres
GR	The Government Regulation
IPCC	The Intergovernmental Panel on Climate Change
MSW	Municipal solid waste
NGOs	Non-governmental organizations
NPAP	National Plastic Action Partnership
OMC-MDTF	The Indonesia Oceans, Marine Debris, and Coastal Resources Multi-Donor Trust Fund
RKASKPD	Annual work planning and budget (Rencana Kerja dan Anggaran)
RPJMN	National Medium-Term Development Plan
RPJPN	Long-Term National Government Development Plan
RSW	Rural Solid Waste

SMEs	Small and medium-sized enterprises
SWDS	Solid waste disposal site
SWM	The solid waste management
SYSAV	South Scania Waste Company
TPA	Tempat pembuangan akhir
TPM	Total particulate matter
USAID	The United States Agency for International Development
WH	The Waste Hierarchy
WTA	The willingness to accept

1 Introduction

The environment is a current topic for our time, which is being addressed all over the world. Indonesia is facing one of the greatest environmental challenges of its time, and that is waste. The amount of plastic waste produced in Indonesia has been growing to an unsustainable level. Cities and towns in Indonesia produce an estimated 7.8 million tonnes of waste per year, and more than half of this waste is mishandled. (Bank, 2021) The world is undergoing rapid urbanization and the amount of municipal solid waste produced by the world's cities is growing even faster. Many countries are addressing this issue. In Japan, for example, waste sorting policies are in place and communities contribute to an efficient waste management system that includes a recycling rate of 20.5 percent. In Norway, waste is used as a commodity, imported from neighboring countries to be burned, and energy is produced that is used for things like heating. (Aurea Christine Tanaka, 2013) Only since recent history has mankind begun to address the issue of waste systematically, and so-called waste management has emerged. Production and waste management have a clear impact on the level of the environment in the area, however, appropriate waste treatment has led to increasing costs in recent decades. Due to the acceleration of Indonesian urbanization, pollution of all kinds has grown. One of the main problems is waste and the others are air and water quality. With the increase, the quality of the environment and life as such is deteriorating. (Dethier, 2017) Waste produced in the past was not as big a problem as it is today. Currently, the term solid waste appears as a difficulty that has an immediate impact on the environment. In the past, the term waste was almost non-existent, everything was reused, recycled or used as compost. To this day, they are trying to reuse and recycle in the countryside. ((Bohara, 2020)

The field dealing with waste treatment is waste management has begun to take on international aspects. Current trends focus on 3R and circular economies. Despite the launch of the Community Solid Waste Initiative, the amount of household solid waste is still growing worldwide. The growing problems with solid waste have called on all members of the community to contribute to participatory waste management. (Aprilia, 2021) Open landfilling and waste incineration is becoming a common practice in the Indonesian community. More than 90 % of districts in Indonesia are implementing these waste management methods. (Dhewanto, Lestari, Herliana, & Lawiyah, 2018)There are many small recycling companies in Indonesia, which help with waste management and solves the problem with the waste. (Aprilia, 2021) There has been a significant increase

in the number of different on-demand collection / recycling start-ups. The new start-ups use technological mobile applications to provide a platform for waste services, where consumers can order pick-up and get paid for inorganic waste. Thanks to these companies, recycling is gaining enormous value. By focusing on the collection of recyclable materials, companies help educate consumers about the importance of waste sorting and building sorting habits in the home. (Handjaja, 2021) Waste management is not a simple process, it has a complex and long development. It depends on the management system such as waste reduction from its source, waste sorting to the recycling process. An effective system is needed and that is public involvement. Human resources are an important component of waste management. One of the ways that allows the public to take an active part in the management of their environment is the waste bank, the so-called community waste management systems. The waste management system knows how to encourage the community to independently manage the waste in its home and evenly exchange the waste for savings. The development of waste banks has positive effects, such as reducing the distribution of waste to landfills. And pro-environmental behavior and economic public support are also being built. (Wijayantia & Suryania, 2015)

This thesis will examine start-ups that deal with waste and their view of the waste problem in Indonesia in the field of waste management.

The aim of this thesis is based on the analysis of questionnaires from employees of companies in Indonesia to evaluate what solutions companies have for the problem of waste, whether they educate the population and how the population is involved in waste management.

The content of the work is divided into two parts. The theoretical first part of the thesis is devoted to the description of concepts that belong to the topic of waste, such as environmental issues, waste definitions, waste management, and more.

In the second chapter, attention will be paid to research, which was based on the form of questionnaires sent to waste management start-ups. The obtained data will be processed and described in detail.

2 Literature review

This part of the thesis will describe several important concepts that are related to the topic of waste management.

2.1 Enviromental problems and actuality

Understanding our view towards the environment is important in addressing many applicable environmental issues, from regional issues such as water pollution to global issues such as climate change. However, effective measurement of environmental problems is not always an easy task. (R.E. Dunlap, 2002)

Circular Economy (CE) is a concept aimed at maintaining the value of products, materials and resources economically as possible and minimizing the amount of waste generated. The concept of CE is derived from the 3R principles (reduce, reuse, recycle). The construction industry is one of the largest waste generation industries in Indonesia. In fact, 30 % of landfill waste is construction waste. Most construction professionals in Indonesia understand the importance of construction waste management in the context of the circular economy. However, few construction companies are serious about disposing of construction waste. Most of the construction waste is sent to the landfill only by a third party. Only about 36 % of contractor reused and recycled waste is in the construction site. (Tri Joko Wahyu Adi, 2020)

Marine plastic waste is an important environmental issue at the global and national level and poses a major threat to marine and coastal biodiversity. Marine debris is usually defined as a permanent, manufactured, or processed solid that is disposed of, or left behind in marine and coastal environments. Indonesia hosts the highest level of marine mega biodiversity known as the “Amazon of the Ocean”. When dealing with marine plastic waste, scientific aspects need to be taken into account when developing policies and regulations. Without knowledge of the destiny and characteristics nature of plastic waste in the ocean, it is impossible to develop effective regulations and strategies to reduce waste. (Indonesia, 2017)

Food waste is recognized as a major challenge in improving global health. Therefore, proper disposal of food waste is essential. In Indonesia, women are responsible for managing households, including food waste. However, there are only limited studies

are investigating the role of women in reducing food waste in the community. (Hadiningrat, 2020)

Decades of human activity have caused serious problems related to the environment and its protection. Such as air to water pollution, falling ground water levels, loss of biodiversity, land degradation, greenhouse effects, ozone depletion. (Pant, Verma, & Surya, 2020)

There is alarming evidence that major turning points may have already been reached or passed that will bring about irreversible changes in major ecosystems and planetary climate systems. Diverse ecosystems, such as the Amazon rainforest and the Arctic tundra, may be nearing the limits of dramatic change due to warming and drought. Mountain glaciers have undergone an astonishing retreat, and the effects of reduced water supply during the driest months downstream have long-lasting effects.

Awareness of environmental change has been reported to be higher in developed economy nations than in developing, a pattern also seen in Asian countries. Additional studies have shown that educational background is the strongest predictor of consciousness. Cultural differences are also clear when it comes to climate and environmental change risk perceptions. Understanding the anthropogenic origins of climate change has emerged as the strongest predictor in Latin America and Europe, but in some countries in Asia and Africa, perceptions of regional temperature rise are the most influential. Awareness of changes in temperature and weather is widely known, with 70 % of locations in 122 countries showing elevated temperatures, seasonal changes and precipitation patterns. (Nash, 2013)

Faced with other imminent regional problems, climate change has not yet penetrated the environmental advocacy of some communities, and the disconnect between regional issues and global climate change needs to be addressed. Making climate change relevant at the regional level by linking it to prominent regional issues and communal benefits has greater global awareness and its association at the regional level, especially for communities at risk.

2.2 Waste management

According to the Ministry of the Environment of the Czech Republic, waste management is a dynamically developing sector of the national economy. Countries that

are industrially and economically advanced have developed their waste management intensively only in the last 20-30 years. The first awareness of the Waste Act was not adopted in the Czech Republic until 1991. Prior to this year, waste management was not subject to any legislative control or rules and was not subject to any sectoral rules, with the exception of the so-called secondary raw material.

The current Act No. 185/2001 Coll. (Waste Act) focuses on waste prevention, defines the waste management hierarchy and promotes the basic principles of environmental and health protection in waste management.

Characteristic waste management activities include waste collection, transport, treatment and disposal, as well as control, monitoring and regulation of production, collection, transport, treatment and disposal and waste prevention through in-process treatment, reuse and recycling. (Nations, 1997)

Image 1: Solid waste management

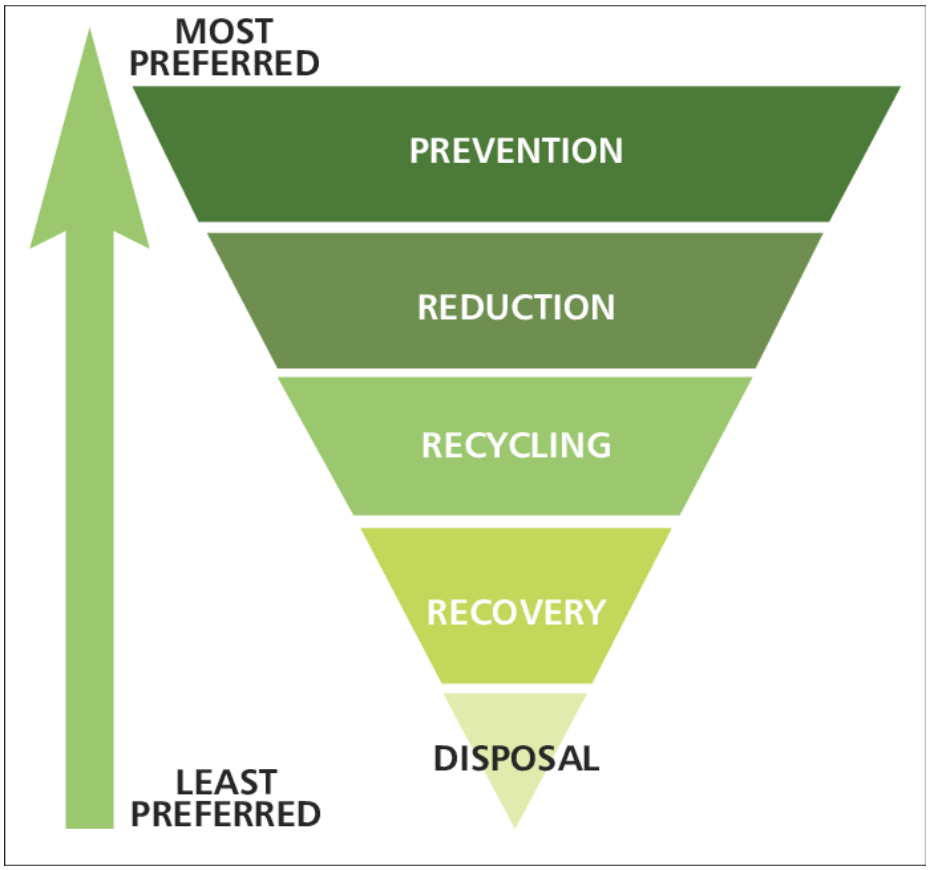
(Dreamstime, 2022)

Waste management is shaped by a waste hierarchy. The Waste Hierarchy (WH) is defined as a priority order in waste prevention management legislations and policies

where the most preferred option is prevention, followed by preparing for re-use, recycling, other recovery choices, and finally disposal as the least preferred option. This hierarchy has the following order of priority: (1) prevention; (2) preparation for re-use; (3) recycling; (4) other uses; (5) liquidation.

The shape that best represents the waste management hierarchy is an inverted pyramid with the top facing up and divided into five horizontal layers

Image 2: Waste management hierarchy



(UNEP, 2011)

WH is a principle that has been interpreted and applied in waste management policy in various ways. In general, municipal solid waste needs to be managed in such a way as to mitigate its potential negative impact on the environment and human health. There is also a belief that modern populations should strive to become sustainable and strive for a zero-waste society in accordance with the principles of the circular economy.

There are several ways to dispose of waste, one is to leave it in a landfill and the other is to dispose of it. It varies from country to country, in developed countries it is a

better way to dispose, in less developed countries, on the contrary, landfilling waste because they do not have the necessary means of disposal. (Ferrari, 2016)

2.2.1 Waste recycling

Waste recycling is a long and demanding process. The most important are three R‘s, which means: Reuse, Reduce and Recycle. Recycling the waste is just one of the three R's that focuses on environmentally friendly waste management, a more comprehensive approach to this is summarized in all "three R's":

I. Reduce: It's aimed at getting people to buy only what they need, not anything extra, because the best way to reduce waste is not to create it.

II. Reuse: If people buy certain goods, it is important to try to reuse the packaging or the entire product.

III. Recycling: When it comes to waste disposal, it is important to find ways to recycle it, instead of going to the landfill.

People produce more and more garbage and do not know how to dispose of it. Inefficient or irresponsible disposal of any waste can pollute the environment and pose a risk to society's health. (Abdul-Rahman, 2014)

The 3Rs concept is basically a way to handle waste properly. The first step with the highest priority is Reduce, which means first of all the reduction of waste generation, then Reuse and Recycling, the so-called giving the waste material a second chance before its disposal at the landfill. In addition to the "3R" concept, there is also the more widespread "5R" concept, which addresses waste issues and includes various strategies for sustainable waste management. Otherwise, this cycle is also called the zero waste cycle, which is based on 5 stages and those are: Refuse, reduce, reuse, recycle and rot.

I. Refuse: Rejecting things that are not needed. When something is not consumed, it cannot turn into waste. Better efficiency can be achieved by rejecting single-use items and instead being able to use items that can be used multiple

times. The most common waste that can be denied is disposable plastic bags, conference gifts, disposable plastic products, this waste is one of the main wastes in the streets, beaches, oceans, parks and cities.

II. Reduce: Another of the five R's is a reduction and occurs when a rejection cannot be made. These are products that are really needed or cannot be reduced. The whole population lives in the consumer world, it is not customary to refuse. This step makes people think about their real needs. Sometimes it leads to a more minimalist way of life.

III. Reuse: It means using a certain product repeatedly, if possible. It only depends on the person how creative he is. Reuse can extend the life of the product. For example a products or various items can be repaired.

IV. Recycle: This is the return of material to the production of a new item. This process requires a system that collects the waste and transforms it into a new product. There are special bins for these materials that allow you to sort the materials. Usually the material is divided into groups such as plastic, paper, glass, metal and more. In households, people sort waste into these groups, which can be recycled.

V. Rot: It is compost, an organic waste that decomposes. From this compost, a fertilizer is created, which is used in the garden for the organic products that are grown. Organic waste includes kitchen waste and other organic substances. When organic waste is mixed with other wastes, it causes an unpleasant odor and methane is formed, they do not decompose naturally and cause air pollution. (Ekmekcioglu, 2020)

In partnership with the Norwegian Ministry of Foreign Affairs, Indonesia Regency Government Association (APKASI) and Indonesia Municipal Government Association (APEKSI) to investigate the causes of Indonesian waste system challenges and how to make circular plastics system. The Indonesian government has shown a great deal of effort in waste management, reducing waste by 30 % and waste management by 2025, including 70 % reduction in marine plastic waste by 2025. They have set a national goal

of Action Partnership that has found less than 40 % of Indonesian waste is properly managed. 40 million tonnes of waste, including 4 million tonnes of plastic, are still flowing into the environment. The NPAP report aims to double the level of waste management to 80 % by 2025. (SYSTEMIQ, 2021)

2.2.2 Waste burning

Waste burning also called waste incineration it is defined as the incineration of solid and liquid waste in controlled incineration plants. Waste is incinerated in modern incinerators, which are specially designed to make the process as environmentally friendly as possible, which means incinerators have high chimneys and specially designed combustion chambers that provide high combustion temperatures, efficient waste mixing while supplying air for better combustion. The waste that is incinerated includes municipal solid waste (MSW), industrial waste, hazardous waste, clinical waste and sewage sludge. (G.H. Sabin Guendehou, 2006)

In European countries, the use of energy from residual waste, including incineration, is compatible with high recycling rates. Therefore, both incineration and advanced thermal treatment (ATT) can be part of an overall waste management strategy, but not at the expense of waste reduction or recycling. (Incineration of Municipal Solid Waste, 2013)

MSW incineration is currently more common in developed countries, while clinical waste is common for both developed and developing countries. Combustion generates emissions that differ whether with or without energy recovery. Non-energy emissions are reported in the waste sector, while emissions from energy recovery are reported in the energy sector, both with a distinction between fossil and biogenic carbon dioxide (CO2) emissions.

There is also an open waste incineration process, which can be defined as the incineration of unwanted combustible materials such as paper, wood, plastics, textiles, rubber, waste oils and other contaminants in nature or in open landfills where smoke and other emissions are released directly into the air without passing through a stack. Open combustion includes combustion equipment that does not control thermal regulation or combustion time. This waste management practice is used in many developing countries, while in developed countries, open incineration is usually either strictly regulated or

otherwise more common in rural areas than in urban areas. Any waste incineration is a source of greenhouse gas emissions. Relevant gases emitted include CO_2, methane (CH_4) and nitrous oxide (N_2O). Emissions of CO_2 from waste incineration are usually more significant than CH_4 and N_2O emissions. (Affairs, 2013)

The total burned household waste and the potential emissions released from waste burning in Semarang City, Indonesia, were estimated. Sixteen subdistricts in Semarang used the Transect Walk Survey method to monitor garbage piles. Carbon monoxide (CO), carbon dioxide (CO2), hydrocarbons (HC), nitrogen oxides (NOx), and total particulate matter (TPM) were directly analysed by waste incineration simulations. Potential emissions of other pollutants were predicted by multiplying the weight of incinerated waste by the emission factors available in the literature. The estimated amount of waste incinerated in Semarang from 2020 to 2021 is 58.8 Gg / year, which is about 9.70 % of the total waste generated in Semarang. This estimate is double the 2020 municipal estimate. The surrounding area (both inside and outside) has been identified as the main cause of waste incineration. Garden waste was also the most commonly burned waste (73.61 %), followed by plastic waste (17.45%). Other waste products such as paper, leather, textiles, rubber and food were also burned. Overall, reducing waste incinerator activity is an important step in reducing the potential for air pollution and climate change. (Bimastyaji Surya Ramadan, 2022)

2.2.3 Biological waste treatment

Biological waste sorting includes biological treatment of organic waste, either by aerobic composting or anaerobic digestion. Anaerobic digestion is a process that produces biogas. (Ulrik Reeh, 2002) Composting takes place in piles or in composting plants with optimization of process conditions and also filtration of the produced gas.

These two organic waste treatment processes, such as food waste, garden and park waste and sludge, which are common in both developed and developing countries. Anaerobic treatment is usually associated with methane (CH4) recovery and combustion for energy. Greenhouse gas emissions from the process are reported in the energy sector.

The advantages of biological treatment are the following reduction of the volume in the waste material, stabilization of the waste, destruction of pathogens in the waste material and production of biogas for energy use. The final products of this treatment are

recycled at best and are further used as fertilizers and also as soil treatment material or can be disposed of in SWDS. Biological treatment of organic waste has revived over the last ten years, as efforts have stepped up to improve the recycling of nutrients and organic matter into the soil and, in particular, to minimize landfilling of biodegradable waste in order to reduce greenhouse gas emissions. Biological waste treatment generally affects the amount and composition of waste that will be deposited in the SWDS. (Riitta Pipatti, 2006)

The ultimate goal of bio-waste treatment is to optimize the use of resources and energy while minimizing the impact on the environment at the lowest possible investment and operating costs. (Ulrik Reeh, 2002)

Efforts made to convert dangerous and toxic waste into non-dangerous and toxic waste were carried out by dumping, shredding, cleaning, rinsing and disinfecting at least three times with chlorine. It complies with the 2017 Indonesian Ministry of Health Regulation No. 27, which stipulates that 0.05% chlorine can be used for surface cleaning during the process. In addition, the 2015 Ministry of Environment and Forestry Indonesia Regulation No. 56 permits the use of an additional 3 % and 6 % sodium hypochlorite (NaOCl) in the chemical disinfection process. However, there were still differences in dosage, and exposure time during the disinfection process was not mentioned in either regulation. The government needs to reassess the recommended ideal dose for the surface disinfection process to avoid potential risks to people and the environment. (Elanda Fikri, 2021)

2.2.4 Landfilling of waste

Landfill is a term used to describe physical facilities used to dispose of solid waste and solid waste residues in the Earth's surface soils. Since the turn of the last century, the use of landfills has been the most economical and environmentally friendly method of solid waste disposal worldwide. (George Tchobanoglous, 2002)

The term landfill is considered to be synonymous with a municipal solid waste sanitary landfill when the landfill is designed on the principle of waste retention and is characterized by the presence of a liner and leachate collection system to prevent groundwater contamination. Landfill includes other terms such as "secure landfill" and "treated landfills", which are also sometimes used for municipal solid waste disposal.

Under the widely used term in the past „sanitary landfill“, we can imagine a description of MSW disposal units constructed on the basis of a landfill and a shelter, but without protection against ground water pollution. Landfilling is intended for types of waste such as mixed waste that is not found suitable for waste treatment, pre-treatment and post-treatment of effluents from waste treatment sites, untreated or recycled waste that is not hazardous. Landfilling is not carried out for waste such as bio-waste or garden waste and for dry recyclable materials.

A certain landfill is reserved for various types of waste, for example a landfill for the flow of hazardous waste into municipal waste will be carried out at a landfill for hazardous waste, this process is managed by a state authority. Furthermore, the landfilling of construction and demolition waste is carried out in a separate landfill, where the waste can be stored and mined for future use in earthworks or road projects.

Landfills are regularly inspected and boreholes are drilled in which subsoil samples are obtained under the landfill base to assess permeability and soil. The quality of the samples is compared with the quality of groundwater near the landfill. In the case of satisfactory leachate quality and permeability of subsoil layers, the existing landfill can continue to operate. If the local groundwater quality is poor, the existing landfill must be closed.

Problems associated with landfilling are contamination of groundwater and surface water, air contamination by gases, dust and unpleasant odors. Other problems are also often caused by rodents, pests, slope disturbances and erosion. (Central Public Health & Environmental Engineering Organisation (CPHEEO) Ministry of Housing and Urban Affairs)

In Asia, many countries adopted a semi-engineered or full sanitary landfill as the most attractive way of disposal options. Cities such as Bandung, Singapore, Hong Kong, Seoul, Chennai and Tokyo have well-designed and operated landfills. In the densely populated towns and villages of the region, the availability of land for landfills is a major limitation. For example, in Hong Kong, China and Singapore, severe territorial constraints have led to the development of comprehensive engineering infrastructure solutions that ensure a high level of operations and maintenance management and enable the development of acceptable landfill solutions in coastal areas, coastal islands and mountain areas. (Escap, 2010)

MSW remains a serious problem in Indonesia. In addition to implementing the Indonesian government's commitment to reduce CO2 emissions, Presidential Decree No.

18 of 2016 was issued to accelerate the development of waste-based power plants. Construction of waste-based power plants from landfills is expected to reduce urban waste disposal budget deficits while preserving environmental protection. In addition, several types of power plant scenarios can be used to see the economic feasibility of building a waste-based power plant in the Jatibaran landfill. The potential and economic feasibility of landfill gas in this study is calculated using the Intergovernmental Panel on Climate Change (IPCC) inventory software and LandGEM's LFG CostWeb. As a result, even within 6 years of operation, only the power sales project of a standard piston engine generator set reached the break-even point, and the net present value of the project lifetime of 15 years was around 755 thousand US dollars. (Mohammad Soleh, 2020)

2.2.5 Sustainable waste management

Sustainable solid waste management includes waste reduction and waste separation, and this is one of the most preferred elements in the waste hierarchy. These two elements in the hierarchy significantly affect the end products of the overall solid waste management process. (Ariva Sugandi Permanaa, 2015)

Sustainable solid waste management requires an adequate understanding of the characteristics, sources and rates of solid waste production. It is important to deal with waste in order to understand the composition, volume and level of production from different sectors. The distribution of different sources of waste shows that several (Ebikapade Amasuomo, 2016)

Economic and environmental aspects of sustainability are taken into account to achieve sustainability. (Balakina, 2019)

The basic principles of a sustainable waste management strategy are sustainable development, the waste hierarchy, prudence, regionalization, the most optimal environmental solutions, the polluter pays and producer responsibility. (Elsaid, 2015)

Sustainable waste management systems in most cities in Indonesia still rely on individual collection, transportation and disposal systems in landfills. Statistical data on Indonesian waste shows that 79.5 % of the waste is disposed of in landfills (TPA). (BPS, 2008) The risk is high and need to change system immediately. Interfering with either system compromises the sustainability of the overall waste management system. Other methods need to be developed to prevent the waste management system from shutting

down. One of the most feasible and practical ways is to implement waste reduction or mitigation practices integrated into the city's solid waste management system. Waste reduction should be implemented early at the source (household) and then at the TPS (temporary disposal site) level. This waste reduction is a practice of waste separation and recycling. This system has long been adopted in many developed countries and has proven successful in reducing the proportion of landfill waste and reducing its negative impact on the environment. (Sunarto T. S., 2018)

2.2.6 Waste management in Indonesia

According to the latest statistics, Indonesia a country which belongs to the ASEAN (Association of Southeast Asian Nations) association, has the largest population, about 270 million and a growth rate of 1.2 % per year. (Badan Pusat Statistik, 2020) With such a large population growing steadily, the amount of waste is also increasing, this is a problem that the country is facing. (Sunarto &. S., 2020)

Today, more than 55 % of Indonesians live in cities. With the current rate of urbanisation, more than 73 % of Indonesians will live in cities by 2030. (United Nations Development Programme, 2017) In light of this, Indonesia has been encountering pressing problems with regard to the management of municipal solid wastes. MSW is generally defined as waste collected by municipalities or other local authorities. Typically, MSW includes household waste, garden/yard, park waste, and commercial /institutional waste. (IPCC, 2006) With a total population of 270 million (Badan Pusat Statistik, 2020), Indonesia generates 194,002 tonnes/day of MSW in a total area of 1,910,931 km^2. This amount of waste generation is dominated by urban centres. (Christy, 2020) The largest amount of MSW in Indonesia flows from households, which is around 39.8 % and from traditional markets around 17.2 %. (SIPSN, 2022)

Waste management remains a major challenge for cities with large populations and increasing per capita income, and is usually faced with high levels of waste generation. Recognized as an effective long-term means of overcoming waste problems, source isolation as a first step towards recycling is currently being promoted in developing countries.

The Government of Indonesia enacted Law No. 18, 2008 on Waste Management. This law stipulates that everyone is obliged to separate waste at the source. Waste reuse

is also emphasized by law as part of waste reduction. This law is governed by Decree No. 81 of 2012 on the management of household waste and household waste. However, source sorting is not yet widespread in Indonesian cities.

Researcher Setiawan studied the factors that determine the general acceptability of waste separation in Surabaya. (Setiawan R. P., 2020) Indonesia's second largest city with advanced urban waste treatment services. Dhokhikah et al. In eastern Surabaya, only 47 % of respondents have already introduced household waste separation. (Yeny Dhokhikah, 2015) Of the respondents who do not separate waste, 62 % are willing to separate household waste. Waste separation is mainly done in specific pilot areas. It is important to understand the factors that contribute to the acceptance of waste segregation policies, as governments can get more support for policy implementation. In addition, governments can prioritize policy implementation for the most responsive groups of people.

Brotosusilo et al. studied the waste management behaviour of Indonesian urban residents. (Agus Brotosusilo, 2020) The data used in this survey were collected from more than 600 households in six different provinces of Indonesia. Data were collected from 100 households in different cities. The provinces corresponding to these data include the Special Administrative Region of Jakarta, Jambi, West Java, East Java, Maluku, and West Sumatra. Sampled cities include Jakarta, Ambon, Tasikmalaya, Jambi, Muaro Jambi, Padang, and Surabaya. These cities were chosen as they are characterized by relatively high urban populations within the provinces of interest. Meanwhile, provinces were chosen based on their population density in conjunction with the magnitude of the waste handling problem.

Questionnaire provides spatial and household awareness, household overview, household members, self-regulated waste disposal routines / practices, knowledge and contribution to waste disposal, awareness and attitude towards waste disposal, and an explanation of the assessment.

Overall, the study illustrates how the desirable habits related to environmental consciousness differ across urban citizens among different regions and economic classes. Great contradictions have been found in states and cities in people's understanding of a healthy and clean environment. It was also pointed out that ignorance about waste management is widespread. Implanting a personal awareness of the local environment proves to be a good start to keeping the environment clean. The positive correlation observed between general living conditions and litter behaviour suggests that households

with litter behaviour also tend to perform better in living conditions. This significant positive correlation indicates self-interest and ignorance. The study also suggests that higher levels of household economic well-being correlate with more desirable behaviours in maintaining a clean and healthy environment. Such behaviour is also adopted by citizens living in clean areas.

The solid waste management (SWM) system usually affects both the formal and informal sectors. The formal sector includes municipal agencies and formal enterprises, while the informal sector consists of individuals, groups and small enterprises engaged in activities that are not registered and are not formally regulated. Waste buyers and waste pickers who carry out recycling activities belong to the informal sector. (Aprilia, 2021) There are solid waste management systems that take a certain integrated approach in a given city or region, taking into account both end-users, waste generators and end-of-chain solutions. In Indonesia, there is active public participation in the form of "waste banks", which is a community SWM system for collecting recyclable materials. Indonesians embraced the principles of waste banks when the term Reduce, Reuse, Recycle became popular starting in the 1990 s. (Aprilia, 2021)

Waste banks are one of the new concepts for solving Indonesian waste problems. Instead of burning waste or throwing it into rivers, communities set up places where villagers can store their waste. This concept, or bank sampah, was created by locals in 2008. The original concept is that the deposited waste is sold to waste traders or pengepul, who then resell it to recycling companies. The Indonesian government has agreed on the concept of a waste bank, saying it is currently the best waste management option in the country. There are more than 5,000 waste banks in Indonesia, and the amount of waste treated varies significantly. Waste bank customers, mostly women, bring different types of waste, such as paper, glass and several types of plastics, which are already separated.

There are different types of plastics that have different ascribed values, one of the most valuable types being small plastic water cups and the least valuable being plastic bags. Waste bank volunteers weigh the waste, calculate its monetary value and record the information in the ledger. The waste is then stored in a warehouse until it is sold to waste entrepreneurs. However, the program is not effectively promoted with local communities, so citizens are often unaware of the bank's existence. The payout system at waste banks is as follows, and that people get money every three months from the waste bank, when they come to drop the waste, on the other hand with waste collectors they come to pick the waste from a household and give the money directly to the people. So they recieve

money everytime, when the waste picker is there. Due to the growing importance of waste, an offer has opened up for the informal labor sector. This informal sector provides income for many people, but unfortunately it offers poor and precarious working conditions. (Keller-Bischoff, 2020) Waste banks process only inorganic waste with economic value, while organic waste is processed in composting plants, outside the waste bank system. (Aprilia, 2021)

Most public services, such as public works, health, education, agriculture, communications and the environment, are administered by municipalities. In most cases, the city and its surroundings are independently managed by different municipalities. There are 450 municipalities that supply cities and counties. Basic services for water supply, sewerage and MSW management are the joint responsibility of the national, provincial, municipal and private sectors.

In Indonesia, there is also a landfill, there are controlled landfills that are inspected and a sanitary landfill system that was put into operation in 1989. Where approximately 5,500 tons of MSW is transported almost 1,500 trucks a day. Sanitary landfills are not strictly inspected. Operational records are poor, due to a lack of financial resources, properly trained and qualified staff. Due to landfilling, landslides took place and landfills took up a lot of space, there was no room for more. (Mochammad Chaerul, 2007) The open landfill method is a major source of environmental pollution as it becomes increasingly difficult to identify new disposal sites due to public opposition and land costs. (Aprilia, 2021)

2.3 Education and awarness

Success for sustainable solid waste management is linked to public involvement and mutual trust. Experts rely on citizens, who should reduce the amount of waste produced, separate or dispose of specific types of waste at home properly, to pay for waste management services. The governments of the countries should motivate this support, they must gain the trust of the citizens. (Kaza, 2018)

Participation is a process by which residents or any other managing authority organize and engage at the level of a residential area or neighborhood in order to improve the conditions of everyday life. This includes varying degrees of individual or collective

involvement in terms of financial or physical support, social or political commitment. Residents set up steering committees that run the entire community. (Subash, 2002)

Local authorities must ensure that waste management works properly, set the conditions for citizens to understand the consequences of poor waste management and be prepared to cooperate. Community involvement can help mobilize efforts from different parts, such as non-governmental organizations (NGOs), community organizations (CBOs), private players, local governments and others. (Kalra, 2019)

Various programs and policies are used to encourage or require participation in downsizing. Governments have the opportunity to put in place measures to reduce the amount of waste produced, including: Restrictions on packaging and products, setting procurement guidelines, prohibitions on the disposal of certain materials and products, legislation requiring manufacturers to follow certain packaging and product guidelines, proportional taxes on the use of material and part of the product waste, awareness and training programs, information centers, requiring waste audits and developing resource reduction plans. (George Tchobanoglous, 2002)

An effective waste management requires cohesion among various stakeholders like NGOs, local government, citizens, waste entrepreneurs, rag pickers, community-based organizations etc. Information campaigns and education are needed to create this coherence. (Kalra, 2019)

2.3.1 Population education

By rapidly raising living standards and developing technologies, this leads to higher solid waste production. Households in urban areas are less likely to incinerate or bury waste, but garbage piles in public places are more common, which has an impact on the environment and citizens. Waste piles can be found on the streets and in large public places, most of which are in the form of food and beverage packaging waste. Garbage disposal behaviour is influenced by spatially based attributes. This means that areas with lots of street restaurants, abandoned buildings or areas close to roads have a higher tendency to accumulate garbage than houses with greenery and well-maintained premises. People-nature interactions can affect ecosystem, economic and cultural resilience at local and regional level. Waste disposal shakes the resilience of the ecosystem. A large amount of waste is caused by insufficient environmental awareness.

Waste not only disrupts aesthetics, but also has an impact on the health of the population. Human behaviour can be regulated by prevailing societal norms. Individuals tend to accept behaviour adapted to socio-spatial contexts.

To improve the waste problem, policies have been developed for the payment of plastic bags. Its goal is to minimize the use of plastic waste. Unfortunately, these established policies are not working very well in Indonesia. The presence of large amounts of waste on the roads, in the river or at sea attracts a lot of attention. The problem of waste does not only come from within the country, there is information that waste is being exported from developed countries to developing countries. Enforcement is alleged to be the cause of waste behaviour because existing sanctions are not strictly enforced. Several approaches are used to solve the problem of waste disposal, either through technical approaches or social knowledge. It is impossible to deal with waste with only one approach, that is the limitation. Due to the complex waste problem in Indonesia, it is necessary to combine these approaches. The problems that arise stem from the amount of waste and its waste disposal behaviour. Differences in waste management in Indonesian cities are due to differences in people's understanding of the concept of a healthy and clean environment. Profusion is also one of the causes of these problems.

Improper waste management behaviour is, for example, waste incineration. Incineration is still a very common way of destroying waste. Behaviour change improves waste disposal awareness and the identification of environmentally harmful human behaviour.

Several studies indicate that the level of education of the population is a factor influencing waste generation. Efforts can be made by providing education to maintain environmental sustainability. The level of education is important in making decisions and dealing with environmental damage. One of the barriers to pro-environmental behaviour is the knowledge that individuals with lower education will throw more rubbish than individuals with higher education. Formal education plays a role in the right level of waste management. (A. Brotosusilo, 2022)

There is no waste sorting in households, which is a big problem in a waste bank because all solid waste is mixed. Improving knowledge and access to the environment would ensure better sorting of solid waste in society. Someone who really cares about the environment has the knowledge and behaviours necessary to create an alternative solution that involves both the individual and society as a whole. It is necessary to analyse responsible mechanisms as behavioural factors that affect waste management and sorting,

such as knowledge of household waste management. Other factors that relate to waste sorting behaviour are environmental value, demographic variables such as education, income, home ownership, area and type of building.

Behaviour determines the interest in the environment in accordance with individual beliefs. An environmentally conscious person would not take advantage of an economic advantage, he would just be content to do something useful, which means that waste sorting will be more convenient.

A high level of education recycles waste more than a low level of education. Low-income households with insufficient financial capacity do not sort waste due to lack of space in households and the inability to buy waste bins.

According to the study, 53 % of people burn household waste and most of them say they have a good knowledge of waste management. Only a small proportion of households in Indonesia (approximately 9 %) sorted waste and people cited the main cause of laziness as a reason for not sorting waste. (Zakianis, 2017)

Citizens' awareness is an essential part of Indonesia's efforts to address environmental problems, from disaster risks to biodiversity conservation. Environmental values are less entrenched in Indonesian society, leading to an underestimation of natural resources and environmental services. (Kelsie Prabawa-Sear, 2020)

A gap in existing laws is ambiguity, such as insufficient socialization of professional regulations, poor law enforcement for those who break the law, as well as regional waste regulations. Not all components that have an impact on this process are actively involved in drafting regulations. (Laura Astrid Hasianna Purba, 2020)

Currently, the Indonesian government's interest in the environment is largely due to population pressures, due to high population growth rates and insufficient levels of education. Indonesia participated in the UN Decade of Education for Sustainable Development from 2005 to 2014. There are many different government commitments regarding the provision of environmental education in Indonesia, such as the agreement between the Minister of the Environment and the Minister of Education of 3 June 2005 on environmental education and Act No. 32 from year 2009 on Environmental Protection and Management. Under President Susil Bambang Yudhoyon, Indonesia presented itself as a "good citizen in the field of the world", mainly through active intervention at the Bali Climate Change Conference in 2007. Unfortunately, its successor, President Joko Widodo, has averted some of the initiatives and level does not present much on the environment. Indonesia still lacks the political will and bureaucratic expertise to

implement environmental regulations. Politicians lack leadership and interest in environmental issues.

There is no ecological habit in society yet. The truth is that there has long been an environmental movement in Indonesia. Environmentalism has long been associated with universities and environmental NGOs. These organizations and schools are trying to fill the void of government activities in this area.

The first awareness of the environmental movement began at universities. In the 1970 s, five Environmental Studies Centres (ESCs) were established at universities. By 1994, there were 53 of them, which increased environmental awareness among academics in Indonesia. The current of environmentalism emerged and campus and non-campus activists converged in the 1980 s. The humanities and social sciences, rather than the physical and biological sciences, are now addressing pressing environmental issues in Indonesia. Environmental NGOs (ENGOs) are at the heart of environmental movements. (Kelsie Prabawa-Sear, 2020)

In Indonesia, the development of environmental education in schools has been integrated into character education. The schedule for cleaning patrols, extracurricular activities, joint garbage cleaning and community service are managed by the director. Examples of different activities are closely related to the effort to increase students' knowledge and perception. The importance of attractive school curricula and internet literacy as drivers of how students perceive waste. (Teddy Prasetiawan, 2021)

2.3.2 Activities

Rural Solid Waste (RSW) is part of integrated waste management as lifestyle changes and increased income, quality, and quantity of waste in rural areas. Solid Waste Management (SWM) requires a systematic approach that integrates environmental effectiveness, public acceptance, and economical affordability. Public acceptance means actively accepting, actively supporting, and adopting newly introduced technical devices and systems. The general acceptance of waste management can be measured by population participation. Citizen participation is recognized as a way to achieve sustainable waste management and can bridge the gap between government and citizens in dealing with environmental conflicts. Public participation in waste management should focus on "waste as a resource" and "waste as a source of income" on a household basis.

It serves the purpose of daily waste treatment, waste utilization as a resource for specific regional production, and household income and utility factors involved in solid waste management. Home involvement in waste management can take the form of waste separation and recycling. The concept of waste management, including waste separation and recycling, is only successful if it is endorsed by the general public, including locals. Local residents are non-negligible stakeholders in both routine waste management and decision-making processes, as they are both targeted and targeted by waste management services. Community performance patterns and attitudes formed by the cultural and social background of the region determine the structure and function of civic participation. Therefore, the challenge of waste management today is to improve public participation.

In Indonesia, the number of researches focusing on public willingness to participate in waste management and its influencing factors is still low. These factors could be demographic variables, i.e., age, gender, household typology, knowledge, and recycling time as well as educational level, occupation, or income level. Identifying these factors and their importance may be beneficial for the improvement of public participation in waste management since it depends on the local situation. The design of a successful scheme may not necessarily be replicable elsewhere. Public acceptance can be reflected by the willingness to accept (WTA).

The contingent valuation method (CVM) was applied in this study to draw people's willingness to accept (WTA) economic sacrifices to separate waste (Christia Meidiana & Harnenti Afni Yakin & Wawargita Permata Wijayanti, 2017. "Household's Willingness to Accept Waste Separation for Improvement of Rural Waste Bank's Effectivity," Chapters, in Florin-Constantin Mihai (ed.), Solid Waste Management in Rural Areas, IntechOpen.). The contingent valuation method (CVM) was claimed to be the most suitable tool available to measure nonmarket value. Previous studies used it to measure public goods and services and to assess farmers' participation preferences. Properly designed willingness to accept (WTA) can estimate the strength of demand for those who are willing or never willing to consume a certain good.

The WTA classification of households living in Gili Trawangan was measured and the expected compensation for it was assessed by the household for WTA. Gili Trawangan is a famous tourist destination island. Visits to the island are increasing by 11.8 % each year, resulting in increased waste generation. Households, hotels, and restaurants are the main sources of waste on the island, accounting for 602 tonnes of waste per day, of which about 42 % are inorganic. Currently, the island is not provided with

waste disposal by the local government. There is a community initiative to operate waste separation and waste banks to reduce inorganic waste such as plastics, paper, metals, and glass and generate revenue from sales. Unfortunately, the public participation in waste separation is very low, which may be due to the inefficiency of waste banks.

For technology development for waste management, Indonesia still lags behind developed countries such as Europe and America. The need for a proper waste management system is rapidly increasing. With a loan of USD 100 million from the German government, Indonesia plans to build central dumpsites in Java regions (Malang, Jambi, Jombang, Sidoarjo, and Pekalongan).

Indonesian cities are now experiencing waste issues that are impacting communities and economies. To rectify this emergency, the Indonesian government has worked with CDM Smith to develop "Advanced Solid Waste Management Systems" for several selected regions and cities throughout Indonesia. The system is to create advanced waste treatment facilities with the latest technologies to divert waste from landfills in Indonesia.

On top of that, the treatment systems will ensure that recyclable waste is segregated and reintegrated into the production cycle. Organic waste is treated to reduce greenhouse gas emissions. As a result, this advanced solid waste management system will help minimize the amount of waste, save natural resources and reduce carbon dioxide emissions from untreated organic waste. West Java's Swedish Waste Management Technology

West Java is exploring the cooperation opportunities to implement the waste management technology of South Scania Waste Company (SYSAV), Sweden, including sustainable technology, a waste-to-energy plant, transportation, and education. Although the waste management technology from SYSAV is expensive, this advanced technology has shown positive results. However, the adoption will not be fruitful if people lack the awareness of how to treat their rubbish or waste.

Indonesia has been cooperating with Norway and Denmark for urban waste management, as the country faces considerable challenges in improving its solid waste management. Norway has contributed USD 1.4 million to the Indonesia Oceans, Marine Debris, and Coastal Resources Multi-Donor Trust Fund (OMC-MDTF); and Denmark has also provided more than USD 800,000 to the fund.

Besides foreign contributions, the Indonesian government is committed to allocating USD 1 billion for the next five years.

Informal waste collectors play an important role in the waste management economy. However, often their contribution is minimized or goes unrecognized by society, with low compensation and poor working conditions. Meanwhile, a lack of transparency and traceability of plastic feedstock from the informal sector is a growing concern for large buyers of this feedstock and waste collection companies. The integration of the informal sector in Indonesia is critical to improving livelihoods and to improving the digital literacy of the informal waste collectors, and most importantly, contributing to the NPAP Multistakeholder Action Plan goal of doubling Indonesia's waste collection and recycling capacity. To support this goal, the following cohort members have improved the integration of the informal sector in Indonesia's waste management economy:

Duitin Indonesia: Duitin Indonesia helps people to start recycling in a fairly easy manner. it's as easy as a ride-sharing app, where the contributor will request a pickup and the picker will come over and pick it up. the contributors then will get rewards such as monetary rewards.

EMPOWER: Empower provides a tracking platform that digitizes plastic waste and ensures that all parts of the value chain are incentivized to achieve segregation at the source and traceability of the materials from the collection throughout recycling.

Griya Luhu: Griya Luhu is a leading ecopreneur in changing peoples' behavior and awareness toward sustainable waste management by using digital technologies. They promote integrating digital technology and community empowerment to improve waste segregation at the source.

Kabadiwalla Connect Indonesia: Kabadiwalla Connect helps leverage a city's existing informal waste infrastructure in the collection, processing, and management of municipal waste streams. Using smartphone-based data collection methods, the company is on a mission to map and enumerate stakeholders in the informal waste-supply chain in cities and towns in the Global South.

Octopus: Octopus is an end-to-end recyclable waste logistic platform, currently operating in six cities in Indonesia from South Sulawesi, Bali to West Java with more than 9000 waste collectors using their app. They provide a solution for recycling industries to acquire their materials in the most efficient way that involves informal sectors. Local waste collectors earn 10 times more by using their platform.

Plastic Bank Indonesia: Plastic Bank builds ethical recycling ecosystems in coastal communities, and reprocesses the materials for reintroduction into the global

supply chain. Collectors receive a premium for the materials they collect which helps them provide basic family necessities such as groceries, cooking fuel, school tuition, and health insurance.

Rekosistem: Rekosistem is a responsible waste management start-up that provides a platform to improve efficiency in the waste value chain. Through their platform, they encourage consumers to participate in waste collection, help waste collection processes to be more productive, provide a steady supply to recyclers, and data traceability to businesses

2.3.3 Waste banks

The concept of waste banks became known in Indonesia in 2008. (Dhewanto, Lestari, Herliana, & Lawiyah, 2018) The Waste Bank was set up on a simple mission to encourage local people to recycle and reduce waste. (Siregar, 2020) A public health speaker on behalf of Bambang Suwerd spoke on television about communities that use a "waste bank" to store waste and recycle it into more useful products. This waste bank model inspired him to invent a waste collection facility that would function as a conventional bank where community members could exchange recyclable materials for cash. His motivation for establishing these banks was his lifelong work to promote environmental health in his community. Waste banks quickly spread to dozens of other locations in Java. The expansion of other banks has often taken place through study tours. (Geldin, 2017)

It is a concept based on the collection and sorting of solid waste. The concept includes systems where the stored waste that the customer brings is weighed and recovered, the waste is later sold in factories or recycling intermediaries, or it is also handed over to local recycling entities for processing. (Waste4Change, 2022)Waste bank is a social innovation designed to educate people to sort waste and to raise public awareness about the treatment of waste that is dumped. (Dhewanto, Lestari, Herliana, & Lawiyah, 2018) Waste banks have been established as an alternative for Indonesia to overcome the problem of waste in urban areas. (Devita Faradina, 2020)

The aim of establishing these banks is to increase public awareness of waste sorting and waste reduction through the 3R (Reduce, Reuse, and Recycle) approach. The development of waste banks in both urban and rural areas has shown a positive trend in

the level of public interest in terms of waste management. Some waste banks in Indonesia are further implementing creative policies to attract community attention to 3R-related events. Local waste banks create and sell plastic installations and offer up-cyclical workshops to generate money for waste treatment. In these unique ways, they attract volunteers to help sort waste. The organizers of these waste banks are trying to create a special place that volunteers can share on social networks and thus spread awareness about this place and the problem that Indonesia faces due to waste. (Keller-Bischoff, 2020)

This system works in such a way that the deposited waste must be properly sorted and each customer has a passbook available, each of which will contain the nominal value of money by selling the waste to a waste bank. An improved wage sorting and collection system with informal recycling can motivate customers to be more efficient and reduce the impact of landfill waste. (Dhewanto, Lestari, Herliana, & Lawiyah, 2018)

This activity aims to educate the public to be more careful when sorting waste and also to promote a sense of community sensitivity in proper waste treatment. Building a waste bank is the first step in raising public awareness on how to start using waste. This is important because waste has a selling value and waste management with an environmental perspective can become Indonesia's new culture. When developing a waste bank and producing recycled products, people's knowledge of the types of waste and how they are handled, especially plastic waste, is important. (Devita Faradina, 2020)

New waste banks have begun to emerge independently in other cities through a network of businesses, non-profit organizations and civil society representatives. Communities have adapted their waste bank practices to local needs and wishes. Some bank employees were paid for their work and others worked voluntarily, some banks became educational tools for schoolchildren, others collected waste from businesses and retail, in addition to household waste, and others operated exclusively as community organizations and cooperatives, while others were managed as a public-private partnership. Individual banks have developed unique service options so that customers can exchange their savings for waste activities for products that are sold at the bank's location. Banks have begun offering customers kiosks and mobile applications so they can use their waste-saving credits to pay for food and household items, energy bills, health insurance, tuition and property taxes.

Waste banks are a form of a green business[1]. Green business is how to take advantage of a certain type of specialized business or a limited target market by serving the community and helping to protect the environment. Waste banks support local economic activities by involving the community and government, as well as providing incentives for the community to improve the local economy through a clean environment and empowerment. The community has control over investments in both resources and decision planning for community groups and local governments. The construction of waste banks in Indonesia is in line with this approach. Successful outcomes of waste banks depend on the local context, but will not be achieved unless the community expresses a need or takes a proactive approach to participate in the activities. If customers lack proper training in recycling, waste bank employees lack proper management training or price manipulation, or excessive waste will cause the purchasing value of recyclable materials to fall below profitable levels. However, most waste banks overcame these problems and many of these banks eventually benefited from financial resources as well as advisory support to existing community waste networks. (Geldin, 2017)

The Ministry of the Environment fully supports the construction of waste banks as an alternative solution to reduce waste deposited for final disposal. This is supported by the mandate of Act No. 18 of 2008 on waste management and Government Decree No. 81 of 2012 on household waste management on the need to change the paradigm from the collection-transport-disposal paradigm to the processing paradigm. To support the activities of waste banks in Indonesia, the government is implementing the waste bank integration model with extended producer responsibility through Act No. 13 of 2012. The aim of the model is for manufacturers to take responsibility for recycling as needed. The waste bank is a form of responsibility for the well-being and improvement of the living standards of people and their surroundings, as well as responsibility for the environment, that is, the management of natural resources for the benefit of the population. (Dhewanto, Lestari, Herliana, & Lawiyah, 2018)

The regulations on waste banks are stipulated in Regulation No. 13 of the Minister of Environment and Forestry of the Republic of Indonesia of 2020, which concerns guidelines for the introduction of restrictions on the re-use of recycling by waste banks. In the fall of 2018, President Joko Widodo launched a program to support the

[1] The green business is a company that does not make any negative impact on the environment, economy, or community. (Upcounsel, 2022)

implementation of Indonesia's Clean-from-Waste 2025 program, which was formalized by Indonesian Presidential Decree No. 97/2017.

This program is one of the government's efforts to continuously develop and improve the following plans, such as reducing waste at source by 30 %, processing and disposing of at least 70 % of waste so that it does not collect and accumulate in landfills, all by 2025. in 2018 in Indonesia, approximately 8,036 waste banks in 34 provinces. (Waste4Change, 2022)

2.4 Waste management start-ups in Indonesia

Start-ups are a high-growth business structure driven by disruptive innovation and were created to solve problems by offering new products under extreme uncertainty conditions. Therefore, the main unification trends seen in waste management start-ups are creativity and innovation. Leading waste management start-ups are using a variety of models and clean technologies to recycle and reuse waste, reducing the need to deplete waste and natural resources.

2.4.1 The innovative potential of start-ups

In particular, the promotion of start-ups has received a great deal of attention as a strategy for dealing with rising unemployment in Indonesia. Many start-ups in the country are dealing with waste separation and other related activities. For the people of the Indonesian islands, this is one of the best waste management solutions as there are few government initiatives to solve the waste problem. Indonesia is witnessing an increasing trend in waste management capacity. By 2025, Indonesia aims to reduce, reuse and recycle at least 30 % of all waste and dispose of the remaining 70 %. This is supported by other examples of national waste management business and community growth. (EKONID, 2021)

In the last couple of years, there have been new directions in waste management technologies in Indonesia. This innovation introduces waste management start-ups and waste collection technologies. In addition to collecting this waste, they also recycle the collected waste into valuable and functional waste.

For example, Growing Plastic startup, developed eco-friendly bubble wrap made from banana peel. Rebricks, manufacturers of disposable sachet packaging into robust paving materials. (Saraswati, 2022)

Green startup develop and implement products or services that contribute to the goals of the green economy. Financing green start-ups is very different from funding traditional start-up's. It must be taken into account that companies, products, services, markets and institutional environments are very diverse. Diversity in start-ups and operating environments influences the nature and scale of financial challenges and opportunities. (Lange, 2013)

2.4.2 Business model

The business model is the key factor that leads to success in start-ups. It provides the starting point that allows a company to maximize its profits-the sooner the business model is in place, the better. A viable business model is a key determinant in obtaining funds. Not all garbage is created equal. The first step in starting a waste management business is to choose what types of waste materials you want to collect and transport. Different industries require different types of waste management. Some of these industries are:

KLIN Indonesia: Is the first and only medical waste management plant in Indonesia.In partnership with the Indonesian Health Ministry, and the National Order of doctors of Indonesia, KLIN Indonesia brings a scalable solution to collect and dispose of medical waste with the latest in clean technology. KLIN's mission is to collect and destroy hazardous waste from used hospitals. Before the KLIN the medical waste used to mix with domestic waste and ends up in rivers, and beaches. (KLIN)

Eco-Bali: Eco-Bali was established in 2006 in response to the urgency of waste management problems in the island of Bali. The vision and mission is to enable everyone towards a zero waste lifestyle and to promote responsible waste management, create green knowledge and eco products towards achieving zero waste. The eco-bali focus is to maximize recycling, reduce quantity of waste to landfill and promote composting. We guarantee the disposal of the remaining residue only in legal facilities. Eco-Bali help take

care of waste in homes, offices, shops, restaurants, hotels, the community or schools. It also offers a bin system. They provide staff training to know how to dispose of waste. In the field of recycling, they work with factories in East Java, where recyclable materials are processed into intermediates such as flakes, pellets and pulp. (Eco-Bali)

Waste4Change: Waste4Change was founded since 2014 and provide services for responsible waste management with vision to reduce waste produced in landfills. They provide services such as consultations, various educational campaigns for staff, the community and students on waste management, waste collection and process the collected waste responsibly to become recyclable material. (Waste4Change)

Kertabumi Recycling Centre: Kertabumi is a community-based social enterprise that's focused on finding solutions to environmental problems in Indonesia through research, campaign and training. The main goal is to solve the major environmental challenges facing society, science and economy by conducting strategic programmes within our four research fields: climate change, biodiversity, green products and waste management. (Kertabumi)

Jangjo: Jangjo strive to be an environment sustainability company that helps to create ecosystem that supports sustainable practices, zero waste solutions and decentralize waste sorting and efficient recycling. (Jangjo)

Octopus: Octopus is a circular economy platform that producers to track & collect their post-consumer product for both recyclable and non-recyclable. The octopus ecosystem ensure ethical collection ecosystem, AI technology provide an effective pricing model for Recycling Industry and our collection model ensure transparency to benefit local waste stakeholders. (Octopus)

Rekosistem: Rekosistem is a waste management start-up that improves the efficiency of the waste value chain. Their platform encourages consumers to participate in waste collection, increases the productivity of the waste collection process, ensures continuous supply to recyclers and traceability of corporate data. (Rekosistem)

Ecofren: Ecofren has more than ten years of experience in managing B3 waste and serving more customers. Ecofren provide integrated and environmentally friendly domestic waste and waste management solutions. Aiming to reduce the amount of waste that goes to landfill, Ecofren focuses its services on sorting waste from the first producer and efforts to optimize the recycling rate of waste. Ecofren services are intended for various types and scales of business, both commercial facilities, MSMEs, distributors who need goods destruction services, as well as individuals who want to participate in waste recycling. (Ecofren)

Trash tech start-up: Artificial intelligence (AI) also plays an important role in waste management start-ups. The AI built into the app allows waste disposal companies to take pictures of garbage, and through image recognition, tools identify items and their associated values. This educates waste workers about the market value of materials and helps streamline operations and maximize wages. Ultimately, this will allow waste workers to collect and dispose of waste more efficiently and increase recycling rates. (Javerbaum, 2019)

Kabadiwalla Connect Indonesia: Kabadiwalla Connect supports the city's existing informal waste infrastructure in the collection and disposal of municipal waste flows. The company uses a smartphone-based data collection method. (Kabadiwalla)

Merah Putih Hijau: MPH started in the small village of Pererenan in 2016. MPH's goal is not only to reduce the amount of plastics in the environment, MPH offers a holistic approach to materials and waste management by ensuring the entire life cycle of all materials in each community. With it, it brings an understanding of the true value of what is waste. (MPH, 2016)

Jakarta Recycle Center: The JRC has several programs consisting of waste management transformation to improve waste management facilities, but also to raise public awareness of waste management to make actions more sustainable.

The company is located in South Jakarta. The programs focus on household waste sorting and waste transportation. Separate waste collection takes place according to the schedule. Assistance and socialization are carried out during transport so that residents can immediately try to sort the waste. Organic waste is processed into compost. The active

role of the community in waste sorting is important factors in the effort to reduce waste from sources. (JRC)

2.4.3 Financing waste sector

In Indonesia the waste management are financed in two main sources, capital investments and operational expenditures, i.e. state budget (APBN) and local government budget (Province and City/Regency APBD). APBN is used not only to finance the central government spending at the central level, but also to fund central government spending at the regional level through the ministries (Vertical Funds) as well as decentralized and co-managed funds.

In APBN, a part of the budget is allocated to transfer taxes to the local government (transfers from APBN to APBD). In the waste sector, financial transfer funds are typically mobilized to finance capital investments. Based on consultation with selected municipalities and information, there are four categories of taxes that are associated with the waste sector, namely.

1. Specific Allocation Fund (DAK),
2. Local Incentive Fund (DID),
3. Special Autonomy Fund (Dana Otsus) and
4. Village Fund (Dana Desa).

All of these fund transfers are then included in the local government revenue alongside the local own-source revenues of the local government budget (APBD).

The local government budget is mainly used to finance operational expenditures of the waste management sector. On the revenue side of the APBD, there are two financing sources associated:

1. the local own-source revenues (waste retribution fees);
2. the central government transfer (fiscal transfers from the APBN to the APBD).

It should be noted that tax transfers (transfers from the APBN to the APBD) are mainly used to finance the capital expenditures of waste management. Nevertheless, recently, one of the fund transfers from the central government has also been earmarked

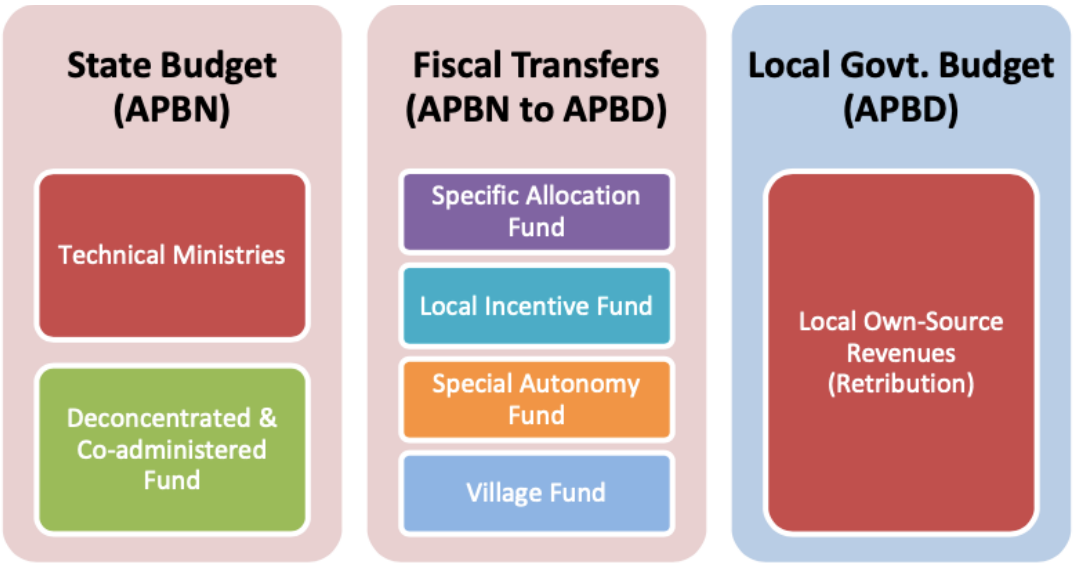
to provide incentives for 12 cities implementing the Waste-to-Energy facility, based on the Ministerial Regulation of the Ministry of Environment and Forestry 24/2019.

On the APBD spending side, waste management related spending consists of annual work planning and budget (RKA SKPD) or operating and capital spending related to the budget document of the municipality responsible for waste management. The operating costs of waste management are discussed in detail in the next section.

In addition to government support for funding the waste sector, development partners and the private sector also provide support to the sector, primarily in the form of fixed investment and technical assistance. Support for the private sector is provided primarily through the CSR program, but support from development partners to the waste sector is discussed in a separate subsection. (Vidyaningrum, 2020)

All public funding sources used to fund waste management and its policy implementation are identified as shown in Image 3 and Chart 1:

Image 3 Public Financing Sources



(Vidyaningrum, 2020)

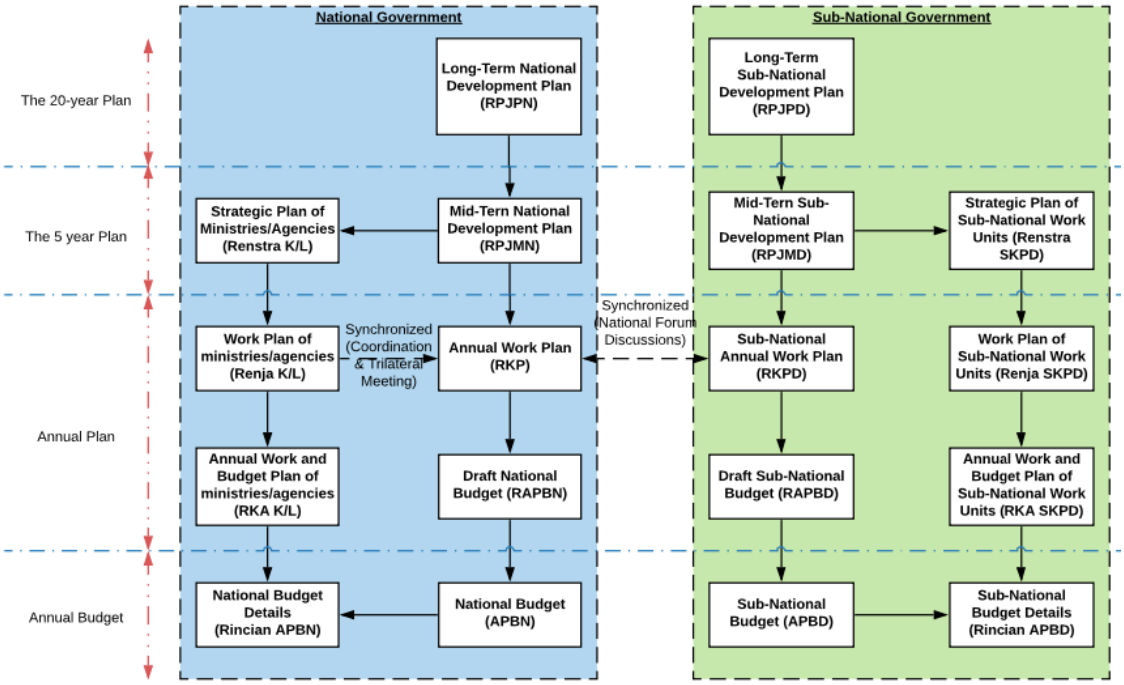
Chart 1: Public Financing Sources and Relevant Regulations

Financing Sources	**Relevant Law/Regulations**	**Concerning**
APBN:	Act 17/2003	State Finances
	Presidential Regulation 78/2019	Details of the National Budget FY 2020
	GR 45/2013 and 50/2018	The procedures for implementing the State Budget
Technical Ministries	PMK 173/PMK.05/2016 (Updated PMK 168/PMK/2015)	Budget Implementation Mechanism of Government Assistance in Ministries/Agencies
	PermenLHK P.12/MenLHK/Setjen/Kum.1/2/2017	General Guidelines for channelling other Government Assistance in the MoEF

	PermenPU 24/PRT/M/2016	Budget Implementation Mechanism of Government Assistance in MoPWH
Deconcentrated and Co-administered Fund	GR 07/2008	Deconcentrated and Co-administered Funds
	PMK 248/PMK.07/2010 (Updated PMK 156/PMK.07/2008)	Guideline in the management of Deconcentrated and Co-administered Funds
Fiscal Transfer (APBN to APBD):	Act No 33/2004	Fiscal Balance between Central & Regional Governments
	GR No 55/2005	Balancing Funds
	PMK 121/PMK.07/2018	Management of Transfer to Regions and Village Funds
Specific Allocation Fund	Presidential Regulation 5/2018 (Perpres 123/2016 updated)	Technical Guidelines of Specific Allocation Funds - Physical
	Perpres 88/2019	Technical Guidelines of Specific Allocation Funds (Physical) FY 2020
	PMK 130/PMK.07/2019	Management of Specific Allocation Funds (Physical)
	PMK 48/PMK.07/2019	Management of Specific Allocation Funds (Non-Physical)
	PermenLHK P104/MENLHK/SETJEN/KUM.1/12/2 018	Operational Guidelines of Specific Allocation Funds (Physical)
	PermenLHK P24/MENLHK/SETJEN/KUM.1/5/201 9	Incentive (waste tipping fee) for the 12 cities applying waste-to-energy facilities
	PermenPUPR 33/PRT/M/2016	Technical Guidelines of Specific Allocation Funds (Physical)
	PermenPUPR 21/PRT/M/2017	Operational Guidelines of Specific Allocation Funds (Physical)
Local Incentive Fund	PMK 141/PMK.07/2019	Management of Local Incentive Funds
Special Autonomy Fund	Qanun Aceh 1/2018	The utilization of the Special Autonomy Fund
	Governor Regulation 26/2019	Distribution and channelling of financial assistance of Special Autonomy Funds to the LGs in Aceh province
Village Fund	PMK 205/PMK.07/2019	Village Fund Management
	PermenDES 11/2019	Prioritization of Village Fund FY 2020
	PMK 49/PMK.07/2016	Procedures of the allocation, distribution, utilization, monitoring and evaluation of Village Fund
APBD:	GR 12/2019	Management of Regional Finances
	Permendagri 13/2006 & 21/2011	Guidelines of Regional Finances Management
Local own-source revenues (Waste Retribution)	Act 28/2009	Regional Government Taxes & Service Charges (Retributions)

The budgeting of the two main public financing sources for the waste sector principally mainly refers to development planning. Therefore, the budget was designed to achieve the goals set in the National Development Plan. The five-year development plan (RPJMN), which corresponds to the overall 20year development plan (RPJPN), is running in parallel with the five-year term of office of the President. In essence, the five-

Image 4 Relationship between the development plan and the budget



(The World Health Organization, 2021)

year plan sets out government priorities and political agenda for the next five years. RPJMN is a fixed, five-year comprehensive plan that is implemented annually through an annual work plan and linked to the budgeting process. In the 2020-2024 medium-term development plan, waste management is a national priority, especially in strengthening the infrastructure that supports economic development and basic services, by improving access to appropriate waste management systems. It also reduces the burden on the environment and improves resilience to disasters and climate change, by increasing waste disposal and reduction rates). Image 4 shows the relationship between the development plan and the budget. (The World Health Organization, 2021)

The Government Regulation (GR) 12/2019 on Regional Financial Management defines operational expenditure as the budget expenditure intended to finance the daily activities of local governments that provide short-term benefits. This reflects the main

purpose of protecting assets and ensuring that planned activities are carried out accordingly. GR 12/2019 lists several types of operating expenses in the municipal budget. Similar to the waste sector, operating expenses include consumables, cleaning equipment including safety clothing and cleaning supplies, vehicle maintenance, fuel, mobile equipment rental, (land) mobile equipment rental, collection and transportation services and goods. Only the direct cost of the service is covered. Labor costs, including salaries and incidental costs, on the other hand, are usually covered by financial transfers from the State Budget (DAU).

In waste management, the operating costs of local governments, especially environmental authorities, are drawn entirely from the local budget (APBD). The four cities (Maran Regency, Banda Aceh, Bukit Tinggi and Jambi) with estimated percentages of waste disposal, especially 60 % to 100 % service area, vary widely from city to city and range from 0.3 % to 2.18 % from the entire local government budget. This figure is below the World Bank's estimated 2.5 % average, especially in metropolitan areas. Of the four cities, the highest average budget allocated for waste management is 2.18 % of the APBD allocated by the Banda Aceh City Environment Agency. Nevertheless, based on the latest analysis by the World Bank, funding the proper operation of the current system usually requires a higher budget of 5 % or more. Also, according to recent historical data, budget trends in waste management in Maran Regency and Banda Aceh have increased slightly, but trends in Jambi and Bukit Tinggi are still fluctuating.

According to the Government Regulation 12/2019 on Regional Financial Management, capital expenditures represent budget expenditures for the acquisition of fixed assets and other assets that provide benefits for more than one accounting period. Especially in the waste sector, capital spending consists of three subcategories, including land costs, transportation equipment and waste treatment facilities.

As mentioned above, capital spending is funded primarily from the state budget through the transfer of taxes to the Ministry of Technology or local governments. A small portion of the local budget can be used to finance capital spending, but the only difference is in the type of infrastructure or facility funded. State budgets are typically mobilized to fund key infrastructure, especially landfills, and processing facilities such as i.e. TPS3R, Recycling Centres (PDU) and supporting equipment of such facilities. As for the infrastructure at the regional scale, the provincial government budget (APBD Province) is usually mobilized to finance this type of infrastructure. In the meantime, city

government budgets are typically mobilized to fund the collection, transfer, and transportation components of the waste management systems, including intermediate collection points, small-scale treatment plants, and so on. However, it is also common to use a public blending model to fund urban infrastructure. For example, when a landfill is built, the state budget is mobilized for planning and construction work, sewage treatment plants, and the provision of heavy equipment at the landfill. Meanwhile, the City Budget (APBD) is mobilized to install drainage systems, road access, fences, weighing bridges and more. The state budget (APBD), on the other hand, is used to support some of the heavy equipment, water quality monitoring equipment, workshops and other support facilities. Please note that there are no standard rules for this mixed system. Therefore, each city may apply different regulations by examining the type of public budget that is eligible to fund a particular type of infrastructure or facility. In addition to that, Chart 2 outlines the summary of the funding scheme and type of infrastructure/facility based on financing sources.

Chart 2: Scheme of various financing sources in the waste sector.

Financing Source	Definition and/or Scheme	Type of Support (Infrastructures and Facilites)	Remarks
Technical Ministries	->LG submits proposal to the ministries (readiness criteria should be fulfilled) -> verification by technical ministries -> disbursement (State Treasury Office/KPPN) and procurement (National Public Procurement Agency/LKPP) ->construction (ministries) ->asset transfer->Audit (Supreme Audit Institution of Indonesia/BPK)	->MoEF: Recycling Centre (PDU) of 5, 10 & 20 tons/day, Central Waste Bank, Composting House & Urban Farming, Biodigester, local treatment facility (TOS), Treatment facility for specific waste, other waste treatment facilities, crushing machines, pressing machines, siever, weighing scale, segregated bins, three-wheeler, waste transportation boat, other supporting equipment. ->MoPWH: TPST, TPS3R, Landfill and Heavy equipment, etc.	->Included in APBN (line ministry budget document/DIPA K/L) ->Technical guideline (MoEF): DG's regulation P.1/PSLB3/SET/KUM.1/5/2018 ->Proposal submitted as early as possible
Deconcentrated and Co- administered Funds	->Deconcentrated Funds: Fund originating from the state budget (APBN) mobilized by the Governor as a representative of the government to implement ceconcentration, excluding vertical funds allocated to the regions.	Contruction of landfills, TPS, TPS3R	->Included in APBN (line ministry budget document/DIPA K/L)

	->Co-Administration Funds: funds originating from the state budget (APBN) that is mobilized by regions and villages in implementing co-administration. ->Funds channeled as grants to the regions through the Directorate General of Human Settlements at MoPWH		
Specific Allocation Funds (DAK)	->Funds allocated in the national budget to the regions, aimed to fund specific local affairs activities and 48lign with national priorities, both physical and non-physical ->LGs submit on-line proposal (Krisna system) -> verification and assess feasibility (technical ministries, Bappenas, Ministry of Finance) -> Results will be synchronized with the resource envelope of DAK in RAPBN->included in APBD-> All public budget approved->contruction (LG) -> Audit (Supreme Audit Institution of Indonesia/BPK)	->MoEF: Waste Bank Unit, Composting House, collection and transport vehicles (Dump Truck, Arm-roll Truck) and Incentive Tipping Fee for waste-to-energy facilities in 12 cities (DAK Non- Physical) ->MoPWH: TPS3R (incl. collection to TPS 3R)	->Included in APBN under Trasfer to Regions & Village Funds ->Included in APBD under Annual Work & Budget Plan of local government working unit (RKA SKPD) ->Proposal submitted as early as possible (ca. 2 years in advance) ->Local governments must provide matching funds (min. 10% of the funds received) intended for physical construction ->MoEF: Ministerial Regulation No. PP.104/MENLHK/SETJEN/KUM.1/12/2018:Opera tional Guideline on DAK ->Ministerial Regulation 33/PRT/M/2016:Technical Guideline on DAK
Local Incentive Funds (DID)	->Part of Transfer to Regions & Village Funds (TKDD) funds sourced from the national budget to some LGs based on certain categories of criteria with the aim of providing incentives towards the improved performance (achievement) in the areas of local financial governance, public service, basic services, and public welfare. ->Ministry of Finance determines the cities' eligibility to receive the funds, based on main criteria (valuation of BPK, no delay in issuing the Local Regulation on Local Budget, implementation of e-government, one-stop	The funds should be prioritized to finance activities that support the improved performance (achievement). In case financing of these activities have been secured, the funds can be used to finance activities for sector outside DID group category	->Included in APBD and APBN under Transfer to Regions & Village Funds ->The channeling of funds distribute into 2 stages after the LGs submit some requirements (Local regulation on local budget of the current year, plans of the use of funds, realisation report of DID)

	integrated service) and performace category (incl. waste management performance)		
Special Autonomy Funds	->Funds allocated to finance the special autonomy of a region (The fund only applies to Aceh and Papua Province) ->The funds set to be equivalent to 2% (two percent) of the national General Transfers (DAU) resource envelope ->City/regency submits proposal to province	Collection/transport vehicle	->Included in APBN under Transfer to Regions & Village Funds ->Included in APBD Province ->The channeling of funds distributed into 3 stages. after the LGs submit some requirements
Village Funds	->Funds originating from state budget (APBN and intended for villages to finance the development, governance, community development and empowerment ->The funds are chanelled through the local budget (APBD), and are then further channelled by the LG to local villages based on specific formula by considering certain criteria, such as village population, poverty rate, level of geographical difficulty, and the like	Segregated bins, temporary collection points, waste cart, transport vehicle, treatment facility (composting, crushing machine), Waste Bank	->Ministerial Regulation: PermenDES 11/2019 on Prioritization of Village Funds FY 2020. ->Included in APBD and APBN under Transfer to Regions & Village Funds

Singapore's Circulate Capital funds small and medium-sized enterprises (SMEs) to combat marine pollution and climate change by supporting the circular economy, announcing that Circulate Capital Ocean Fund (CCOF) has invested in Reciki Solusi in Indonesia, which was founded in 2019 and currently operates waste management solutions in East Java and Bali, meeting the specific needs of cities in Indonesia. Reciki separates waste from households and commercial areas and recovers recyclable materials such as plastics to return to the recycling chain. With the CCOF investment, Reciki has the opportunity to expand its facilities throughout Indonesia. Capacity expansion has a strong impact on the environment by preventing the leakage of 400,000 tonnes of plastic pollution, preventing more than 700,000 tonnes of greenhouse gas (CO2) emissions and managing almost 3 million tonnes of waste in 10 years.

The Reciki model maximizes resources by working with local waste collection partners, which reduces costs and retains local players and jobs.

Some of the loans provided by Reciki were guaranteed by the United States International Development Finance Corporation (DFC) in cooperation with the United States Agency for International Development (USAID). Such a guarantee reduces the investment risk and shows the benefits of combined financing. (Detik Finance, 2022)

Waste4Change, an Indonesian waste management company, has received an investment from Agaeti Ventures. By 2024, the start-up wants to use new means to increase the capacity of the material recovery facility to approximately 2,000 tonnes per day and to develop waste management platforms in cities in Indonesia.

The Ministry of Environment and Forestry of the Republic of Indonesia stated that 69 % of Indonesia's waste ends up in landfills, 23.5 % is incinerated, buried and only 7.5 % is recycled or composted.

This reduces the capacity of the landfill. Waste4Change provides a solid waste management system that is responsible for processing recyclable materials. By integrating the system into information technology in the form of a smart city platform, waste management will be improved. (Waste4Change, 2022)

Jangjo is a waste management company. Its goal is to create sustainable solutions for waste management with the concept of circular economy. This startup was able to obtain initial financing from Darmawan Capital. Through this investment, Jangjo seeks to increase the recycling process 20fold and also create an ecosystem for the circular economy. (Kurniawan, 2022)

Rapel is a start-up company that collects waste through an application that helps residents sell sorted inorganic waste. The CCBO program is exploring innovative solutions to achieve its goals; Partnerships with groups such as Rapel can improve the reach of technology and community involvement. The CCBO program works to support and improve the lives of people working in waste and recycling sector. (USAID, 2021)

The startup, called Magalarva, which converts organic waste into protein powder, received initial funding of $ 500,000 from an unnamed multinational company based in Indonesia.

The intention was to help expand production facilities in Jakarta. The startup was founded in 2017 to investigate the use of black fly larvae to decompose organic waste. The main purpose is to reduce as much organic waste that goes to landfills as possible, while producing sustainable, high-quality protein. (JakartaGlobe, 2019)

2.4.4 Circular economy

We face many environmental challenges, such as soil degradation, deteriorating resource potential, and an increase in waste. These problems are current for the current and next generation. Waste must be part of the nature cycle, it should be disposed of and recovered. The goal of proper waste management is identified as one of the key goals in terms of maintaining the quality of the Earth's environment. Waste prevention, minimization, recycling and treatment must be a priority. To ensure sustainable development, waste should be prevented, minimized, recycled and treated. (Guman, 2020)

By introducing a circular economy, the country will produce less waste, be cleaner, people will be healthier and ecosystem degradation can be minimized. The circular economy is very important, because as the world's population grows and the demand for key raw materials and energy increases, our world is heading for scarcity. Implementing a circular economy would reduce environmental pressures and boost economic growth through job creation. There is a concept of linear economics, which is a one-way model of production and consumption in which goods are made from raw materials, sold, used and incinerated or disposed of as waste. The concept of circular economy is different, it is based on reuse. (Priskila, 2019)

The circular economy is a sustainable development initiative that aims to reduce the direct relationship between social production and consumption systems. The CE system is based on business models that replace the concept of "end of life" with the process of reducing, reusing, recycling materials in production processes or in their distribution and consumption. It operates at several levels (micro, meso and macro) to achieve sustainable development, which presupposes the development of a high quality environment, economic prosperity and social justice for the benefit of present and future generations. Basic principles of circular economy are"3R". Until recently, certain activities were viewed in terms of a linear system of resource consumption and included the following: collection and extraction of resources, product production, product transfer to the consumer, product disposal. Today, there is a need to combine economic development with environmental security and focus on non-linear development capacities, which means focusing on the circular economy. The circular economy should focus on waste management and refocus its efforts on reduction, recycling and treatment

techniques for the benefit of all stakeholders. The waste management process has changed from a simple collection and sorting process to the creation of sustainable systems in which waste is considered a potential resource. (Guman, 2020)

3 Research design

Research design is the organization of the collection and analysis of relevant data for research purposes. The practical part of this diploma thesis is based on qualitative research. It represents an evaluation of questionnaires filled out by waste management start-up companies in Indonesia. The research questionnaire is a fast and efficient method of obtaining information with mixture of both open and closed questions. I compiled a questionnaire, which consists of 19 questions. The first 4 questions are based on basic data, which are age, name, where they work, education and where they come from. The other 15 questions focused on the operation of the company in which they work, education in the field of ecology and waste issues in Indonesia. Once created, the questionnaire was sent to companies via social networks and email in English. The questionnaire was created in electronic form on the Google Forms page. I contacted 15 companies. The number of companies that completed the questionnaire is 8.

3.1 Research frame

The research framework is created through certain steps that are used to achieve the research objectives. These steps are as follows at the beginning of the research, I determined the goals of my work. The main goal of this thesis is to find out how waste managemet companies tackle problem with waste and whether the comunity is involved and how they are educated in this area, all from the perspective of companies that deal with this problem. I conducted research for this diploma thesis online using questionnaires that I created in google forms. The people involved in my research were people who work or own waste management startups. Each of these respondents has a different view of the waste problem in Indonesia and related issues.

3.2 Research questions

This diploma thesis aims to answer the following research questions;

Why, according to companies, waste is such a big problem in Indonesia and how do they tackle it?

How and if people are involved in waste management at all and who is more interested in the problem of household waste, women or men?

How companies solve the waste problem and whether they receive support from the government?

3.3 Key concept

There are many ways to define key concepts. For the purposes of this research, the following key terms have been defined:

Waste is a "by-product" of human society, which physically contains the same substance that is available in the product that is useful. (Ministry of the environment of the Czech rep.)

Waste management focuses on waste prevention, defines the waste management hierarchy and promotes the basic principles of environmental and health protection in waste management.

Participation is a process by which residents or any other managing authority organize and engage at the level of a residential area or neighborhood in order to improve the conditions of everyday life.

Start-ups are a high-growth business structure driven by disruptive innovation and were created to solve problems by offering new products under extreme uncertainty conditions.

Circular economy is a sustainable development initiative that aims to reduce the direct relationship between social production and consumption systems.

3.4 Types of data

Data for this diploma thesis were obtained from primary and secondary sources.

Primary data are first-hand data collected from respondents using questionnaires. In this case, this data was obtained from local waste management companies in Indonesia. Secondary data, on the other hand, includes data that has already been collected and compiled by someone else. This data may not be original in nature, but has been used to supplement and verify the primary data. Secondary data is drawn from books, magazines and the internet.

3.5 Research strategy

My research was conducted online with the help of secondary sources, which I carefully studied and used in the theoretical part of the thesis. The practical part was based on the created questionnaires, which were sent to companies that manage waste throughout Indonesia. The questionnaire was sent via email and social networks such as Instagram and WhatsApp. The questionnaire was received by 15 companies and 8 responses were returned from Jangjo, Kertabumi Recycling Center, KLIN, Ecofren, Octopus, Rekosistem, MPH and Eco-Bali. The received answers were processed into a given form of research.

3.6 Materials and methods

The sources of data in this research were people, documents, media. In a way that was strategically chosen for the use of these resources, questionnaires were created specifically for waste management start-ups, as well as a thorough analysis of documents. This analysis of the document included information on waste management in Indonesia, the startups that are dealing with the problem, the participation of the population and how the concept of a circular economy works. The people in the questionnaire answer the questions, which were arranged in such a way that the answer is formulated in a whole sentence, so that people would write down about the problem.

3.7 Limitations

This thesis had several limitations, such as the small sample size, which limited the generalization of the findings. Distance and communication only in online mode, where the information was not transmitted immediately, but over a long period of time. The difficulty was getting information from specific organizations that often did not communicate. Some of them had to be addressed more than once. The companies that were approached through the research in this thesis often responded but did not want to provide information about their business. Despite all these suffering, I managed to do research that included companies that were willing to fill out a questionnaire.

Questionnaire:

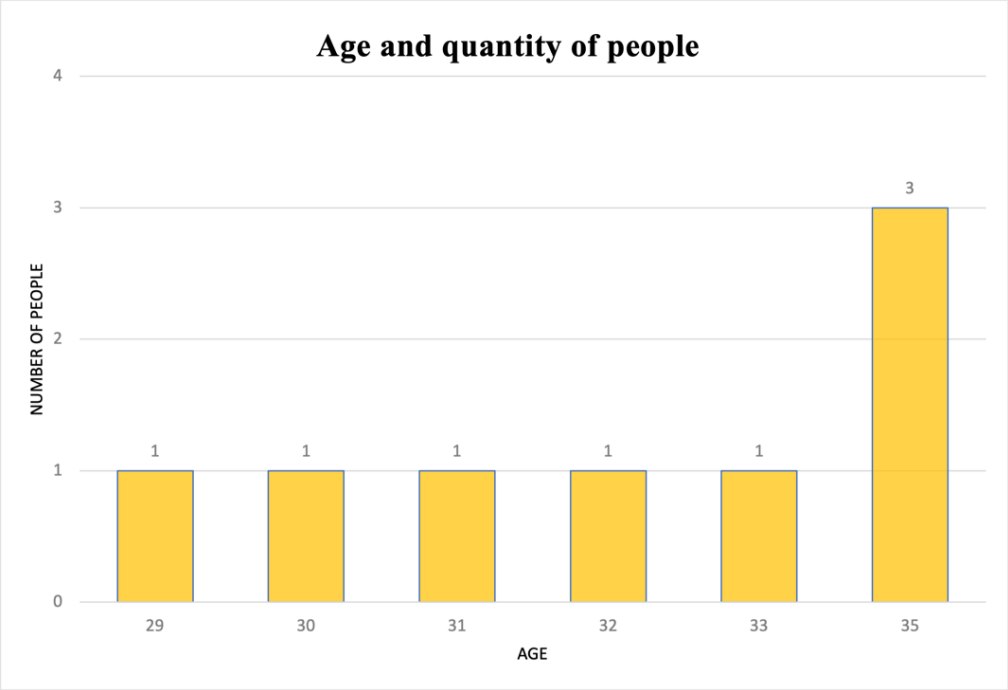
What is your name and where do you work? (company name)
How old are you?
Where do you live?
What is your highest education? If university, which field did you study?

1. Why did you start this company? What was your motivation to found your own business?
2. What kind of contact did you have with the waste sector in Indonesia before starting the company?
3. According to the World Bank, 7.8 million tons of plastic waste are generated in Indonesia, why do you think the waste is such a big problem in Asia/Indonesia?
4. How, do you think, has Indonesia been tackling this issue so far?
5. Which of the three Rs (reduce, reuse, recycle) do you think is most important to tackle the waste problem in Indonesia and why?
6. In your opinion, what role do the packaging industry, politicians and citizens play in waste management in Indonesia?
7. Which role, in your opinion, do women and men have in waste management in Indonesia?
8. Do you have any program for people to become aware of this topic and how they can help?
9. What was the motivation to found your company?
10. Did you study at the university a program which is focused on ecology or waste management or any other related studies?
11. What the contribution of the company is to tackle particular waste management problems in Indonesia?
12. How this company helps solve the problem? Is it possible?
13. Do you have any issue in your business that is hard to solve?
14. Do you get funding from the local community or govenment?
15. Are citizens involved in matters related to your company? if yes, in what kind of matters are they involved?

4 Findings

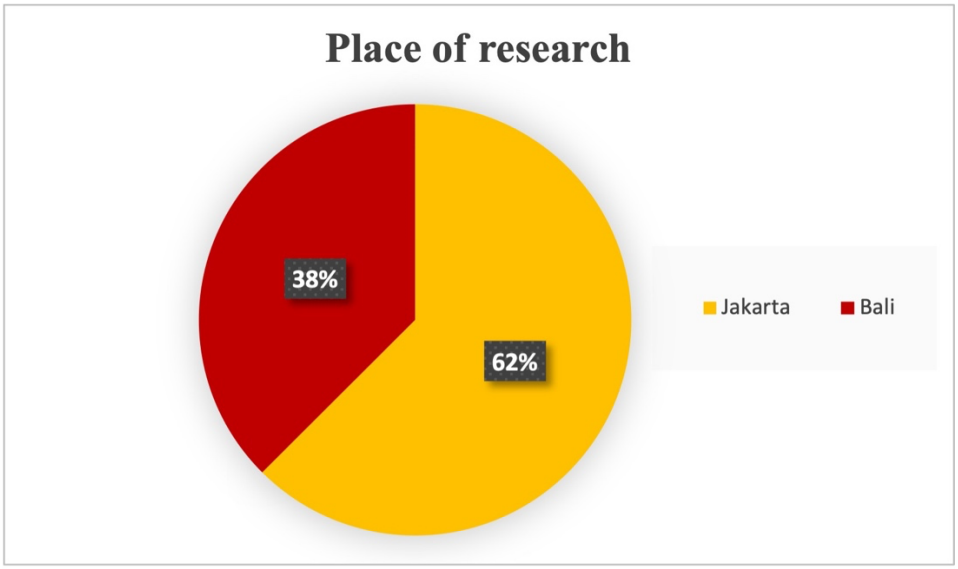
The research involved 8 people from eight different companies, aged 29 to 35 years. Column bar graph number 1 shows the quantity of people involved in research, most people were aged 35. The other age groups had one person each.

Graph 1: Age and quantity of people



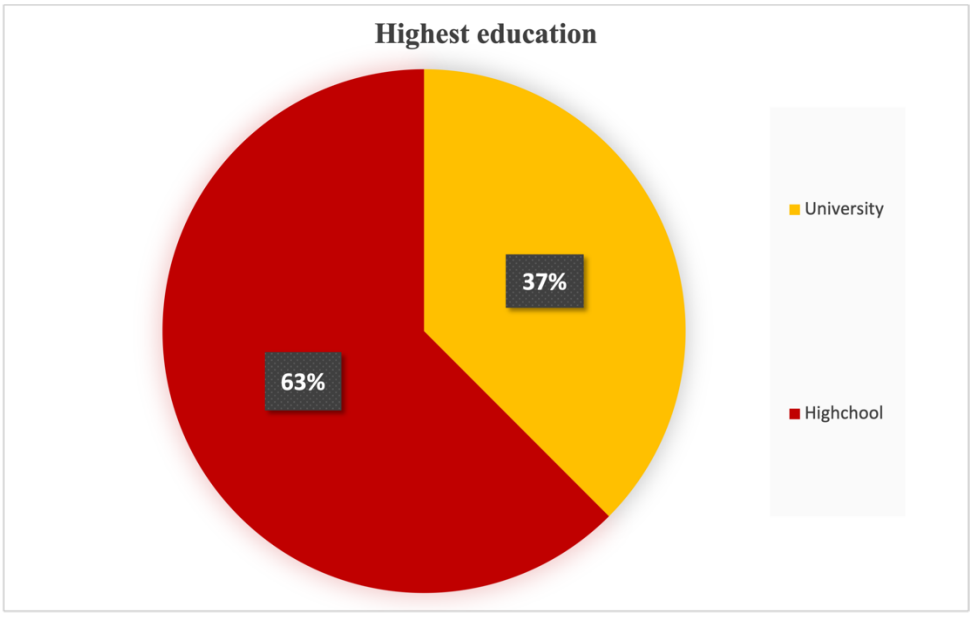
The people who participated in the research are from the area of Jakarta, the capital of Indonesia, located on the island of Java and another place is Bali, which is a small island between Java and Lombok. As can be seen from the pie chart, 62 % of people said they were from Jakarta and 38 % from Bali.

Graph 2: Place of research



One of the questions focuses on education, people answered what is their highest level of education. The pie chart shows that 63 % of people in this survey state high school as their highest level of education, only 37 % of respondents mentioned university.

Graph 3: Highest education



Start-up Jangjo

The biggest motivation for founding Jangjo was the fact that Indonesians became more aware of what was happening in Indonesia, began to grow economically, and this forced them to think about the environmental consequences of economic growth. The company states that previously the waste management industry was generally often overlooked and undermined by humans. There is an urgent need in Jakarta to reduce the amount of waste going to landfill. The landfill near the city has almost full capacity. Starting a business was an opportunity and a solution that would affect the lives of many people.

The company's founder had no previous experience with the waste sector in Indonesia before starting the company. The only contact that took place before founding the company was with the local government, the waste department, the recycling industry and the local leader to get the owner support for the business.

According to a Jangjo employee, the waste problem in Indonesia is associated with sufficient education of the population about these problems. Plastic waste (waste in general) is irresponsibly disposed of everywhere and contaminates the environment. Regulations also lack enforcement and penalties, which often results in laws being overlooked. Jangjo said the central government has tried to put in place strict measures to address the problem, but the most important role is actually played by the local government, which is responsible for enforcing the regulations. Above all, it depends only on the acts of local government, while there are some private companies such as Jangjo that exist to make changes. The 3R system is important for solving the waste problem in Indonesia. In principle, the waste should be really well separated and should be able to find its place back. The supply chain must be robust enough to cover all supply and demand, which is the company's top priority.

The company states that everyone involved should think about where the waste will end up and the government should enforce its regulations more.

The company's customers are mainly women, because it is they who are in charge of caring for household waste. Of course, every citizen, regardless of gender, should participate in the waste sorting movement, because each of them is responsible for their own waste. The company said it was important for the older generation to set a good example for their children and pass the baton on to the next generation. Jangjo provides scheduled pick-up services throughout the city at a cheap and affordable price (IDR

25,000 per month, 4 pick-ups). They provide citizens with sorting bags, a poster with a sorting guide and incentives or rewards for the amount of sorted waste that the company receives. The company hopes to be able to stimulate change in how people see waste management services, and should be treated as a professional and well-respected industry and occupation. Jangjo maintains its integrity and professionalism, one of the main goals of which is to help many existing waste workers to a better income and livelihood by providing for company work.

One of the problems with this business is changing people's behavior and operating costs in general. People in Indonesia are still used to paying little money for a waste collection service, they do not want to pay extra for this service.

The company does not receive any funding from the local community or from the government. The local community is only involved in projects that the company creates, for the purpose of garbage collection or education.

Start-up Kertabumi Recycling Center

Kertabumi Recycling Center was founded in 2017 due to the fact that there were only a few start-ups in the field of waste management, so there was room for another company to get involved. The business owner had no contact with the waste sector in Indonesia before the company was founded.

According to Kertabumi, the biggest waste problem in Indonesia is because the country has a bad government and its position on this problem is ignorant. There is progress in the waste problem, but it is not being addressed enough. The company considers recycling to be one of the most important steps in solving the problem in Indonesia. According to the company, every member of the community plays a crucial role, if people want to change something, they must get involved. Women, who play a more important role as they decide what products to buy and how to sort them, are most involved in household waste management. Kertabumi has a program for locals who get involved by sending or delivering their household waste. The owner of the company, wanted to make the world a better place, so he founded this company and created 105 waste banks, which are visited by more than 20,000 people. They solve the waste problem with the help of recycling and waste banks. The problems that a company experiences in business are of a geographical nature and also expensive transport affects the company. The company does not receive any funding from the government.

Start-up KLIN

KLIN is an Indonesian company, the establishment of which was based on the owner's previous experience in the field of waste management. He used the acquired knowledge and experience to realize his ideology. He was not in the views of the company he worked for, so he decided to start his own business. He was not satisfied with the waste management in the company where he worked. Pollution is perceived by employees as a big problem and the desire to see children grow up in a beautiful world, one of the biggest motivations for starting a business.

Waste in Indonesia and Asia in general is a problem because the government does not set a good infrastructure in this sector. In addition, the behavior and understanding of the citizens is not good, we can talk about ignorance. However, the government alone is not to blame, citizens are also a big problem. Indonesia is tackling the problem as the government takes the first steps towards progress. However, the process of transition from government to local cities and communities is very difficult, said a KLIN employee. According to him, private companies should receive more support.

The most important thing for solving the waste problem in Indonesia is the responsibility of different people. The reduction may be determined by the government through legal provisions. Reuse and recycling are the responsibility of citizens. However, this responsibility can also be promoted through an "incentive system". In general, KLIN considers recycling to be the most important factor of all 3 years.

The packaging industry can make a significant contribution to significantly reducing plastics production through innovation. Here, too, it is partly up to the government to create a legal framework.

The company said that men and women pay the same allowance. However, due to the more traditional distribution of roles, women have a larger component. The company is trying to get support from citizens.

The owner of KLIN had no previous education in the field of waste management

The company wants to participate in the management of waste that the government does not currently do and, on the contrary, they want people to recognize and support this contribution. The waste management process is demanding, the company believes that it is possible to solve the waste problem. Their goal is to create a foundation for other people and set a good example. The only problem in business is the behavior of citizens and the bureaucracy that prevails in the country.

They do not receive funding from either local communities or the government.

Citizens are not directly involved in the running of this company. The company tries to draw attention to itself by sponsoring and to point out the issue of waste in their country.

Ecofren

The establishment of the company was stimulated by the rapid growth of the population in Jakarta, which poses serious problems. The urban population is expected to grow with serious challenges for waste management in urban areas. Large urban centers in Indonesia produce almost 10 million tons of waste per year, and this amount increases by up to 4 % per year. However, proper waste management is not just a government task, but a shared responsibility that involves Jakarta's citizens and households, who are the main end-users of waste management facilities and services. Prior to founding the company, the employee had no contact with the waste sector in Indonesia.

Waste in Indonesia is such a big problem because the main politicians have poor governance and ignorant behavior. The government does not set a good infrastructure course in this sector. Behavior and misunderstanding of citizens and lack of education in this sector is also a big problem.

This problem is being addressed in Indonesia as follows: the government has invested in circular waste management. Customers have begun reusing plastic waste by transforming it into new products, such as plastic tar, which processes plastics into mixed asphalt.

According to Ecofren, recycling is the most important thing for solving the waste problem in Indonesia. Reuse and recycling are the responsibility of citizens. However, this responsibility can also be supported by a system of incentives.

The food and packaging industry plays a major role in controlling the production of plastics. Waste production is higher, especially in the food, paper and painting industries. Everyone involved in the process should have a focused mind on where the waste ends.

When it comes to waste management in Indonesia, women play the most important role because they take care of household waste. In principle, men also contribute almost equally to household waste management. The company seeks to reach out to citizens through sponsorship donations. There are a lot of advertising contributions to our

cooperation with other multinational companies. They are currently helping a community of people collect waste throughout the city at affordable prices.

The motivation for starting a company was the urgency of solving the problem, ie reducing the amount of waste and proper preservation of the environment. The company's task is to make the city clean and green.

Ecofren contributes to solving waste management problems in Indonesia by creating a huge number of waste banks where people deliver waste. They help maintain waste banks and recycle waste. They give work to many people in this field to have a better life.

One of the main problems with this business is that recyclable quality depends to a large extent on the geographical location. Waste collection from various places and transportation have become more expensive. Another problem is the inappropriate behavior of citizens on this issue and the government of the authorities.

The company does not receive any funding from the local community or government.

Citizens are partially involved in the collection of waste that is suitable for recycling. Another fact is that local people are trying to work more closely together to keep the area in which they live clean and recycled.

Octopus.id

The motivation for the establishment came from the fact that the owner was a waste collector, saw a lot of waste every day and wanted to build a company that would take care of all this and help people build a better future for Indonesia. Thanks to his work in the waste management sector, the owner was in contact with this sector and had the basis for founding a company.

The waste problem in Indonesia is huge, and it is because the government is not doing much for waste management and it is also to blame for poor education on issues such as ecology / waste / environment. Indonesia has so far addressed this issue by imposing a ban on plastic bags in Jakarta, but the problem is also that these bans are not everywhere, only in big cities like Jakarta are trying to improve the waste problem.

According to the company, all 3Rs are very important. Because they complement each other, the government should help reduce waste ... and people should focus on recycling and reusing waste. All people play a huge role in the waste management

process. Everyone can help improve the situation. Politicians can create waste laws that will serve as a guide for citizens. The packaging industry can reduce the number of plastic bags and paper packaging. According to Octopus, a woman usually has the task of taking care of household waste. However, men also contribute with the collection. Waste management training programs are being prepared for local communities, and the company is organizing WM-themed activities. Citizens are involved in waste collection programs.

Octopus is involved in waste collection and monitoring. They are a platform that helps manufacturers track and collect their consumer product for both recyclable and non-recyclable, this platform also allows manufacturers to provide incentives directly to verified stakeholders.

The biggest problem this type of business faces is people's thinking about the future of waste. However, it is part of this work. Not everyone is associated with waste problems.

The funds are provided to the company only by a private entity, there are no funds from the government.

Rekosistem

The establishment of this company was based on an analysis of the role of the motivating factor of employees and the factor of political support for waste management performance in Indonesia. The main goal is to reduce the amount of waste in the capital and preserve clean nature.

The company's employee had no previous experience in waste management.

According to the company, producing less waste is more important than reusing and recycling. They do not support the concept of converting plastic into fuel or plastic into energy, because that does not solve the root of the problem. People would think that it is okay to use plastics if they can be converted into energy. Unnecessarily people use a lot of plastic, they have to start changing their behavior and use less plastic.

The Indonesian government is tackling the waste problem by investing in circular waste management. Over the past few years, local, political and trade events have exploded to address the problem of Indonesia's plastic waste.

The most important point for solving the waste problem is recycling. Reuse and recycling are the responsibility of citizens.

According to Rekosistem, the packaging industry plays an important strategic role in waste management as a tool for business development and improving company performance. The packaging is always assessed as needed. First, all packaging should be designed to consume a minimum amount of material while fulfilling its essential function. This reduction in material consumption eliminates any further consideration of reuse, recycling or recovery. Second, wherever practical, containers or packaging components should be reused. Third, wherever possible, packaging should be collected and materials recycled for further use. Finally, the possible use of a different value from the waste should be considered before sending the packaging to the landfill. With this principle in mind, packaging materials should be chosen to convert packaging into consumer goods that will produce less municipal solid waste.

The company states that in Indonesia, women are in charge of household management. They are responsible for the care of food-related activities, such as food purchasing, storage, cooking and, where appropriate, waste management. In addition, Indonesia has an active women's organization, supported by the government. It could be argued that in Indonesia, food waste management will improve if women are strengthened. The activities of women in the neighborhood affect the management of food waste in the home and community. The analysis shows that women who are heavily involved in the activities of women's community organizations can reduce the amount of food waste produced from home. They also manage food and waste adequately. Overall, the involvement of women and community women's organizations in food waste improves food waste reduction and home and community management.

There are programs in this start-up that try to reach citizens through sponsorships. Cooperation with other multinational companies is ensured by advertising contributions. We currently serve a short community of people in waste collection across the city at affordable prices.

The company has created a huge number of recycling banks that keep and reuse materials that people recycle.

One of the biggest problems in the waste management business is that the waste / recycling industry faces significant safety challenges. These include exposure to chemicals, explosions of combustible dust, dangers to protect machinery and exposure to strong equipment with moving parts.

The company does not receive any funding from the local community or the government. The local community is not involved in matters related to the company. Everything is done by the company's employees.

Merah Putih Hijau (MPH)

Bali is an island that is Indonesia's main tourist destination, with a significant increase in tourism since the 1980 s. Tourism-related businesses make up 80 % of its economy. Similarly, the growing problem of plastics and waste is growing. The purpose of starting this business was recycling and composting facilities in Bali. The owner had no previous experience with the waste sector in Indonesia before the company was established.

The waste problem is probably due to the fact that plastic products are cheap to produce in the country. The ubiquity of plastic bags, combined with a lack of awareness of how plastic waste can harm the environment, is probably one of the reasons why Indonesia is facing this difficult situation.

This problem is being solved; last year the government set a goal to reduce plastic waste by up to 70 % by 2025. To achieve this goal, the government said it would contribute $ 1 billion a year to the effort. The government has said it plans to introduce an excise tax on plastics manufacturers.

MPH says recycling is one of the most important ways of dealing with waste. Citizens should be responsible for re-use. They should reduce or replace the use of plastics by avoiding disposable plastic packaging.

Regarding the role of gender in the waste management sector, women are most represented at the base of the recycling chain, most often as informal waste collectors and as sorters of recyclable material.

The company serves locals in the area of waste collection across places. MPH not only seeks to reduce the amount of plastics in the island environment, MPH offers a holistic approach to materials and waste management by looking at the entire life cycle of all materials in each community and bringing back an understanding of the true value of what is called waste.

The company has created a number of waste banks that will reduce waste on the streets. MPH allows villages to promote and offer incentives to separate materials at

source. The biggest problem is the mixing of materials in local households and businesses, which makes waste management impossible.

The start-up raise funds through a fundraising campaigns.

Citizens are partially involved in waste management issues, such as the collection of waste that is suitable for recycling.

Eco Bali

The island of Bali is a popular destination for many tourists, thanks to tourism on the island, waste is increasing and accumulating. Because of this, a start-up for waste management was established. The biggest motivation is to help the island to be cleaner.

Prior to founding the company, employees had no contact with the waste management sector.

The waste problem in Indonesia is based on poor governance. The government is not approaching the problem in the right direction. There is also a big problem in educating the population, especially young people in this sector, because one day it will be up to future generations to keep the country going.

The government is trying to put in place measures to address the waste problem. However, municipal councils have a more important role to play, which can do more with waste in certain areas.

According to Eco-Bali, 3Rs are just as important. use less potential waste and then recycle it and, of course, reuse the product at best. it's best for waste management. Industry, politicians and citizens, each of these people, play a big role in this sector. Everyone needs to do something to improve this waste problem.

Eco-Bali said that more women are the ones who take care of the household, so they have a better idea of what is going on, how to dispose of waste. but I can also contribute to waste sorting.

The company offers an educational program such as eco training, staff training of various facilities.

Eco-Bali start-up is involved in sorting and recovering materials, waste management and disposal at a specific facility. It operates its own sorting and material facilities, waste is properly disposed of. The main focus is on maximizing recycling and reducing waste. Waste disposal is carried out only in a legal facility. The big problem in this business is the ever-increasing amount of waste and more and more people.

The firm does not obtain finance from the government and from the local community. Local communities are only involved in educational programs and attend garbage banks, as well as garbage collection on the beach.

5 Conclusion

This diploma thesis is divided into two parts, a theoretical part and a practical part. In the theoretical part, the first chapter explained the concept of waste and all its forms. The next chapter focuses on waste management, which has several areas of operation, such as landfills, composting and more. Describes the possibilities of disposing of a certain type of waste.

The next chapter discusses in detail the waste management in Indonesia, what kind of waste they deal with and how they are treated.

The last part in the theoretical part is devoted to the start-ups that operate in Indonesia and how their strategies regarding the waste problem work.

The practical part of the work describes the course of research and answers research questions. Participants in the questionnaire survey are people working in waste management start-ups aged 29 to 35 years.

This diploma thesis can be included in the field of start-ups in waste management in Indonesia in two areas which are the island Bali and the capital city Jakarta. Specifically, this work attempts to elaborate on how local start-ups work in the field of waste management and to what extent the local community is involved in the projects. The main research question was to explain why, according to companies, waste is such a big problem in Indonesia and how they manage it. The main reason is that the government does not take waste as a priority, it does not issue a large number of laws that would affect the operation of waste management. The problem is also in the approach of various authorities and especially local people who do not approach the topic of waste responsibly. There is a lack of initiative on the part of the government and other authorities regarding education in the waste sector and its management. People in Indonesia throw away plastic products that are cheap in the country and thus contaminate the environment, they do not need to change anything, the government should focus on the young generation, which can change the country's waste management results for the better.

Another partial question that was answered in the research was a question focused on the involvement of residents in the operation of companies with waste management and who is more interested in this issue of household waste, women or men. Research shows that most companies involve local people in programs and activities to gain

awareness of the field and how they can get involved in these matters. Only two companies, namely Rekosistem and KLIN, do not involve local people in waste management and do not educate them in these areas of their focus.

The gender focus of this sector is in the vast majority that women play a major role in sorting household waste, because the woman is the one in charge of the household and the man usually goes to work and takes care of the family financially. This pattern of behavior is traditional for the elderly in Indonesia, today is more modern and gender is more equal, according to companies, men are also involved today in sorting household waste and also in waste collection.

The third sub-question was about financial support from both the government and the local population. All companies replied that they did not receive any financial support from the government or local authorities. All funds flow from private sources or from advertising campaigns, as well as from activities and programs to which the local community contributes in small amounts.

The vast majority of company founders and employees had no experience with waste management before founding the company, only KLIN and Octopus.id employees used to work for other companies or collect waste in cities and then sell it to companies, who bought the waste. This experience has led them to set up their own businesses and raise awareness of the waste problem in Indonesia. One of the biggest motivations for starting a business was clearly the fact that there is a huge amount of waste in Indonesia and only a small percentage of people do anything about it. The people of these companies want a better future without waste for their country.

In the field of waste management, companies have come up with waste banks, where people bring waste and get money for it. Specifically, the companies Kertabumi Recycling Center, Ecofren and Rekosistem have many waste banks in the area where the locals deliver waste and these companies then process it.

One of the questions that focused on the 3R concept was the most important of these terms reduce, reuse and recycle. Octopus.id, Jangjo and Eco-bali believe that importance is in all these steps. One follows on from the other, and people cannot do without these steps if they want to dispose of waste in an efficient way. Other companies such as Ecofren, Rekosistem, MPH and Kertabumi Recycling Center share one view and that is the most important of all these 3Rs is recycling, which depends on the local community how efficiently it will be fulfilled.

The research that was conducted presents a view of companies in the field of waste management in Indonesia.

Resumé

This diploma thesis deals with the problem of waste sorting and focuses on start-up companies that deal with waste sorting and spread awareness of the problem of waste in Indonesia. The theoretical part is devoted to waste and waste management and how startups are involved, in this area, which operate in Indonesia. The practical part of the thesis includes the course of research and the conclusion of the evaluation of questionnaires. This thesis explains how local start-ups in the field of waste management work and how much the local community is involved in the projects. The main reason for the large amount of waste is that one of the main priorities for the government is not waste. They do not issue laws that would affect the operation of waste management. Another point of research was waste education, people in Indonesia are not educated in waste management, so most companies involve local people in programs and activities to raise awareness about waste management. Research has shown that women play a major role in sorting household waste because the woman is the one who takes care of the household. No financial support from the government was provided to the companies. Most companies had no experience with waste management before the establishment, only KLIN and Octopus.id employees worked for other companies before the establishment of these companies. The companies have put waste banks on the market, where the waste is transported and rewarded for it. Namely, Kertabumi Recycling Center, Ecofren and Rekosistem have many waste banks where the waste is subsequently processed.

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