

GREENPRENEUR: INNOVATIVE INTERACTIVE MEDIA IN MANAGING ORGANIC WASTE EXCHANGE FOR A BETTER CLIMATE

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ABSTRACT

Climate change is a long-term change in the distribution of weather patterns on the earth's temperature with a large and lasting impact that is caused not only by natural activities but also by human activities. One of the causes of rapid climate change is global warming due to the effects of greenhouse gases. Greenhouse gases can be produced from everyday life such as landfilling organic waste and burning waste. The solution to this problem is to convert organic waste into compost and cultivate it into maggot which has economic values. The solution to the previous problem to reduce the problem of landfilling and burning waste is to create an application that can make it easier for people to manage waste such as Trash Stop.

Keywords: *Digital Economy, Climate, Compost, Maggot, Greenpreneur*

INTRODUCTION

Since 2015, Indonesia and other countries have agreed on the *Sustainable Development Goals (SDGs)*. *Sustainable Development Goals (SDGs)* are global action plans agreed upon by world leaders including Indonesia to end poverty, reduce inequality, and protect the environment.⁶The agenda, which was approved by the United Nations (UN) in New York, has 17 goals divided into 169 targets to make people's lives better. One of the goals is to tackle climate change.⁷

The United Nations (UN) the framework for Climate Change (*United Nations Framework Convention on Climate Change (UNFCCC)*) defines climate change as a change caused directly or indirectly by human activities that alter the composition of the global atmosphere and natural climate variability over comparable periods. This climate change has a broad impact on people's lives. The Minister of National Development Planning, Suharto Monoarfa, said that climate change does not only affect the damage to the environment and ecosystems. Climate change also affects economic conditions and people's lives in several sectors. Sectors that will be affected are water, agriculture, forestry, health, marine and coastal areas, and habitats.⁸The following are the impacts and phenomena that occur due to climate change in some of these sectors.

1.1.1 Climate Change in Water Sector

No.	Impact	Phenomenon
1.	Declining water quality	The increase in temperature results in the presence of chlorine levels in clean water.
2.	Reduced water quantity	Global warming does increase the amount of water in the atmosphere which will increase rainfall. Rainfall that is too high will result in a high possibility of water returning directly to the sea without being stored in clean water sources for human use.

Table 1. 1 Impact and Phenomenon of Climate Change on the Water Sector

(Source: Climate Change *Knowledge Center*)

⁶Sustainable Development Goals . In the *Sustainable Development Goals* . Accessed on March 30, 2022, from [https://www.sdg2030indonesia.org/#:~:text=Sustainable Development Goals \(SDGs\) are,can be achieved by 2030.](https://www.sdg2030indonesia.org/#:~:text=Sustainable Development Goals (SDGs) are,can be achieved by 2030.)

⁷What are SDGs ? (2017). In the *Sustainable Development Goals* . Accessed on March 30, 2022, from What are the SDGs (sdg2030indonesia.org).

⁸Impact & Phenomenon of Climate Change. In *the Climate Change Knowledge Center* . Accessed on March 31, 2022, from Knowledge Center Climate Change - Impacts & Phenomena (menlhk.go.id)

1.1.2 Climate Change in Agriculture Sector

No.	Impact	Phenomenon
	Reduced agricultural area	Temperatures that are too hot and reduced availability of water will cause damage to agricultural land.
	Decreased agricultural productivity	Climate change will cause changes in planting and harvesting times as well as produce plant pests that did not exist before.

Table 1. 2 Impact and Phenomenon of Climate Change on the Agricultural Sector

(Source: Climate Change *Knowledge Center*)

1.1.3 Climate Change in the Forestry Sector

No.	Impact	Phenomenon
1.	Declining forest quality and quantity	Climate change has an impact that can cause forest fires. In fact, forests are producers of oxygen that can help absorb greenhouse gases that cause global warming.
2.	Increased greenhouse gases due to deforestation	Trees that die as a result of drying up on their own due to climate change will release carbon dioxide. The death of trees will cause a reduction in carbon dioxide absorbers so that carbon dioxide and other greenhouse gases will increase dramatically.

Table 1. 3 Impact and Phenomenon of Climate Change on the Forestry Sector

(Source: Climate Change *Knowledge Center*)

1.1.4 Climate Change in Health Sector

No.	Impact	Phenomenon
1.	Increasing disease outbreaks	Rising rainfall temperatures can increase outbreaks of diseases such as malaria, cholera, and dengue fever. This is because the virus-carrying mosquitoes breed in hot and humid weather .
2.	Cases of skin cancer, cataracts, and decreased immunity	depletion causes an increase in the intensity of ultra violet rays that reach the earth's surface and can cause skin cancer, cataracts, and decreased immunity. Thus, humans become more susceptible to disease.

Table 1. 4 Impact and Phenomenon of Climate Change on the Health Sector

(Source: Climate Change *Knowledge Center*)

1.1.5 Climate Change in Marine and Coastal Sector

No	Impact	Phenomenon
1.	The sinking of some coastal areas	Rising sea levels cause the shift of land boundaries in coastal areas which then drowns other coastal areas.
2.	The sinking of small islands	Rising earth's temperature causes the melting of ice on the earth's polar plains which causes an increase in sea water which causes the sinking of small islands.

Table 1. 5 Impacts and Phenomena of Climate Change on the Marine and Coastal Sector

(Source: Climate Change *Knowledge Center*)

1.1.6 Climate Change to Habitat Sector

No	Impact	Phenomenon
1.	Habitat change	The phenomenon of warming the earth's temperature, rising sea levels, flooding, and storms due to climate change will bring major changes to the habitat as a natural home for various species of animals, plants, and other organisms.
2.	Extinction of species	Changes in habitat will cause the extinction of various species of both animals and plants such as large trees which are the main absorbers of carbon dioxide.

Table 1. 6 Impact and Phenomenon of Climate Change on Habitat Sector

(Source: Climate Change *Knowledge Center*)

From some of the effects of climate change on these sectors, there is not a single country in the world that will not be affected by climate change, including Indonesia. The Minister of Finance of the Republic of Indonesia, Sri Mulyani, stated that climate change is a *global disaster* whose magnitude is expected to be the same as that of the Covid-19 pandemic.

⁹In Indonesia itself, the high level of vulnerability from the impacts of climate change is the estimated economic loss that reaches Rp132 trillion by 2050. ¹⁰Therefore, the issue of climate change is one of the biggest challenges facing humanity today and also in the future. So, the handling was not only done by the government alone. It takes a concerted effort, including the younger generation, to take part in controlling climate change like Generation Z.¹¹

PROBLEM STATEMENT

The two main causes of climate change are global warming and the effect of greenhouse gases. ¹²Global warming is an event that increases the temperature of the earth's surface globally. The increase in the earth's surface temperature is caused by the presence of solar radiation in the earth's atmosphere which is then converted into heat energy in the form of infrared rays by the atmosphere and absorbed by the earth's surface. Some of the infrared rays are reflected in the atmosphere and captured by greenhouse gases which then cause an increase in the earth's temperature. ¹³Greenhouse gases include water vapor (H₂O), carbon dioxide (CO₂), methane (CH₄), ozone (O₃), nitrogen oxides (N₂O), and chlorofluorocarbons (CFCs).¹⁴

The greenhouse effect is needed to maintain the earth's temperature and prevent the temperature difference between day and night from being too large. However, excessive greenhouse effect can increase global temperatures, melt polar ice caps, destroy ecosystems, raise sea levels, and extreme climate change. ¹⁵The problem of excessive greenhouse effect is the result of activities that are often encountered in daily life, such as the following:

⁹Yusuf Imam Santoso, *Sri Mulyani Says No Country Can Be Free from the Threat of Climate Change*, accessed from <https://newssetup.kontan.co.id/news/sri-mulyani-sebut-tak-ada-negara-yang-bisa-terbebas-dari-threat-climate-change>, on April 12, 2022, at 03.05 WIB.

¹⁰Eusebio Chrysnamurti, *Potential Losses Due to Climate Change Reach Rp132 Trillion in 2050*, accessed from <https://ekonomi.bisnis.com/read/20200415/9/1227201/potensi-kerugian-hasil-change-iklim-reach-rp132-trilin-pada-2050>, on April 1, 2022, at 20.30 WIB.

¹¹Atalya Puspa, *Needs the Role of the Young Generation to Overcome the Challenges of Climate Change*, accessed from <https://mediaindonesia.com/humaniora/387140/require-peran-generation-muda-atasi-tantangan-change-climate>, on April 1, 2022, 21:05 WIB.

¹²Yuli Nurhanisah, *Getting to Know Climate Change, its Factors, and Its Impacts*, accessed from <https://indonesiabaik.id/infografis/mengenal-change-iklim-faktor-dan-impact>, on April 2, 2022, at 13.50 WIB.

¹³Ramli Utina, "Global Warming: Impact and Efforts to Minimize It", *Journal of Lecturer in Biology, Faculty of Mathematics and Natural Sciences, University of Gorontalo*, p. 2

¹⁴Nibras Nada Nailufar, *6 Greenhouse Gases*, accessed from <https://www.kompas.com/skola/read/2019/12/06/155959869/6-gas-rumah-kaca?page=all>, on 2 April 2022, at 13:57 WIB.

¹⁵Safera Dewarani, *Getting to Know Greenhouse Gases more closely*, accessed from <https://dlhk.jogjaprov.go.id/menkenal-more-close-gas-rumah-Kaca>, on April 3, 2022, 19.45 WIB.

Amount of Organic Waste

Garbage or organic waste is waste that comes from the remnants of household needs or the remains of living things that can be recycled (*recycling*) into other forms, which can bring prosperity to mankind. If thrown away, this organic waste by chemists in developed countries is often known as 'wasting money' or 'money that evaporates'. This is because if it gets the right and proper handling, organic waste can bring abundant benefits for the managers.¹⁶

According to Wardhana (2010), organic waste that accumulates in the landfill and does not get proper handling will result in an anaerobic fermentation process at the bottom of the pile. This anaerobic fermentation of organic waste will produce gas which, when it reaches the atmosphere, acts as a greenhouse gas (GHG). One of the greenhouse gases that can act as a greenhouse gas from organic waste is methane (CH₄). Therefore, the collection and storage of waste at the final disposal site (TPA) is only a temporary solution, mainly related to the cleanliness of the city.¹⁷

In 2019, the Ministry of Environment and Forestry noted that the amount of landfill or waste in Indonesia reached 67.8 million tons/year consisting of organic waste with a percentage of 57%, plastic waste at 15%, paper waste at 11%, and others by 17%. Plastic waste which is currently often echoed as a source of problems in the environment is the second position, which is only as much as 26.27 million tons.¹⁸

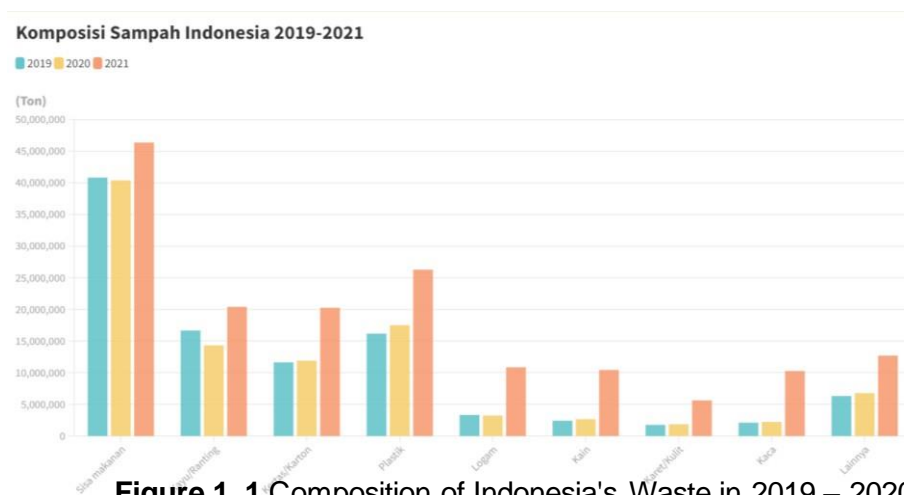


Figure 1. 1 Composition of Indonesia's Waste in 2019 – 2020
(Source: SIPSN data as of March 17, 2022)

¹⁶I Gusti Ngurah Puget, "Organic Waste, Compost, Global Warming, and Planting Aglaonema in the Yard", *Agricultural Journal*, Vol.1 No.2 (December 2018), 127.

¹⁷*Ibid.*, p. 130.

¹⁸Inez Kriya and Syahrier Firmansyah, *The irony of food waste in Indonesia: A spoonful of rice is thrown away, a mountain of garbage is reaped*, accessed from <https://projectmultatuli.org/sesendok-demi-sesendok-lama-lama-menjadi-gunungan-sampah-food/>, on April 4, 2022, at 08.07 WIB.

The nature of this organic waste is easy to decompose. However, if too much organic waste is piled up, it will produce methane gas which can damage the ozone layer. When tons after tons of waste are left buried and deprived of oxygen, methanogens will appear and be stored under the soil surface. Methane gas is flammable and can explode like a bomb. So do not be surprised if in the 'mountains' waste is prone to fires that seem to have no cause. This situation also happened in the Leuwigajah Village TPA, Bandung.¹⁹ Methane gas is 21 times more potent as a greenhouse gas than carbon dioxide because it absorbs more heat than CO₂. So, the accumulation of waste, especially organic waste, is indeed one of the sources of the problem of creating greenhouse gases in the form of methane gas which can cause climate change.²⁰

Incineration of Waste or Garbage



Figure 1. 2 Illustration of Burning Garbage

(Source: National Geographic Indonesia)

Garbage burning is one type of waste processing that is still widespread in Indonesia. On the one hand, burning garbage is an effective way to eliminate waste generation and pathogens. Moreover, in some places, there is no garbage collection service. Inequality of waste transport services makes waste incineration considered a cheap and easy method. Burning waste can produce harmful compounds such as CO, CO₂, CH₄, NO_x, SO₂, and *volatile organic compounds* (VOCs).²¹ In the combustion process, CO₂ is produced which

¹⁹Landslide Cipeucang TPA Reminds TPA Leuwi Gajah. In *Equatorial Facts*. Accessed on April 4, 2022, from <https://www.factkhatulistiwa.com/longsornya-tpa-cipeucang-meningatkan-tpa-leuwi-gajah/>.

²⁰Tontowi, Armaita Sutriati, Yuyu Sofia, *System Model for Reducing Greenhouse Gas Emissions from Reservoirs and Peat Swamps* (Bandung: Center for Research and Development of Water Resources, 2014), p. 3.

²¹Jatmiko Wahyudi, "Greenhouse Gas (GHG) Emissions from Open Burning of Household Waste Using the IPCC Model", *R&D Journal*, Vol. XV No.1 (June, 2019), 66.

is obtained from the management of CH₄ gas which turns into CO₂. Thus, the burning of waste that produces CO₂ is also the cause of the increase in the effect of greenhouse gases.²²

Target

1. Able to prevent the accumulation of waste in the Final Disposal Site (TPA) which produces greenhouse gases
2. Able to find the best alternative solution so that no more waste burning is done carelessly

VALUE PROPOSITION

As described earlier, the problem of the effects of greenhouse gases that cause climate change is indeed related to the hoarding and burning of waste that is often encountered in everyday life. Moreover, it turns out that the hoarding of organic waste, such as food leftovers from households, is much higher than the plastic waste that is often advertised. Therefore, the following is a solution to manage organic waste that will benefit the community, especially in Indonesia.

Turning Garbage or Organic Waste Into Compost



Figure 2. 1 Compost

(Source: Republika *online*)

Composting is a method of organic waste management that aims to reduce and change the composition of waste into useful products et al, 2017). The process that occurs in composting is that organic materials will undergo a weathering process. Then from the weathering, there will be interactions between microorganisms or spoilage bacteria that work in organic waste.

²²Ibid., p. 67.

All organic waste will experience weathering caused by microorganisms that thrive in moist and wet environments.

The use of compost is very good for soil and plants. Compost can provide micronutrients for plants. Compost is also useful for increasing the binding capacity of the soil to water so that it can store groundwater longer. The availability of water in the soil can prevent the dry layer on the soil. The use of compost is useful for maintaining root health and making plant roots easy to grow.²³

Through this compost management, it will also generate new jobs for organic waste managers. This is because the compost fertilizer will also have economic value so that it can become a business field. Agriculture practitioner, M. Yusri, said since 2001 that organic fertilizers have a higher economic value than chemical fertilizers if they are developed properly. Until now, the price of organic fertilizers tends to be more expensive than the price of chemical fertilizers. In 2021, the price of organic fertilizer could reach IDR 25,000 per kilogram.²⁴ This is because it is still rare for people to want to make organic fertilizer. After all, they don't want to bother. Therefore, processing organic waste into compost can certainly be a profit opportunity.²⁵

Maggot Cultivation



Figure 2. 2 Maggot

(Source: DKI Jakarta Environmental Agency)

²³Understanding Compost and Its Uses for Soil Fertility. In *the Department of Food Security and Fisheries of Buleleng Regency* . Accessed on April 4, 2022, from <https://www.factkhatulistiwa.com/longsornya-tpa-cipeucang-meningatkan-tpa-leuwi-gajah/>.

²⁴Anang Panca, *Latest Info on Organic Compost Fertilizer Prices (All Brands and Packagings)*, accessed from <https://harga.web.id/harga-pupuk-kompos-organik.info#:~:text=lf%20diberated%202020%20then%2C%20price,Rp12%20thousand%20to%20Rp15%20thousand,> on April 12, 2022, at 03.55 WIB.

²⁵The Use of Pupul Compost is Considered More Economical. In *News Liputan6.com* . Accessed on April 12, 2022, from <https://www.liputan6.com/news/read/14498/gunakan-pupuk-kompos-dinilai-more-ekonomis>.

Maggots are Black Soldier insect larvae Flies or BSF that can convert organic material into biomass. This fly is different from ordinary flies because the larvae produced are not larvae that are the medium of disease. Maggot's life cycle occurred for 40 days. Starting from the form of fly eggs, maggots need organic waste to grow for 25 days until they are ready to be harvested. Maggot can decompose organic waste 1-3 times its body weight for 24 hours, even up to 5 times its body weight.

One kilogram of *maggot* can reduce 2-5 kilograms of organic waste every day. This amount can significantly reduce organic waste. *Maggot* Dead BSF flies have a very high protein content of up to 40 – 50% and can be used as animal feed. The economic value of *maggot* cultivation ranges from Rp. 15,000 to Rp. 30,000 per 100 grams. Thus, *maggot* cultivation is a solution option in dealing with organic waste. Because, apart from being able to handle organic waste, *maggot* also has economic value.²⁶

METHOD

In the current era of 5.0 *society*, humans as the main component are objects that can create new value through technological developments that can minimize gaps in humans and economic problems in the future.²⁷ Thus, the solution to the problem of landfilling and burning waste due to inequality in Final Disposal Sites (TPA) and transportation of waste requires a touch of technology to reduce inequality. So, one way that can be done is to create a pick-up and exchange application for organic waste such as Trash Stop.



Figure 3. 1 Trash Stop Logo

Trash Stop is the latest form of a practical organic waste management system. This is because, so far, waste management has been carried out by hoarding and burning waste, which produces greenhouse gases. The problem of waste management has always been a complicated matter due to inefficient waste management habits and inadequate financing (Slamet, 2004). On this basis, Trash Stop will be something new for the community. Through

²⁶Monavia Ayu Rizaty, *Reduce Organic Waste by Raising Maggot*, accessed from <https://katadata.co.id/ariayudhistira/infografik/618f1ec50b131/kurangi-sampah-organik-dengan-beternak-maggot>, on April 3, 2022, 23.46 WIB .

²⁷Ni Nyoman Lisna Handayani and Ni Ketut Erna Muliastri, " *Disruptive Era Learning Towards Society 5.0 (Elementary Education Perspective Study)*", Ganesha University Journal of Education, 2020, 3.

Trash Stop, the community will not spend money to manage waste. People will make money through Trash Stop.

Trash Stop Application, organic waste will be picked up directly and exchanged into an e-wallet which can be converted into money in a savings account. Besides being able to be exchanged, in the Trash Stop application, you can also donate using deposited organic waste. Thus, the notion that waste is useless and requires money for its management will slowly fade away with the presence of Trash Stop.

With the Trash Stop, it will automatically minimize the problem of inequality in Final Disposal Sites (TPA) and transporting waste to the community. All levels of society will be able to feel the same rights and experience in managing organic waste easily, simply by exchanging organic waste via the Trash Stop application. There will be no more stories about people traveling long distances to reach the Final Disposal Site (TPA) and garbage collectors who never come past the house location. Then, there will be no more slum areas or cleaner areas because organic waste management has been made easy and practical. Through this, a healthy climate can be established. Automatically, this supports the existence of the *Sustainable Development Goals (SDGs)* because the gap is starting to be resolved for the sake of a prosperous society.

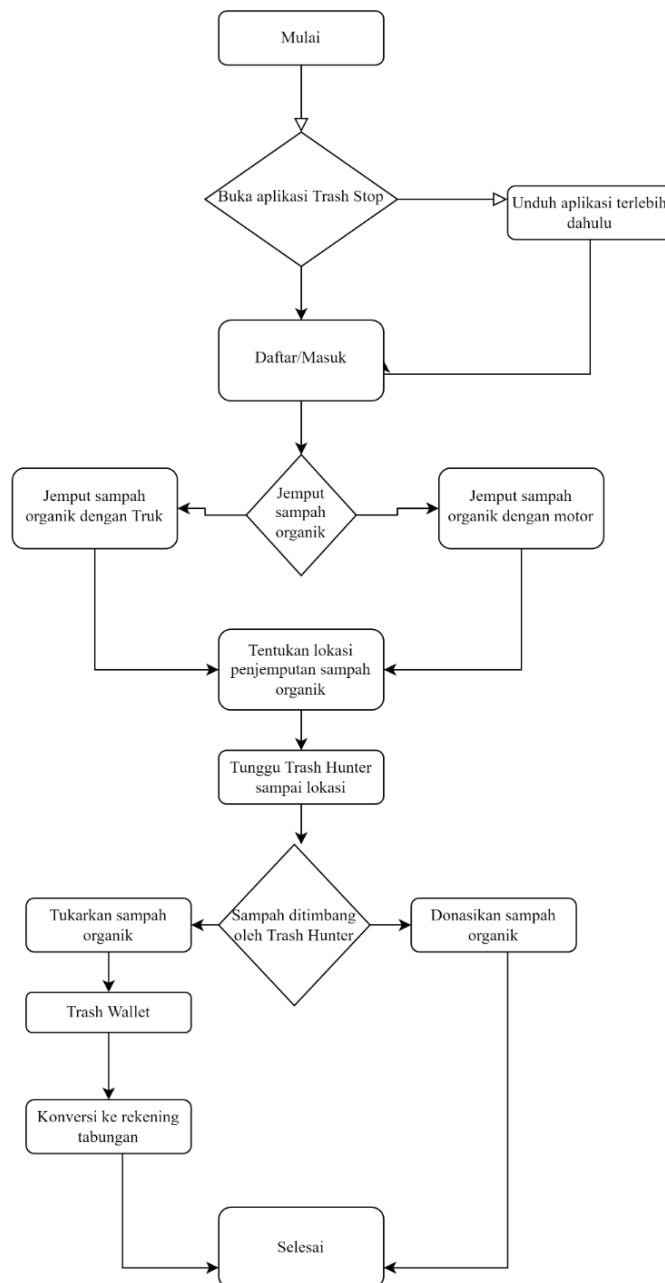


Figure 3. 2 Trash Stop Application Usage *Flowchart*

The presence of this Trash Stop is indeed a new solution for organic waste. The reason Trash Stop focuses on organic waste is that all this time, only plastic waste has been echoed. Organic waste has a greater amount. Some applications make it easy to manage plastic waste, such as PlasticPay. This is different from organic waste which does not yet have a special technology-based application that can help manage organic waste. Thus, the existence of this Trash Stop is expected to be a new solution that makes it easier for people to manage organic waste practically and profitably.

In its management, when the organic waste has been received by the organic waste picker (*trash.* *hunter*), this waste will be managed into compost and cultivated into a *maggot*. Compost and *maggot fertilizer* The finished product will be packaged and then sold. The sale of compost and *maggot cultivation* will be an income and source of funds for Trash Stop. Because the price of compost and *maggot fertilizer* is not something that can be underestimated. Trash Stop's steps in managing organic waste are as follows:

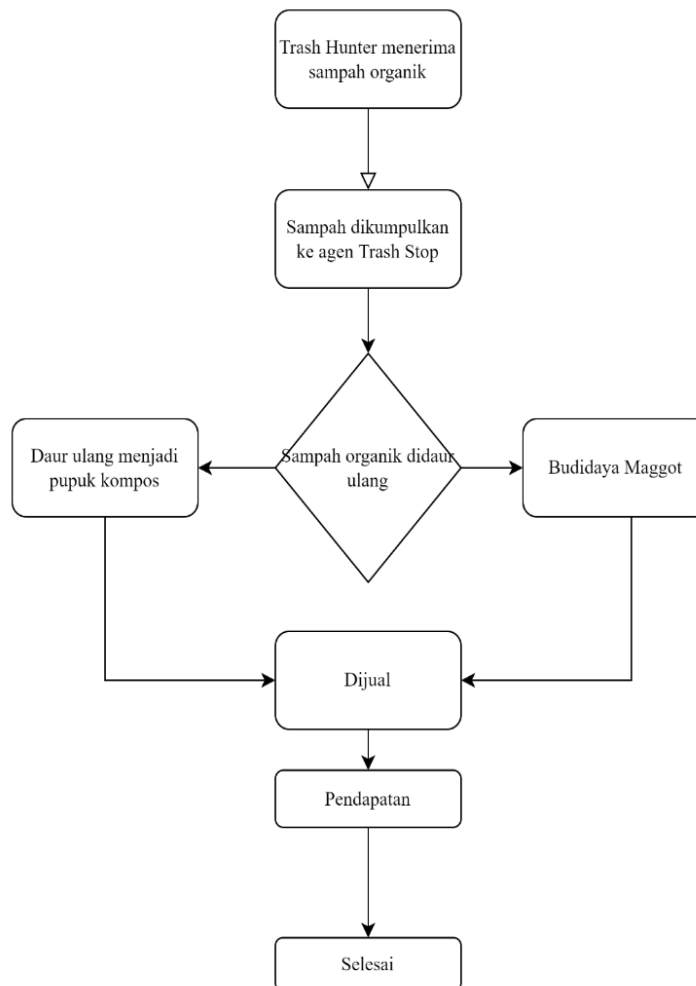


Figure 3. 3 Flow chart Organic Waste Receipt

The presence of Trash Stop has also become a place of new job opportunities for people in Indonesia. People who need work can have the opportunity to be a picker of organic waste, which is called *trash hunter*, compost maker, and maggot cultivator. The handling of climate change is resolved, and poverty due to not having a job is also overcome.

1.1.1 User Journey

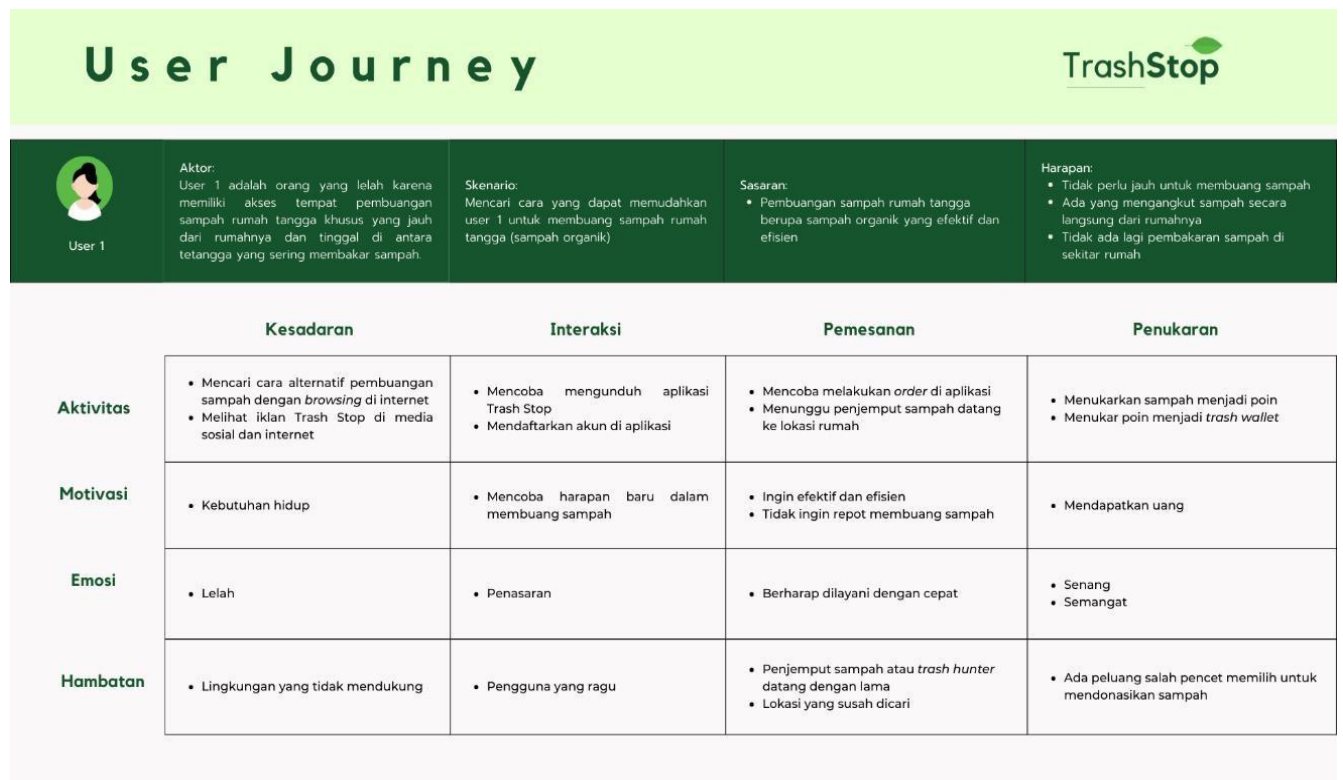


Figure 3. 4 User Journey Trash Stop

RESULT AND DISCUSSION

Climate change not only affects the environment but also affects economic conditions and people's lives. The climate change that occurs due to the greenhouse effect clearly must be handled together as an effort to support the *Sustainable Development Goals* (SDGs) that must be carried out by all parties including Generation Z as the next generation of the nation. Burning of waste due to uneven distribution of landfills and transportation of waste is the cause of greenhouse gases that cause climate change. The accumulation of organic waste that has the potential to produce greenhouse gases in the form of methane is also the cause. Thus, in the era of 5.0 *society* Currently, the creation of pick-up and drop-off applications for organic waste such as Trash Stop is the right solution in dealing with landfills and incineration of waste. The climate will be protected, the people will be prosperous.

Through technology-based applications such as Trash Stop, depositing garbage will indeed be more practical and profitable. However, on the one hand, it does not rule out the possibility of problems such as people who do not understand the technology and the difficulty of eradicating ineffective and inefficient waste management habits. Therefore, there should

indeed be a collaboration between the government and Generation Z in educating all levels of society about the new ease of managing organic waste. The government can do this by providing adequate access to information for all people and Generation Z will try to make improvements and developments on innovations so that they are more easily accepted by the community.

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