SDG 12.5

Prioritizing E-Waste

How can Earth keep up with digital integration?

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Digital Integration is on the rise

Many businesses now use these services

NETFLIX

Shopee

Lazada

zoom

Grab Food

Uber Eats

- Cinemas
- Physical Inventory
- Face-to-face Meetings
- Dine-ins
- Face-to-face Communication

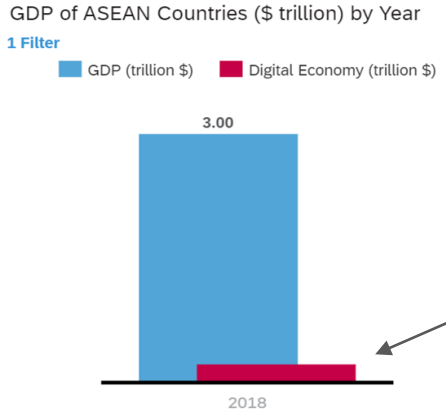
Key Insight 1:

ASEAN Countries depend on Digital Integration to increase their GDP

Digital Integration is growing fast in sectors which allows ASEAN's digital economy to increase.

Sources: ASEAN (2020); Bain & Company (2018); Research and Markets (2017)

ASEAN's Digital Economy as % of GDP

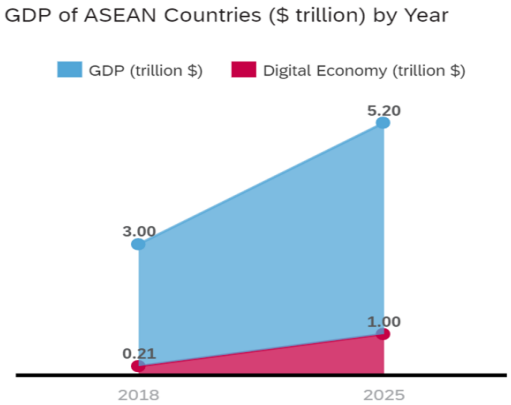


ASEAN countries had a cumulative GDP of **$3 trillion** as of **2018**

7%

of it was contributed by **Digital Economy**

GDP Growth Estimation by 2025



GDP in ASEAN countries estimated to increase by

$1 trillion

due to **digital integration** alone by **2025**

Digital Integration is growing and we depend on it for survival

Digital Integration has helped people survive during COVID-19

Education

Payment

Eateries

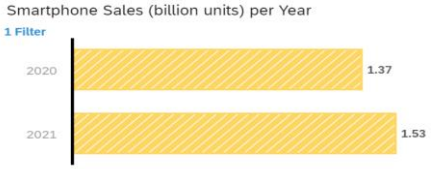
Key Insight 2:

Electronic Device demands are growing

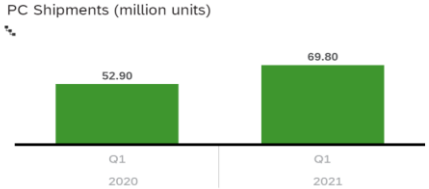
Digital integration involves the use of electronic devices which are growing in demand in recent times

Sources: ASEAN Stats Data Portal (n.d.), Gartner (2021)

Growth in Smartphones and Computer Demands

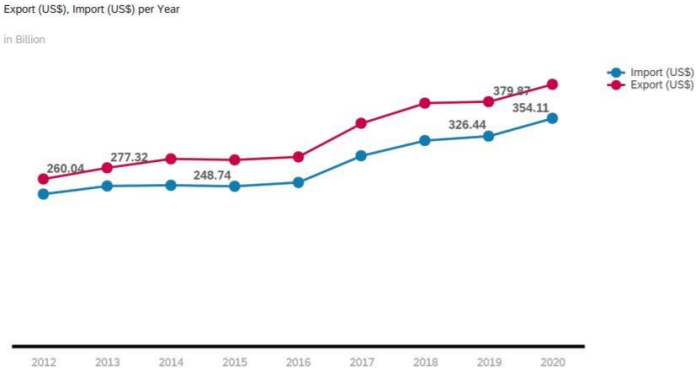


Worldwide smartphone sales forecasted to grow by **11%** from 2020 to 2021

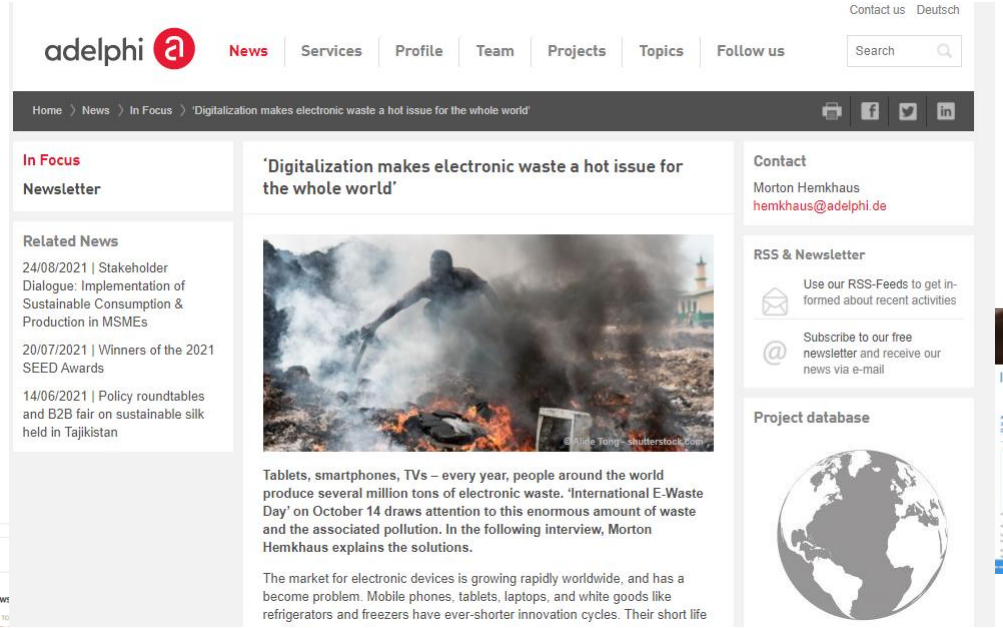


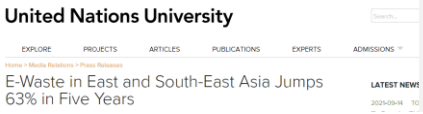
Worldwide PC Shipments grew by **32%** in Q1 of 2021 comparing to Q1 2020

Growth in Import & Export of Electronic Devices in ASEAN Countries



Digital integration caused growth in electronic devices leading to an increase in electronic waste (e-waste) across the world





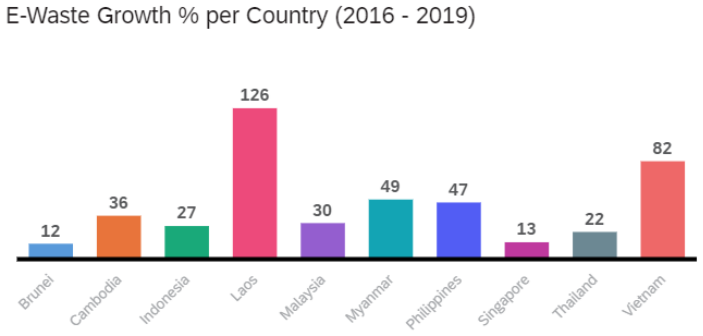
Sources: Adelphi (n.d.), Khuer (2017), United Nations Institute for Training and Research (2020)

Key Insight 3:

E-waste numbers are rising

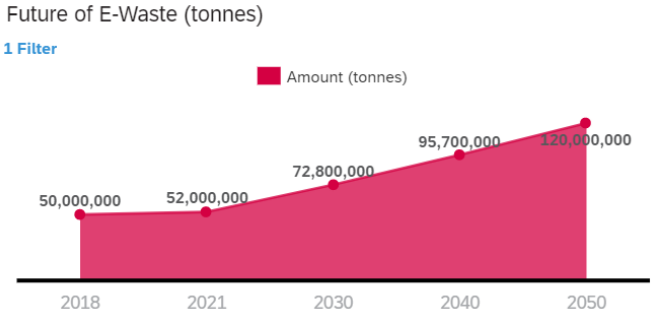
E-waste generated in ASEAN countries have been growing year by year, and is predicted to only continue surging

E-Waste Growth in ASEAN Countries



The amount of e-waste in ASEAN countries have only **grown**

E-waste numbers are continuously rising



The amount of e-waste worldwide is forecasted to **keep rising**

Sources: Baldé et al. (2017), World Economic Forum (2019), Forti et al. (2020)

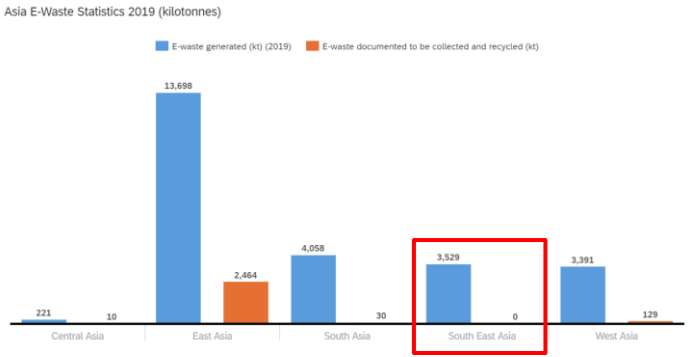
Key Insight 4:

E-waste has not been handled properly

As the amount of e-waste continuously rises, e-waste laws and efforts in ASEAN countries are still not sufficient to prevent the upcoming surge in years to come.

Sources: Hicks et al. (2019); Forti et al. (2020)

E-waste Situation in Asia



South East Asia is the only region that **does not formally collect and recycle e-waste**

E-waste laws are still in progress

Countries	Legal Framework	Collection Mechanism	Processing Infrastructure	Environment, Health & Safety Standards
Singapore	Low	Medium	Medium	High
Thailand	Low	Low	Low	Low
Philippines	Medium	Low	Low	Low
Vietnam	Medium	Low	Medium	Low
Malaysia	Medium	Low	Medium	Low
Indonesia	Medium	Low	Medium	Low
Myanmar	Low	Low	Medium	Low
Cambodia	Medium	Low	Medium	Low

Sources: Honda et al. (2016), Hick et al. (2019), BusinessMirror (2021)

Summary of the E-Waste Process in ASEAN Countries

1 Obtaining Electronic Devices / E-Waste

2 Disposing of Electronic Devices by End Users

3 Extracting Materials from E-Waste

4 Final Destination of E-Waste

At electronic devices' end of life:

Electronic devices manufactured → **Informal collectors take them** → **Recover valuable/reusable materials** → **Valuable materials are exported to other countries or resold to public**

Illegal e-waste imports → **Recover valuable/reusable materials**

Disposed → **Dealt with via burning and landfills**

Leftover invaluable materials → **Dealt with via burning and landfills**

10 out of 10 ASEAN countries dispose e-waste into landfills or burn them

94% of Singapore's e-waste is **burned**

80% of Philippine's e-waste **ends up in landfills**

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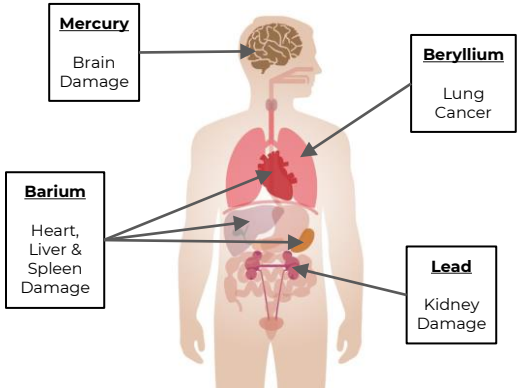
Burning Landfill

Negative Effects

1. **Air, Water and Soil Pollution**
2. **Hazardous components of e-waste can potentially harm our health**



Root Cause & Gap to Close

1. **Lack of Awareness**
2. **Lack of Incentives**
3. **Lack of Convenience**

Sources: Elytus (2019), Gangwar et al. (2019), Jabatan Alam Sekitar Malaysia (2020), Morton (2019), Honda et al. (2016), Hick et al. (2019), BusinessMirror (2021)

Executive Summary

Situation

There is a **high demand in digital integration** across ASEAN Countries

Problem

With the increase of digital integration, comes with the **increase of E-waste**.

Environmental and **health problems** are at **higher risk**.

Due to the lack of **awareness, incentives, and convenience,** most e-waste are landfilled and burnt.

Question

How can we **lessen the risk** of environmental and health problems through **reducing E-waste** while **coping with the high demand of digital integration** across **ASEAN Countries** through increasing **awareness, incentives, and convenience**?

Answer

Cradle-to-Cradle Technical Cycle to achieve E-Waste Circular Economy

+

E-Waste Eliminator App

Emerging Trends | ICT4SDG

October 11, 2019

How Switzerland is winning the battle against e-waste

Circular Economy for e-Waste

Produced

184 kilotons

of e-waste in **2016**

Collected and Recycled **75%**

with **134 kilotons**

recovered in **2015**

Recycling rate **95%** in **2018**

Source: ITUNews (2019)

Introducing
"Cradle-to-Cradle" Technical Cycle
to achieve E-waste Circular Economy

Source: Patwary (2016)

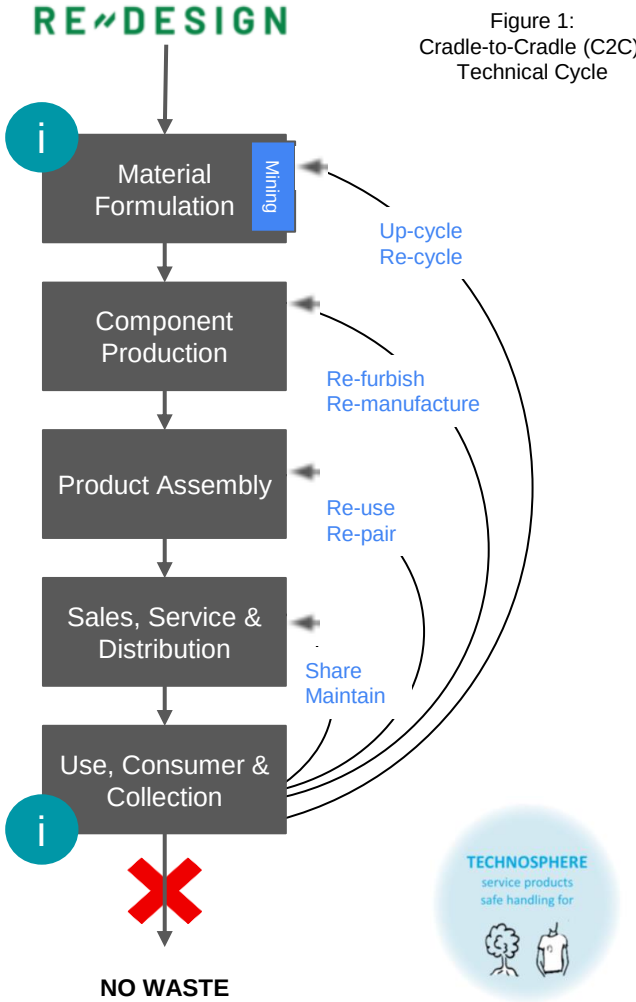


Figure 1:
Cradle-to-Cradle (C2C):
Technical Cycle

C2C Implementation Process in ASEAN Countries

1 Manufacturing electronic devices

2 Repairing/Reuse of Electronic Devices

3 Extracting Materials from E-Waste

4 Final Destination of E-Waste

Upscale Recycle

Refurbish Remanufacture

Re-use Re-pair

Share Maintain

Upscale Recycle

Recycle

Goals:

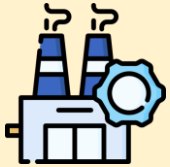
- Product life cycle
- **10%** of e-waste being **burned**
- **10%** of e-waste **ending up in landfills**

Factories | Industries | Consumers | Recovery Facilities | Resell | Burning | Landfill

Input

Sources: Colville (1994), Kumar (2008)

Reverse Logistics



Materials Recovery Facilities (MRF)

Sustainable Production of Electronics

Target

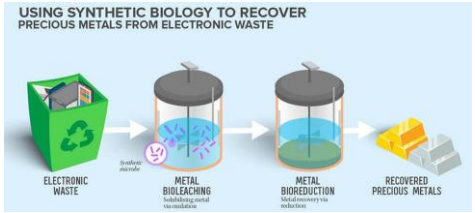
Reverse Logistics	Materials Recovery Facilities (MRF)	Sustainable Production of Electronics
Consumers, and Industries	Consumers, and Industries	Consumers, Industries, and Factories

Process

Reverse Logistics	Materials Recovery Facilities (MRF)	Sustainable Production of Electronics
All operations will be related to **3R** of materials and products through **sales strategies**	**5% - 45%** of incoming materials in dirty MRF can be recovered Separation and recovery of materials through an e-guide	Material Health, Material Reutilization, Renewable Energy, Water Stewardship, Social Fairness **C2C certification** is achieved by companies

Output

Reverse Logistics	Materials Recovery Facilities (MRF)	Sustainable Production of Electronics
Refurbish, Repair, and Remanufacture Products	Recovered materials will be sold in the market or directly to companies	Environmentally friendly products with efficient design



Existing Applications to Combat the E-Waste Problem

Baidu Recycle

Recognized as a ‘Global Solution’ by the United Nations, the app **connects consumers, dismantlers and manufactures** together. Users can **price** their electronic devices and recycle their electronic products using an e-waste pick up service

MyGizmo

Created an **electronics marketplace** to promote reuse, recycling, recovery, and electronic waste awareness

MyEwaste

Has **educational material** on electronics devices composition and **navigation** to e-waste collection centres

Sources: Baidu USA (2015), Trayak (n.d.), United Nations Development Programme (2016)

Image taken from Stone Group (2020)

Integrating E-Waste Eliminator

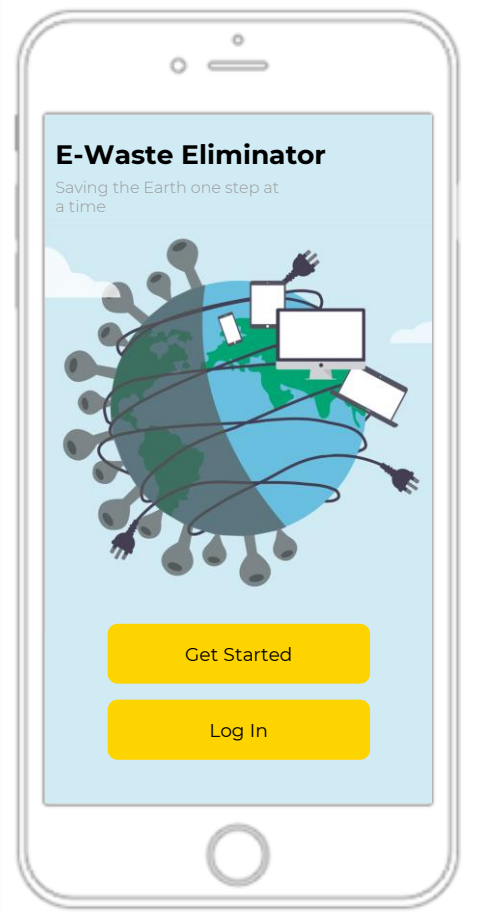
App into the “cradle-to-cradle” technical cycle

Objectives:

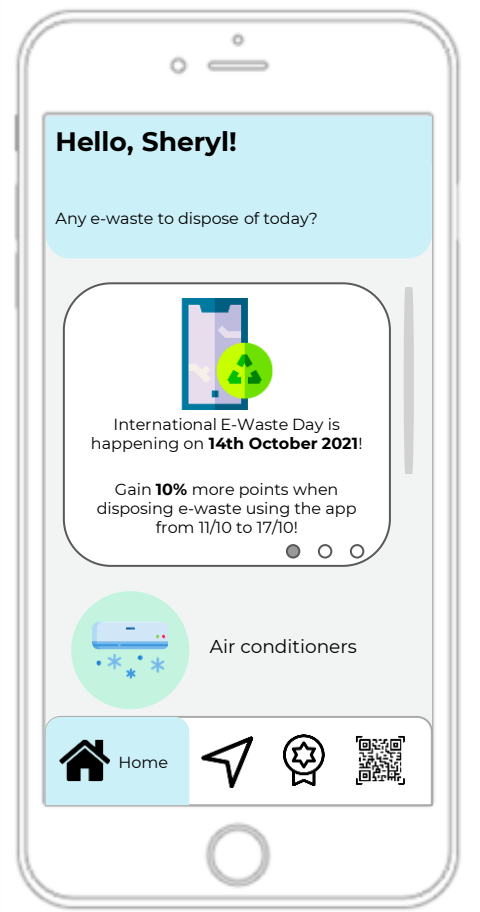
1. To help in **reducing** the amount of e-waste
2. To **promote** the proper method of disposing e-waste
3. To **educate** the public on the composition of electronic devices

What?

1. Have **personalized incentives**
2. **Easy access** to the nearest collection centres
3. **Easy tracking**
4. Involved in **environmental protection**
5. Have e-waste **education**

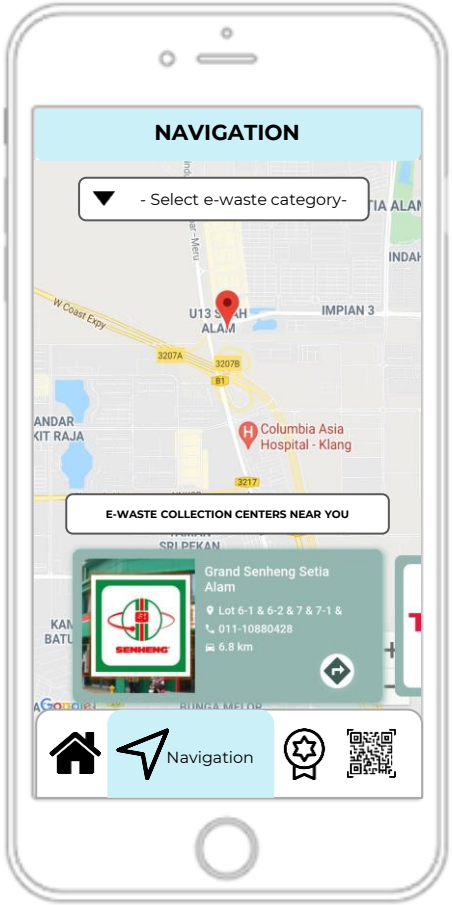


1 Create an account / Log in

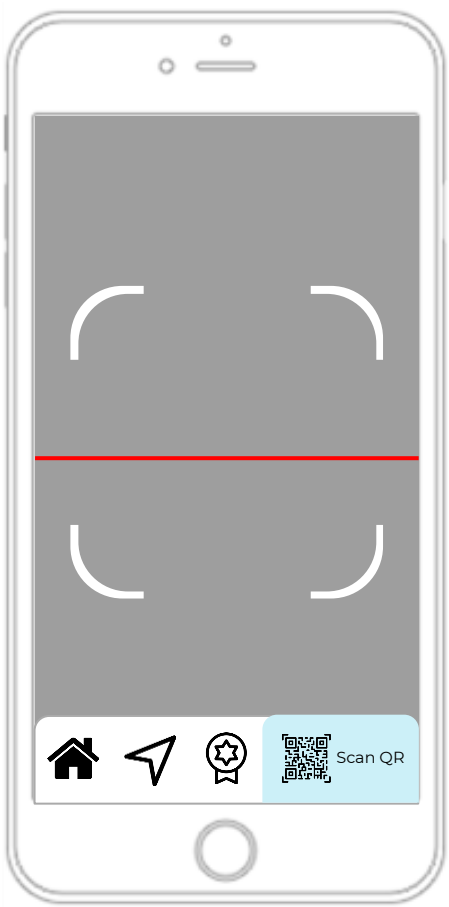


1. Create an account / Log in
2. View recent news & upcoming events

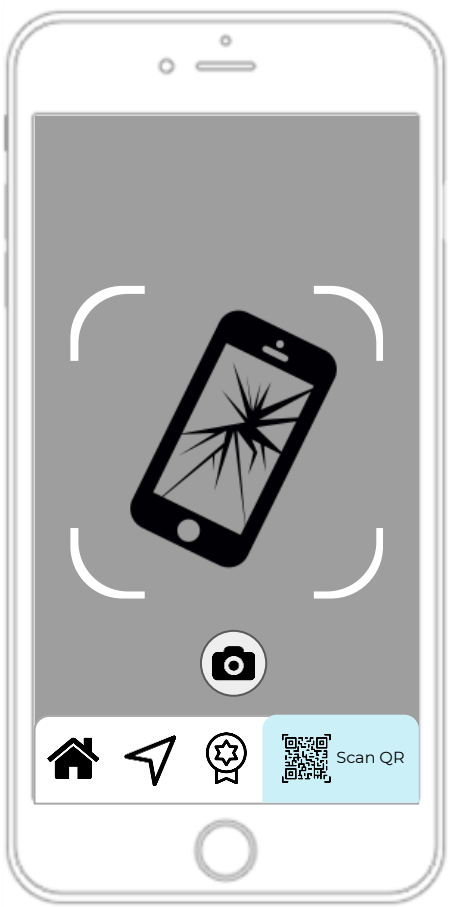
1. Create an account / Log in
2. View recent news & upcoming events
3. Read up on the materials each device comprises of



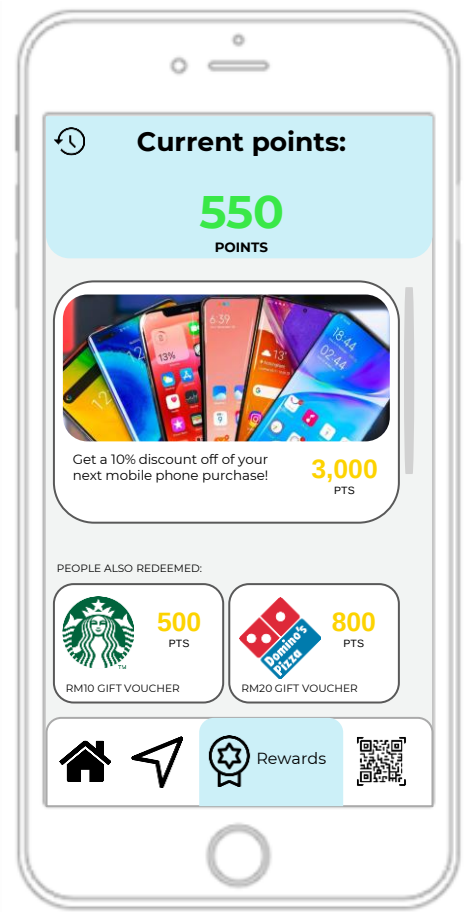
1. Create an account / Log in
2. View recent news & upcoming events
3. Read up on the materials each device comprises of
4. Navigate nearby collection centers



1. Create an account / Log in
2. View recent news & upcoming events
3. Read up on the materials each device comprises of
4. Navigate nearby collection centers
5. Scan QR code



1. Create an account / Log in
2. View recent news & upcoming events
3. Read up on the materials each device comprises of
4. Navigate nearby collection centers
5. Scan QR code
6. Take picture of the disposed electronic device



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7. Points are gained and can be exchanged for different personalized incentives

1. Create an account / Log in
2. View recent news & upcoming events
3. Read up on the materials each device comprises of
4. Navigate nearby collection centers
5. Scan QR code
6. Take picture of the disposed electronic device
7. Points are gained and can be exchanged for different personalized incentives
8. Track post-disposal electronic devices and their involvement in environmental protection

Go-to-market

CATCH

Social Media

Government Public Service Announcement

Digital Billboards

CONNECT

International E-Waste Day Campaign

International E-Waste Day

SDG Campaigns

SUSTAINABLE DEVELOPMENT GOALS ACTION CAMPAIGN

CONVERT

E-Waste Eliminator App

Can be found on:

Google play

CONTINUE

Personalized Incentives

Each e-waste disposed:

1. Points collected for rewards

E-Waste Tracker

Able to track:

1. What happens to disposed e-waste

2. Involvement in environmental protection

SDG 12: Responsible Consumption and Production

12.5

By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse

ASEAN SOCIO-CULTURAL COMMUNITY BLUEPRINT 2025

A.2.ii Harness the use of information and communication technologies across different age groups as a means to connect with the regional and global community;

C.4.i Strengthen public-private partnerships to promote adoption of environmentally-sound technologies for maximising resource efficiency;

C.4.ii Promote environmental education (including eco-school practice), awareness, and capacity to adopt sustainable consumption and green lifestyle at all levels;

C.4.iii Enhance capacity of relevant stakeholders to implement sound waste management and energy efficiency; and

C.4.iv Promote the integration of Sustainable Consumption and Production strategy and best practices into national and regional policies or as part of CSR activities.

D.1.ii Promote regional standards, including methodologies and tools to assess, record, calculate the disaster losses and damages, and share non-sensitive data and create common information system, to enhance interoperability, ensure unity of action, and strengthen resilience;

D.2.ii ii. Promote regional standards to enhance interoperability, ensure unity of action and strengthen collective resilience; and

ASEAN ECONOMIC COMMUNITY BLUEPRINT 2025

29.iii. Build higher consumer confidence and cross-border commercial transactions by strengthening product safety enforcement, stronger participation of consumer representatives, and promotion of sustainable consumption;

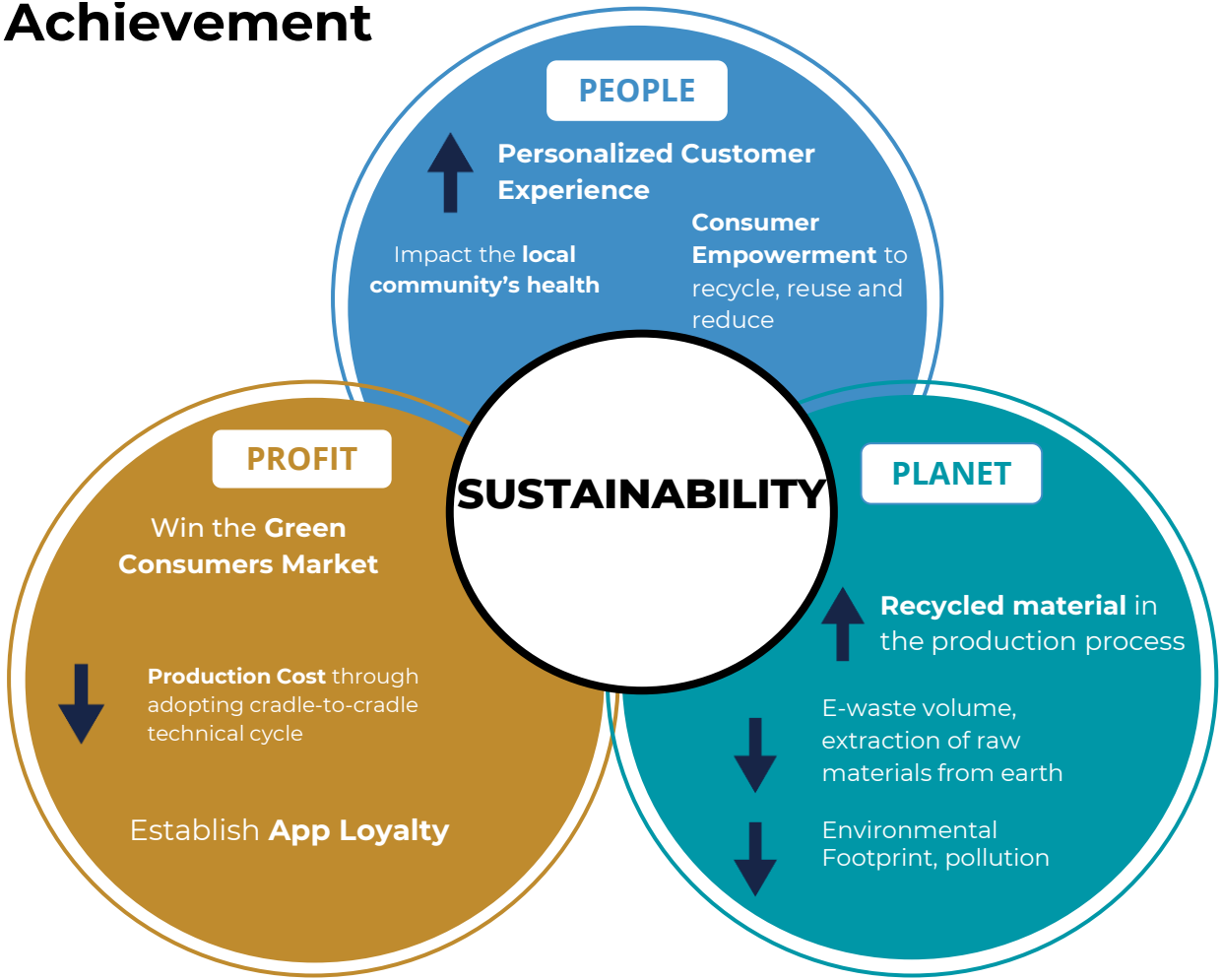
41.ii. Develop a framework to support the deployment and utilisation of efficient and low carbon technologies, and call for international support to ensure ASEAN access to mechanisms that foster low carbon technologies more affordably;

51.i. Economic Transformation: Explore the further utilisation and coordination of ICT for economic development and promote digital trade in ASEAN;

Implementation Plan

Timeline	Phase	Stakeholders	Action
2022	**Phase 1:** Legislation for implementation of 5 key concepts: 1. The prevention of waste management by eco-design 2. The extended life of electronics 3. The design of recycling 4. The reduction of recycling costs 5. The creation of an information-sharing mechanism	ASEAN Governments, Waste Management Industry	Legislate concepts that can build and drive the momentum of each country's implementation plan for e-waste management
2022 - 2030	**Phase 2:** Provide training to educate and raise awareness on C2C technical cycle implementation	ASEAN Government Professionals	Conduct campaigns, conferences, webinars to educate on C2C technical cycle
2022 - 2030	**Phase 3:** Create a digital platform such as the "E-Waste Eliminator" app to support e-waste programmes/initiatives	ASEAN Government Professionals, Software Engineers	Form partnerships with software engineers and data analytics professionals to better create and implement the "E-Waste Eliminator" app
2024 - 2035	**Phase 4:** Review on the product life cycle of each electronic product and further build on a suitable framework and policy for each industry and country to uphold and implement respectively	ASEAN Government, Electronics Industry, Waste Management Industry	Understand and create frameworks and policies for each industry for implementation

Impact & Achievement



“One man’s trash is another man’s treasure”

Thank You

- Team Brain Drain -

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Appendix

E-Waste Statistics in ASEAN Countries

Country	Waste Generated in 2016 (tonnes)	E-Waste Generated in 2016 (tonnes)	%
Brunei	210,480	7,700	3.7
Cambodia	1,089,429	14,000	1.3
Indonesia	64,000,000	1,274,000	2.0
Laos	77,380	7,500	9.7
Malaysia	12,840,000	280,000	2.2
Myanmar	841,508	55,000	6.5
Philippines	14,660,000	290,000	2.0
Singapore	7,514,500	100,000	1.3
Thailand	26,770,000	507,000	1.9
Vietnam	22,020,000	141,000	0.64

Sources: Baldé et al. (2017), United Nations (2017)

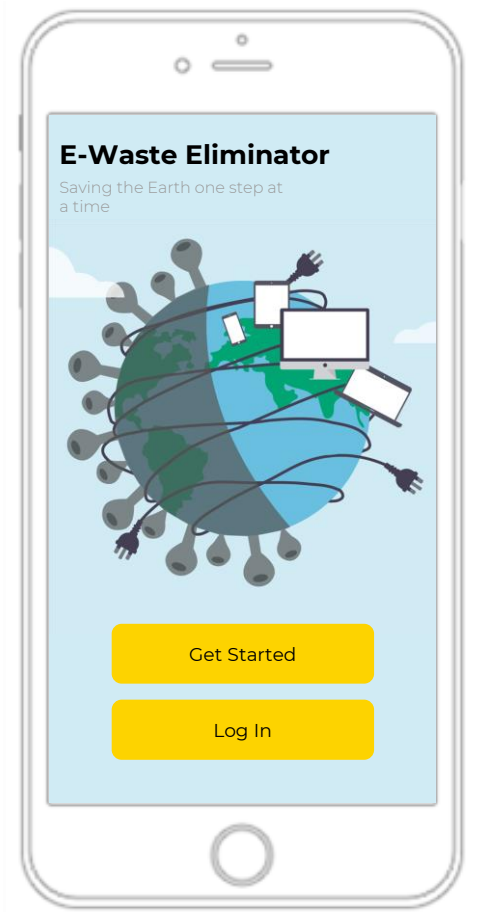
Country	E-Waste Generated in 2016 (tonnes)	E-Waste Generated in 2019 (tonnes)	Increase
Brunei	7,700	8,700	12%
Cambodia	14,000	19,000	36%
Indonesia	1,274,000	1,618,000	27%
Laos	7,500	17,000	126%
Malaysia	280,000	364,000	30%
Myanmar	55,000	82,000	49%
Philippines	290,000	425,000	47%
Singapore	100,000	113,000	13%
Thailand	507,000	621,000	22%
Vietnam	141,000	257,000	82%

Sources: Baldé et al. (2017), Forti et al. (2020)

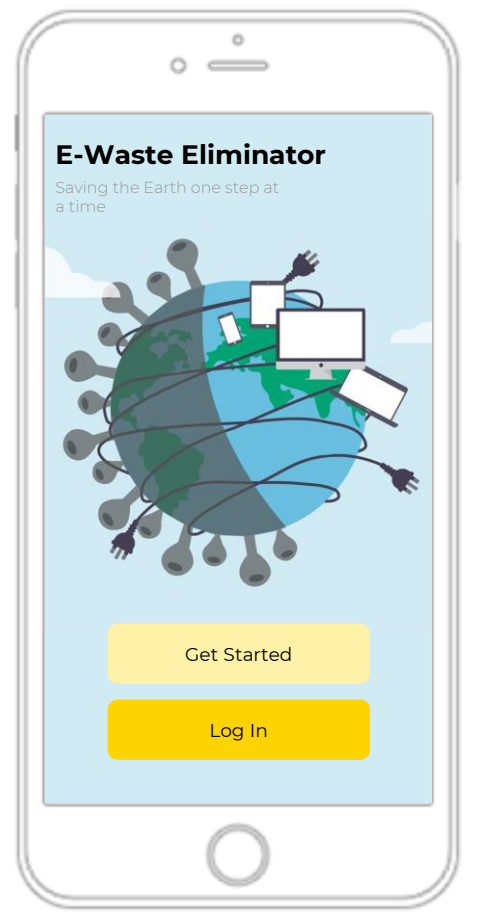
Country	Region	E-waste generated (kt) (2019)	E-waste generated (kg per capita) (2019)	E-waste documented to be collected and recycled (kt)	National e-waste legislation/policy or regulation in place
Brunei Darussalam	Asia	8.7	19.7	NA	No
Cambodia	Asia	19	1.1	NA	Yes
Indonesia	Asia	1618	6.1	NA	No
Lao People's Democratic Republic	Asia	17	2.5	NA	No
Malaysia	Asia	364	11.1	NA	Yes
Myanmar	Asia	82	1.6	NA	No
Philippines	Asia	425	3.9	NA	No
Singapore	Asia	113	19.9	NA	Yes
Thailand	Asia	621	9.2	NA	Yes
Viet Nam	Asia	257	2.7	NA	No

Source: Forti et al. (2020)

Full Concept Framework of E-Waste Eliminator



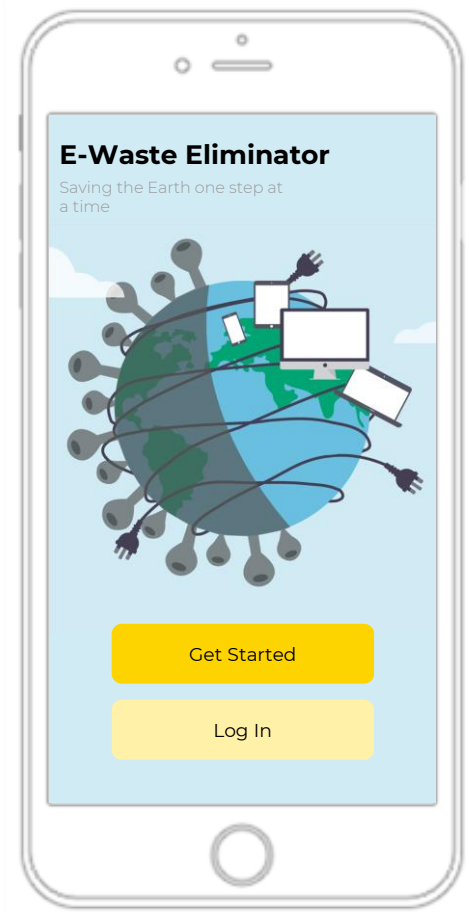
Title Screen



Title Screen

1

Create an account

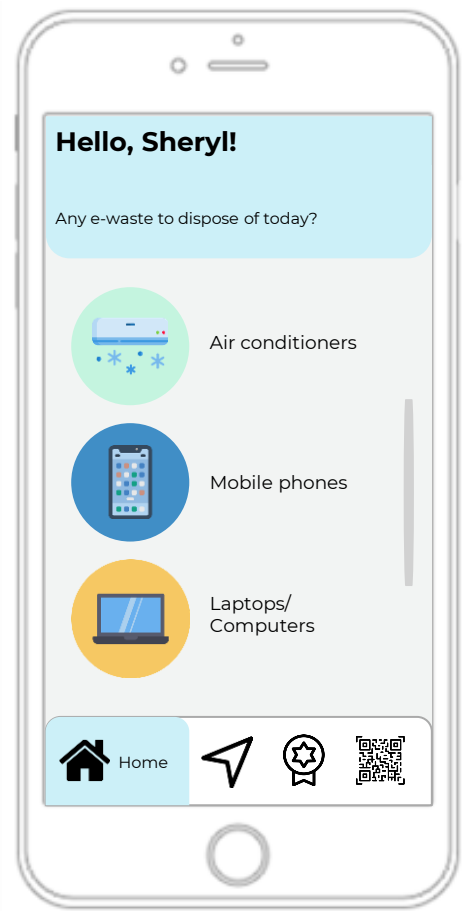


Title Screen

1 Log in

Home Screen

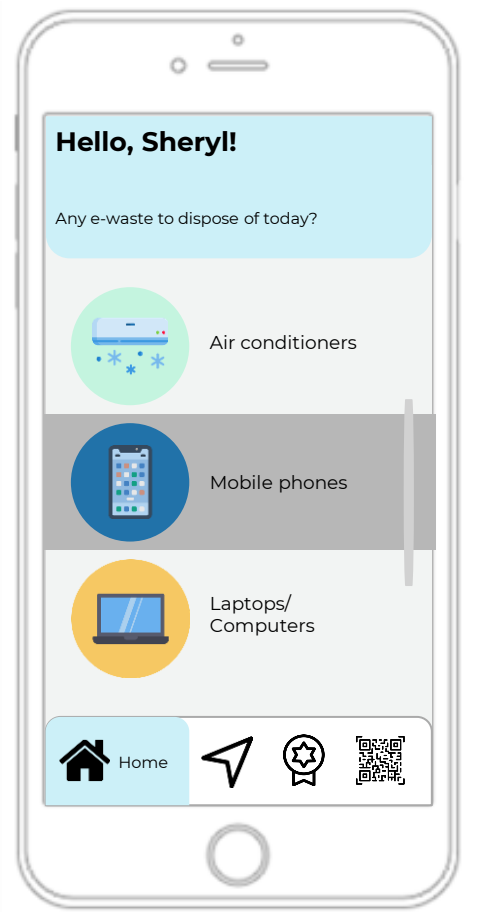
2 Recent news & upcoming events



Home Screen

2

Upon scrolling down, users can see a **list of electronic device categories**



Home Screen

2

They can be tapped on to view further details

Facts Screen

3

Users can learn what materials their devices are comprised of

Facts Screen

3

Users can learn what materials their devices are comprised of

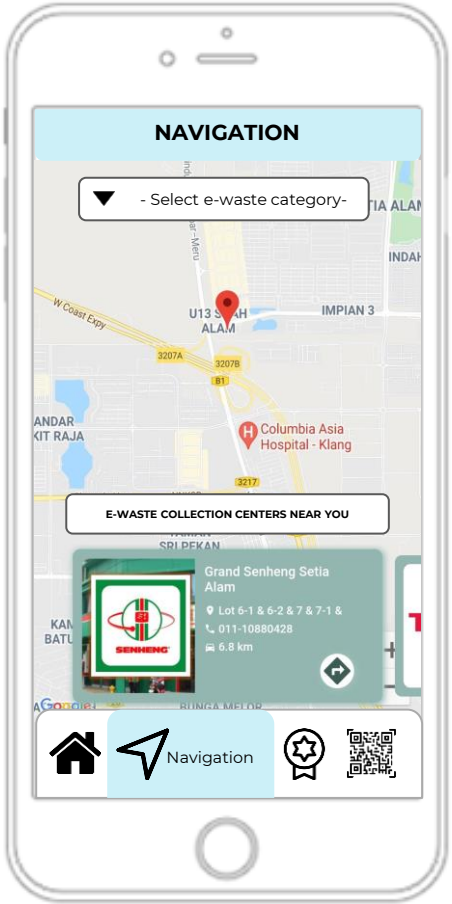
Collection centres can be navigated by clicking **the yellow button** below...

Facts Screen

3

Users can learn what materials their devices are comprised of

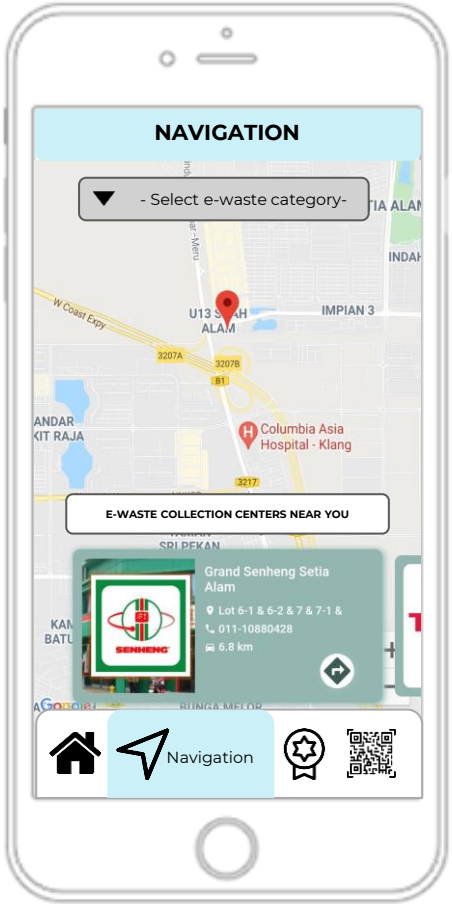
Collection centres can be navigated by clicking the yellow button below **OR** by **clicking the arrow icon** below.



Navigation Screen

4

Allows users to **navigate nearby collection centers** by connecting to Google Maps API

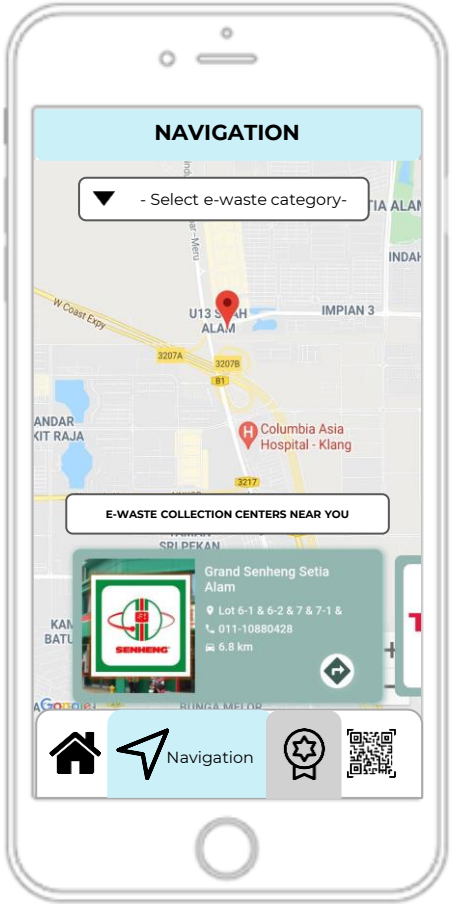


Navigation Screen

4

Allows users to navigate nearby collection centers by connecting to Google Maps API

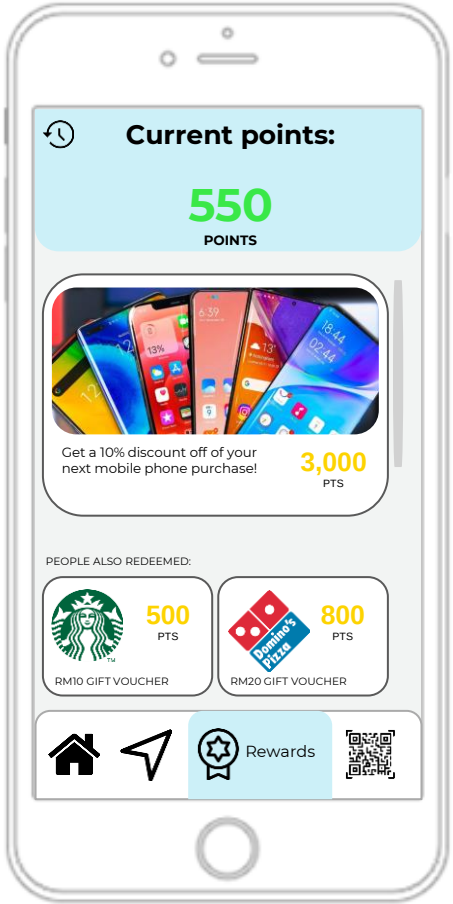
Navigate **based on the category of electronic device**



Navigation Screen

4

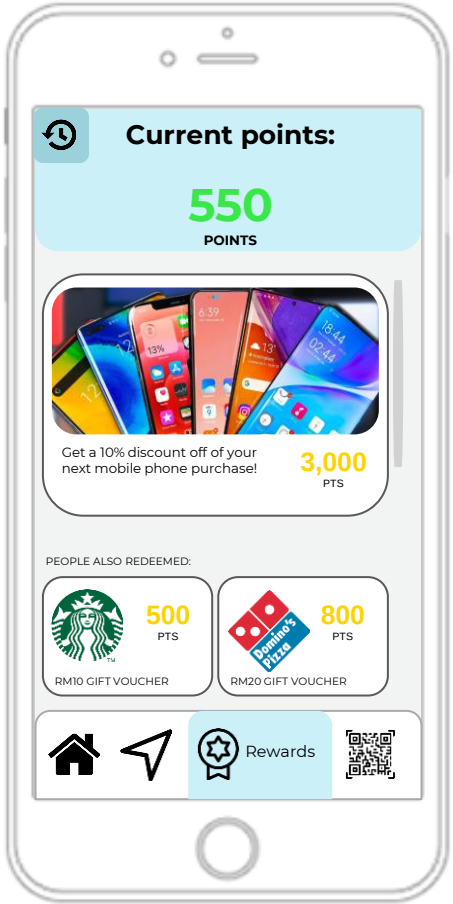
User rewards can be accessed by **tapping the icon below as shown**



Rewards Screen

5

Users can gain points based on mass of disposed electronic device (kg), which can be exchanged for different **personalized incentives**.



Rewards Screen

5

Users can click the button on the top right to view

Rewards History

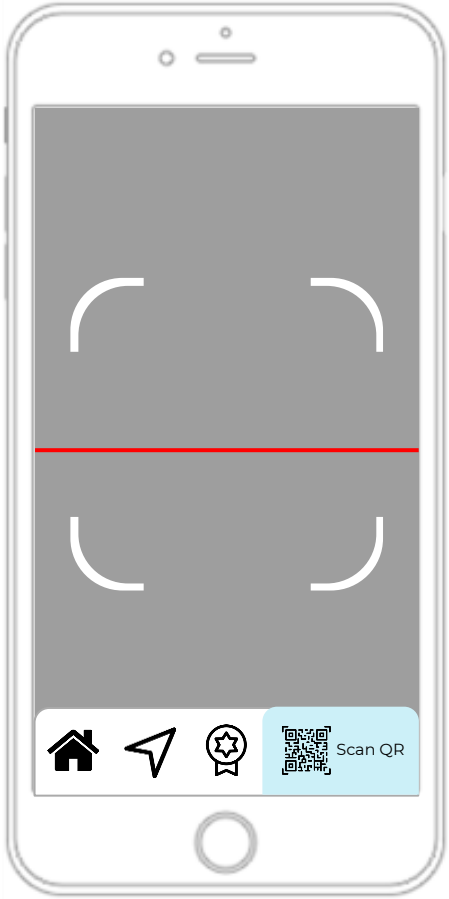
6

Users can track disposed electronic devices using a tracker where they can see where they get their points from and what happens to the e-waste they dispose. They are also able to see how much they are contributing to reducing e-waste.

Rewards History

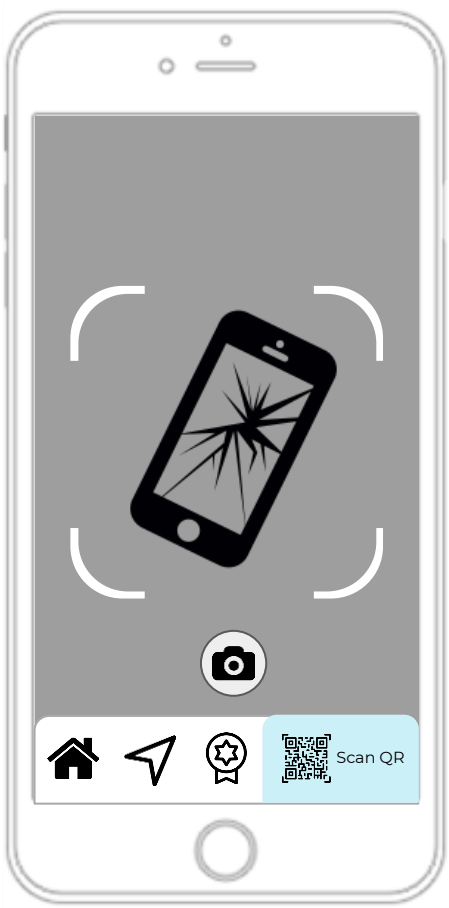
6

Users can track disposed electronic devices using a tracker where they can see where they get their points from and what happens to the e-waste they dispose. They are also able to see how much they are contributing to reducing e-waste.



7

QR code scanner that is scanned at collection centers to keep track of each users' disposed e-waste to award points appropriately



7

QR code scanner that is scanned at collection centers to keep track of each users' disposed e-waste to award points appropriately

Case Studies in ASEAN Countries

Singapore

Situation in 2016

Pillar	Stage	Description
Legal Framework	Low	• No specific e-waste management law exists in Singapore and it is considered to be non-hazardous solid waste for legal purposes. • The Singapore Standard SS587:2013 is an industry implementation of national standards on the management of end-of-life ICT equipment. • The Hazardous Waste (Control of Export, Import and Transit) Act (1998) regulates export, import and transit of hazardous waste in accordance with the principles and provisions of the Basel Convention.
Collection Mechanism	Medium	• Waste collectors are private/public entities and need a license from the government to operate. There are nine licensed public waste collectors of solid waste and over 300 licensed general waste collectors. Residents are provided recycling bags/bins and door-to-door collection takes place every two weeks[42]. • Cash-for-trash locations are provided by Public Waste Collectors (not valid for lamps and batteries). • At voluntary collection programs (e.g., RENEW[43]), recyclers work with several brand owners to recycle the waste collected by the take-back mechanisms. • A total of 2,700 kg were collected in 2012, 6,500 kg in 2013, and 8,700 kg in 2014[44].
Processing Infrastructure	Medium	• Several privately owned companies have their recycling facilities in Singapore, particularly for the recovery and refining of precious metals. Other e-waste fractions that cannot be processed domestically are exported.
EHS Standards	High	• Environmental Public Health (Toxic Industrial Waste) Regulations (1988) regulates the collection, treatment and disposal of toxic industrial waste. • Recycling plants are strictly monitored for environmental and health safety standards and must have latest recycling technology to be certified and allowed to operate.

Source: Honda (2016)

Singapore’s Situation

The Resource Sustainability Act (July 2020)

- Part of Singapore’s strategy to build a sustainable, resource-efficient and climate-resilient nation

Established an Extended Producer Responsibility (EPR) System for E-Waste Management (Started 1 July 2021)

- Responsibilities are assigned to key stakeholders in the e-waste value chain
- Producers of regulated electrical and electronic products will be made responsible for the collection and proper treatment of their e-waste
- All e-waste collected under the e-waste management system will have to be channelled to licensed e-waste recyclers for proper treatment
- Aggregation and recovery of valuable resources from e-waste funded by the National Environment Agency

How?

- ALBA E-waste Smart Recycling Pte Ltd ("ALBA") was appointed as Producer Responsibility Scheme Operator
- Deployed e-waste recycling bins across Singapore in public areas

Sources: Towards Zero Waste (n.d.), National Environment Agency (2021)

Other Initiatives

- StarHub's RENEW (REcycling Nation's Electronic Waste) Programme
- ReCYCLE: Singtel x SingPost E-Waste Recycling Programme
- City Square Mall E-Waste Recycling Programme
- Project Homecoming - Ink & Toner Cartridge Recycling Programme
- IKEA's Light Bulb Recycling Programme

2019: Only 1 in 10 young Singaporeans recycle e-waste - 34.1% do it wrongly by throwing into general recycling bins (lack of awareness)

Sources: Towards Zero Waste (n.d.), Teh (2019)

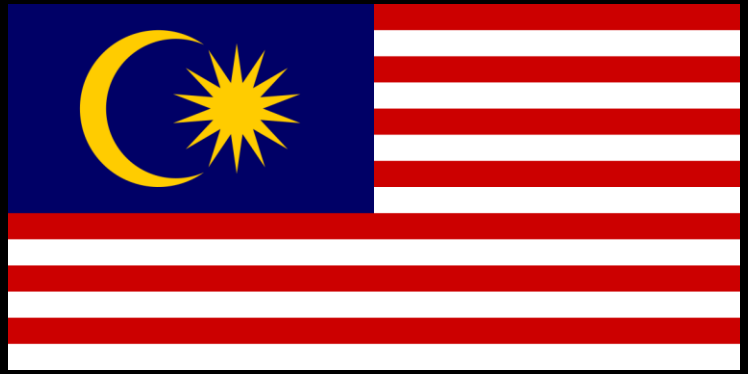
Just 6 per cent of Singapore's e-waste is recycled, mainly through corporate collection schemes, while the rest is burned in incinerators.

Look at how much e-waste Singapore has saved from the landfill

Did you know there are almost 200 bins across the island where you can recycle electronic waste? Many have been around for just over a year, but in that time have saved 23 tonnes of gadgets from ending up in landfills.

Sources: Hicks et al. (2019), Shah (2015)

Malaysia



Malaysia's Situation

High amounts of e-waste due to exponential growth in mobile phone adoption

The reasons for keeping unwanted WEEE at home ranged from:

- reluctance to dispose of a gadget bought at a high price
- potential for cannibalisation of parts
- **consumers were waiting for scrap collectors to buy their e-waste, rather than having to pay someone to collect it (need incentive)**

Initiatives

- E-Waste Alam Alliance
  - Objectives of the programme are to implement a sustainable system of collection, segregation and transport of e-waste while creating awareness and cooperation among stakeholders, including manufactures, retailer and consumers.

Source: Honda (2016)

Pillar	Stage	Description
Legal Framework	Medium	Malaysia does not have specific e-waste legislation; however, there are other rules and guidelines under the hazardous waste framework that are applicable for e-waste handling and processing. • Environmental Quality (Scheduled Wastes) Regulation in 2005 under the Environmental Quality Act. The amended regulation categorises E-waste as a scheduled waste SW110. • Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia in 2008 (the first edition) and 2010 (the second edition) from the Department of Environment, Malaysia that provide guidance on determining whether used electrical and electronic equipment is E-waste or second-hands goods.
Collection Mechanism	Low	The collection and take-back system in Malaysia is still largely done by itinerant informal collectors and small agents/buyers. Retail drop-off at Senheng occurs under the E-waste Alam Alliance Program. Consumers can request free pick-up of bulky EEE products, such as refrigerators or washing machines.
Processing Infrastructure	Medium	There are two types of formal e-waste facilities: a full recovery facility and a partial recovery facility. Although there is no clear definition to distinguish between the two, a full recovery facility is capable of dismantling of e-waste, crushing and segregating recyclable materials and recovering precious metals by hydrometallurgy. A partial recovery facility is capable of one or some of those operations. There are 138 e-waste recovery facilities with a total capacity to handle 288,000 tonnes/year. Of these, 39 are full recovery facilities, and 98 are the partial recovery facilities as of November 2015.[75] Informal recyclers are also engaged in dismantling and metal recovery operations.
EHS Standards	Low	The Environmental Quality (Prescribed Premises) (Scheduled Waste Treatment Disposal Facilities) Regulation issued in 1989 prescribes the control measures on collection, treatment, recycling and disposal of as well as inventory of the scheduled wastes, including e-waste.

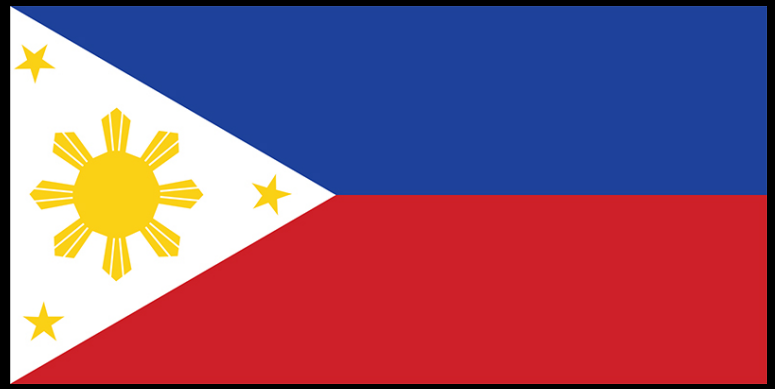
Source: Honda (2016)

It is ironic that all these valuable materials end up in landfills while the rising demand for electronics results in intensified mining of raw materials, which come with their own set of environmental and social impact.

"Their other option is to do open burning. They just burn the component and get the metal. That can give them a higher revenue," says Mo.

Source: Tan (2021)

Philippines



Philippines's Situation

Consumption of electronics have grown exponentially in the last 15 years.

There is a lack of a proper e-waste management framework and infrastructure to deal with massive e-waste generation

Process:

- E-waste generated from large-scale manufacturers is usually sent to either waste treatment facilities located in the nearby export processing zones or to licensed waste treatment units for proper waste treatment and disposal, typically a Treatment, Storage and Disposal facility accredited by the Department of Environment and Natural Resources (DENR)
- Formal recyclers in the Philippines are mainly transporters of metal scraps and crushed electronic components for exports and further material recovery in other countries.
- Due to limited waste disposal infrastructure, a great quantity of processed waste is exported to other countries from the Philippines for further metal recovery

Near end of life electronic devices are refurbished and resold in surplus stores, which become a source of livelihood for many households

Source: Alam (2016), Honda (2016)

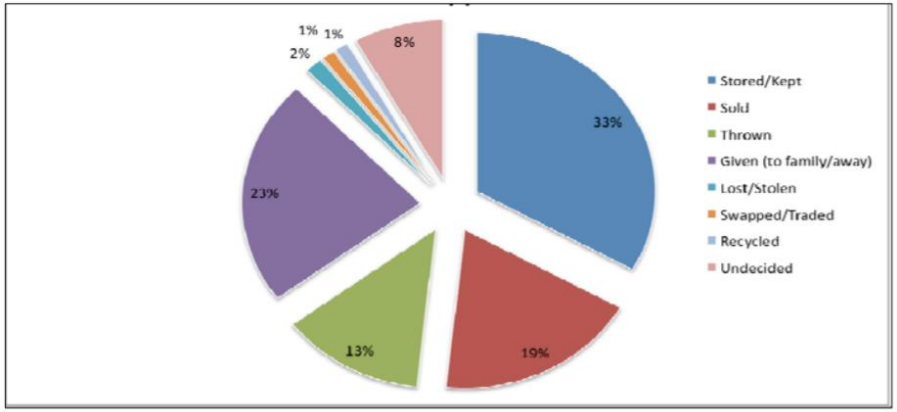


Figure 1. Common disposal methods for cellular phones in the Philippines.

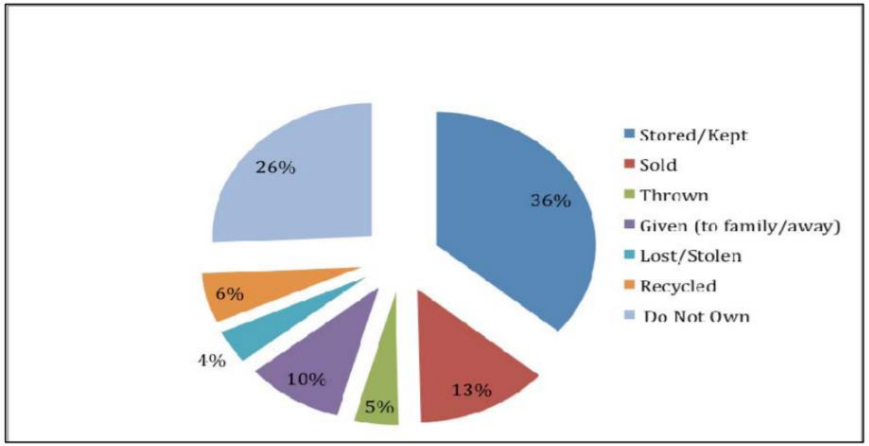


Figure 2. Common disposal methods for laptops/desktop computers in the Philippines.

Extra Statistics

- **70%** of discarded metal present in landfills come from discarded and improper recycling of e-waste
- **31%** of Filipino citizens do not know about e-waste
- **Near 100%** of the respondents had no idea on what happens to their electronic devices in terms of e-waste management

Source: Alam (2016)

Pillar	Stage	Description
Legal Framework	Medium	• Philippines ratified the Basel Convention in 1993, but it is not party to the Ban Amendment. There is no specific law to address e-waste management in the Philippines. However, e-waste is categorized as a hazardous waste in the legal framework for hazardous waste management and the overall framework for e-waste management falls under two legislations: • The Ecological Solid Waste Management Act of 2000 (RA 9003) and its implementing rules and regulations, DAO1992-29 classifies consumer electronics and white goods as special wastes that must be handled separately from other residential and commercial wastes. However, there are no guidelines that specify how to handle them. • The Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990 (RA 6969) regulates the handling, storage, and disposal of hazardous materials that are found in electronic products. Although the law recognizes the hazardous components of EEE, it does not have any specific provision for the management of e-waste. • DAO No.28 Series 1994, Department Administrative Order No. 28, Series of 1997, Department Administrative Order No. 27, Series of 2004, and Department Administrative Order No. 66, Series of 2004, allows import and export of recyclable materials containing hazardous substances under limiting conditions. It requires importers to first register with DENR and obtain import clearance for each shipment. The Environment Management Bureau under the DENR has implemented an online application system for permitting and monitoring, including applications for import of used EEE. • A proposal on E-waste and Cellular Phones Recycling, Senate Bill 911, 2013 is under discussion. It would ensure environmentally sound management of e-waste under specific guidelines. However, this is as yet not in force at the time of publication.
Collection Mechanism	Low	The municipality is responsible for e-waste collection under RA 9003-waste. However, there is no functional system initiated by the government for e-waste collection, which is, as a result, either disposed together with the municipal waste or scavenged by the informal sector.
Processing Infrastructure	Low	• There are limited formal processing facilities for dismantling, sorting, segregating and compacting e-waste, though many are being developed. They export the fractions to other countries for final smelting and material recovery. • Backyard practices include dismantling and metal recycling/recovery using manual techniques and rudimentary processes. • Treatment, Storage and Disposal (TSD) facilities for hazardous wastes also accept e-waste for final disposal. As of December 2014, there were 20 TSDFs in the Philippines.
EHS Standards	Low	• Licensed recyclers/formal recyclers are required to follow a minimum set of environmental and safety standards for operation. Most of TSD facilities in the Philippines are partly invested by international recycling companies, and they introduce international standards on ESM for hazardous wastes. However, the informal sector involved in recycling takes few precautions while involving itself in e-waste activities. They dismantle e-waste with bare hands or using simple tools and recover metal by burning wires or integrated circuit boards, which exposes workers to toxic fumes.

Source: Honda (2016)

Informal recycling markets in China, India, Pakistan, Vietnam, and the Philippines handle anywhere from 50 percent to 80 percent of this e-waste, often shredding, burning, and dismantling the products in "backyards." Emissions from these recycling practices are damaging human health and the environment.[2]

Globally, it is estimated that more than 50 million metric tons of e-waste is produced per year and its continued importation and the increased local generation in the Philippines has become a cause for concern. Roughly 80% of these e-waste end up in landfill which makes the informal community and adjacent environment susceptible to toxic hazards.

Source: BusinessMirror (2021), McAllister (2013)

Vietnam

Vietnam’s Situation

There exists a second-hand market for electronics for many Vietnamese citizens who cannot afford to buy the latest electronics, but would like to maintain a lifestyle that heavily relies on information technology.

Informal businesses and trades go on without much control and consideration for the environment, because **awareness about both the environmental damage caused by current practices, and the value contained in electronic devices are very low**.

Process of informal businesses/trades:

- Materials that are of known value are cherry-picked and traded/resold with limited disassembly
- Takes place in the black market
- Valuable material is exported to China, invaluable material is dumped into the environment

15/150 formal facilities have proper technology to dismantle and recycle e-waste

Bulk generators of e-waste sell to formal facilities, while small generators of e-waste sell to informal businesses/trades

Residual components get dumped into landfills

Source: Honda (2016)

Pillar	Stage	Description
Legal Framework	Medium	• Although the Basel Convention has been ratified, Vietnam is not yet party to the Ban Amendment. • Regulations on the Recovery, Processing and Disposal of Waste Products, Decision No. 50/2013/QD-TTg, that aim at environmentally safe management of e-waste preceded the Regulations on the recovery, processing waste products that came in force from July 2015. • Though e-waste imports are prohibited under Decision No. 20/2006/QD-BBCVT, national waste trade agreements Decision No. 12/2006/QD-BTNMT and Decree no. 12/2006/ND-CP allow scrap materials to be imported as secondary materials for industrial production. They also provide guidelines on implementation of trade laws on temporary importation and re-exportation of commodities (including e-waste). The guiding articles for the Decree No.187/2013/ND-CP regarding the import and export of used information technology products provides the list of banned information technology products. • Regulations on Hazardous Waste Management in force since September 2015 Other relevant legislation and regulations • Chapter VIII of Law on Environmental Protection (1994) stipulates waste management and introduces producer responsibility to recover discarded products including electronic and electric equipment. • Supplemental regulation: List of Hazardous Waste (2006) lists e-waste as a hazardous waste. • Supplemental regulation: Regulation on Companies Engaging in Hazardous Waste Generation, Transportation and Disposal requires a hazardous waste generator to register with a local Office for Natural Resources and Environment, and a hazardous transporter and disposer to apply for a professional license. • National Technical Regulation on Hazardous Waste Thresholds (2009) • The Prime Minister's Decision for the Regulation on Management of Hazardous Waste (1995) prescribes the environmentally sound management of hazardous waste.
Collection Mechanism	Low	Domestic and small businesses sell their e-waste to informal collectors, whereas formal recyclers are able to intercept e-waste only from big organizations.
Processing Infrastructure	Low	Vietnam has an active repair and refurbishment market; however, the country currently does not have the technical capacity to treat e-waste on a large scale. Only 15 companies are authorized to recycle e-waste, and the quantity of waste input received (around 2.5 tonnes per day) is significantly below the capacity for plants to operate profitably[94]. Most of the e-waste is manually recycled in approximately 90 craft villages, which use manual techniques to sort, pre-process, melt and cast the metals from e-waste. The Urban Environment Company (URENCO) is a state-owned company in each province/city that is responsible for collecting and treating waste in Vietnam. URENCO in Hanoi has treated e-waste on an experimental basis since 2009.
EHS Standards	Low	There is an absence of EHS standards in craft villages and no use of masks or safety gear while treating e-waste with chemicals. Wastewater and effluents are discharged into nearby rivers, causing extreme pollution. Residues such as CRT glass and PCBs are then either disposed in open, unmonitored dumps or landfills, or incinerated. Part of e-waste used for energy recovery is incinerated at private facilities that do not comply with national standards.[95] Only two authorized incineration facilities exist in Vietnam.

Source: Honda (2016)

Cambodia

Cambodia's Situation

Increasing demand for gadgets and appliances

No specific laws mandating environmentally safe management of e-waste

Has an import ban: *Article 21 of the Sub-Decree on Solid Waste Management*

- Prohibits the import of hazardous waste from other countries
- However, illegal imports continue

Process:

- E-waste is individually retrieved by informal sector collectors who sell it either to repair shops for dismantling or waste traders
- Reusable parts are kept for sale, recyclable materials are sold to local scrap yard owners for export
- Residues are **burned by owners or discarded in dumpsites or landfills**

Source: Honda (2016)

Pillar	Stage	Description
Legal Framework	Low	Although Cambodia has not issued any laws or regulations for e-waste management (including recycling), the Ministry of Environment, Cambodia, plans to develop a new sub-decree on e-waste management under Law on Environmental Protection and Natural Resource Management. The relevant laws for ESM management of e-waste currently in place are: • Law on Environmental Protection and National Resource Management (December 1996) stipulates the "prevention, reduction, control of airspace, water and land pollution, noise and vibration disturbances as well as waste, toxic substances and hazardous substances". • Sub-decree on Solid Waste Management (April 1999) covers all activities related to disposal, storage, collection, transport, recycling and dumping of garbage and hazardous waste. In this annex of the sub-decree, hazardous waste includes metal waste and the compounds found in e-waste; waste from used or discarded electric lamps; and PCBs from microwave ovens, air conditioners and TVs. In particular, Articles 15, 20 and 21 are the most relevant for e-waste. • Article 8 of Sub-decree on Water Pollution Control stipulates that the disposal of solid waste, garbage and hazardous substances into public water areas or drainage systems shall be strictly prohibited. The storage or disposal of solid waste, garbage and hazardous substances that lead to water pollution shall be strictly prohibited. • Sub-decree on Air Pollution and Noise Disturbance stipulates the strict monitoring of emissions from used electrical and electronic equipment and/or electrical and electronic waste burning. Lack of awareness and knowledge of these laws among implementing officials renders their enforcement ineffective.
Collection Mechanism	Low	E-waste is individually collected by waste-pickers, who transport it by handcart, bicycle, motorcycle or small trucks to either repair shops for dismantling or to waste traders.
Processing Infrastructure	Low	Dismantling and recycling take place largely in the informal sector, mostly manually. Few repair shops and recyclers in Phnom Penh use pumping machines to extract gases from air conditioners and refrigerators. No formal e-waste recycling facilities exist. A "repair and recycling shop" is a kind of a second-hand shop; they buy used equipment for repair and resale, including components and parts that can be used as spares. However, they do not engage in material recovery activities.
EHS Standards	Low	There is a lack of awareness regarding safety and environment during e-waste management. There is no mandate on wearing safety gear during dismantling processes, which has led to several accidents. Free discharge of toxic gases into the atmosphere from equipment results in health and environmental hazards. Residues are burned in dumpsites or disposed of in public places, causing extreme ground, water and air pollution.

Source: Honda (2016)

Indonesia

Indonesia’s Situation

Indonesia has a large and growing electronics sector, driven by greater consumer demands, especially for mobile phones and computers

Ban Amendment in 2005:

- However, e-waste continues to be illegally imported

Active trade in e-waste to China and Hong Kong for recycling, but **residues are burned in open areas or dumped in landfills**

There are a few limited collection centres, but limited to voluntary initiatives

There is low consumer awareness of proper e-waste treatment

Collection and recycling of e-waste takes place in the informal sector:

- E-waste gets dismantled and reused in repair and refurbishment markets, while its non-functional components get **discarded in public dumpsters/end up in landfills**

Source: Honda (2016)

Pillar	Stage	Description
Legal Framework	Low	No specific e-waste management law exists in Indonesia. Although the country has acceded to the Basel Convention and ratified the Ban Amendment, illegal e-waste imports continue. • E-waste is not defined by law and falls under hazardous waste regulation, Government Regulation No. 18/1999 and No. 85/1999, concerning Hazardous Waste Management. The Hazardous Waste Management Regulation Act No. 32/2009 defines hazardous waste management as an activity covering the reduction, storage, collection, transportation and/or its piling. According to Article 59 of this Act, the producer of hazardous waste is legally bound to treat it. Treatment of hazardous waste needs to be a done by a licensed entity. • According to Act No. 32/2009, Article 69 point 1, import of hazardous waste is prohibited into the country. • Under the Ministry of Trade Decree No. 48/2011 concerning the import of second-hand computers and monitors, Article 12 states the conditions under which the imports of the above items are allowed. On the 30 May 2016 the Indonesian Ministry of Trade approved Regulation 41/2016 on the amendment of Regulation No. 82/2012 on import requirements for cellular phones, handheld computers, and tablet computers[110]. A draft on Ministerial Decree for Indonesia National E-waste Management which is based on the EPR principle is being developed.
Collection Mechanism	Low	Most of the country's e-waste is collected by informal collectors or scavengers and classifiers.[111] Households sell e-waste to scavengers, and institutions sell it to classifiers. Scavengers sell the e-waste to aggregators who sort the waste and sell it to classifiers for further processing. Six formal collection facilities in Java and one in Tangerang collect e-waste from household communities and institutions, segregate it, pack and send it out for export or domestic sale.[112]
Processing Infrastructure	Low	Informal classifiers are involved in manual dismantling and reusing components, which is hazardous to health. Unusable parts are dumped into landfills or incinerated. The classified and sorted items are then recycled for material recovery by processors and recyclers. Three formal recyclers are reported to have reconditioning and smelting facilities in Java, and there is one dismantling facility and a few smelting facilities in Batam Island.
EHS Standards	Low	There is currently a lack of environmental and safety compliance in the informal sector. Classifiers do not take any safety precautions while manually dismantling electronic products. Residues generated post dismantling and recycling processes are either dumped in landfills or burned in open areas, causing extreme soil, water and air pollution.

Source: Honda (2016)

Thailand

Thailand’s Situation

51.3% of e-waste is sold to the informal sector or junk shops

25.3% is stored by consumers

15.6% is disposed along with other wastes

7.8% is donated/given to relatives for further use

Most e-waste is collected and processed by the informal sector who use hazardous techniques to dismantle and recycle the e-waste collected from households and offices

- **Residues are disposed of in municipal waste stream or burned in the open**

Some e-waste is donated to charity organizations where products are refurbished and resold to the public

- Helps to generate work for people living in nearby communities

Collection services are also offered by the Local Administration Office (small formal recycling firm), but collected quantities are extremely low and usually **end up being disposed in landfills**

Source: Honda (2016)

Pillar	Stage	Description
Legal Framework	Low	No specific law for e-waste management exists in Thailand. A draft of legislation, known as the Thai Draft WEEE Bill proposed in November 2014, was based on EPR principles. However, until 2016 at the time of publication, this Bill was not passed. The country is party to the Basel Convention but not to the Ban Amendment. E-waste management falls under the Hazardous Substance Act B.E 2535 (1992) and its amendment B.E 2556 (2013). E-waste falls under the following categories under the act: • No. 5.2 category: Chemical Wastes, type 3 must obtain a permit from Department of Industrial Works. • No. 5.3 category: Used EE Appliance, type 3 is exempted from getting a permit and registration but it is required for importing used EEE.
Collection Mechanism	Low	Limited collection services for e-waste are offered by municipalities and local administration offices. However, most of the household e-waste is collected by the informal sector. Some international e-waste recyclers offer collection services to businesses and industrial users,
Processing Infrastructure	Low	Between 2010 and 2011, formal e-waste recycling/dismantling facilities permitted to recycle e-waste in Thailand went from 22 to 41[122, 123]. Factories use manual techniques and simple tools to dismantle e-waste, as they lack formal dismantling technology. Only limited metal recovery is achieved in Thailand, mainly iron, copper and aluminum.
EHS Standards	Low	According to the Factory Act B.E. 2535, e-waste management facilities are classified as: • Factory type 105: sorting or landfilling facility of wastes • Factory type 106: recycling facility in which unusable industrial products or industrial wastes are utilized to produce raw material or new product. The there is little monitoring or control of environment, safety or health standards in either the formal or the informal sector. There are no measures to protect informal recyclers from inhaling toxic dust and fumes while dismantling and burning electronic waste in order to recover precious metals.

Source: Honda (2016)

Myanmar

Myanmar’s Situation

There is an active informal sector with an established network for collection of end-of-life products and their recycling, repair, refurbishment and parts harvesting

The residues left after the extraction of reusable components, and recyclable materials are either **disposed with solid wastes or burned by owners or discarded in dumpsites or landfills**

Myanmar is yet to establish legal frameworks for e-waste management but e-waste is controlled under Basel Convention

Hazardous waste management is covered in Environmental Conservation Rules 2014

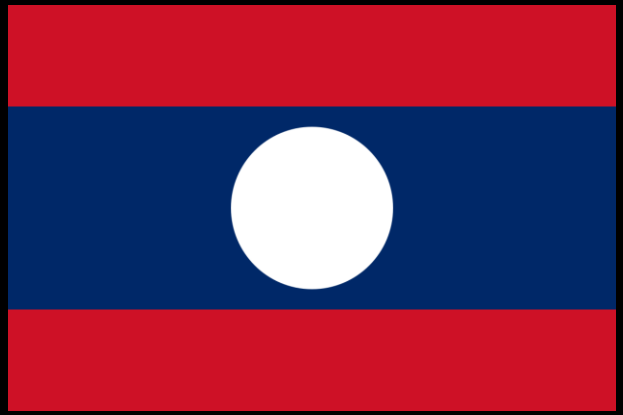
Sources: Latt (n.d.), United Nations (2017)

Master Plan for Improved Hazardous Waste Management in Myanmar (2019-2030):

1. Formulation of regulations for HWM and strengthening the compliance, monitoring and enforcement
2. Raise awareness and build capacities on HWM
3. Gather information on HW generation from various sectors in Myanmar
4. Propose system for cost recovery and implement 'Polluter Pays Principle' in Myanmar
5. Prioritise hazardous waste avoidance, minimisation, recycling and recovery Options
6. Implement environmentally sound hazardous waste segregation, collection and transportation
7. Implement environmentally sound hazardous waste treatment

Source: Latt (n.d.)

Laos



Laos' Situation

Two types of waste recycling processes in Laos

- the first process is the dismantling of value metal, plastic, cable and others by hand
- the second process is the melting of the circuit board

Factories do not meet the proper technical standards and without environmental protection measures which affects workers and people who live near the factory to have **dizziness, severe chest pain, skin irritation** and other negative effects

Laos has issued the second notification No. 1855/PM, dated 17 Nov 2017 to ban the importation of E-waste

No sanitary landfills, usually carry out open dumping and burning

Source: OIE (n.d.)

No specific regulation exists on E-waste. However, there are related laws and regulation such as:

- International law (Basel Convention)
- Environment protection law (2012); Article 38.39.40
- Manufacturing law (2013)
- Ministerial Instruction on Hazardous Waste Management No. 0744/MONRE, 11 February 2015.
- Decree on Environmental Impact assessment (2010)
- Decree on National Environmental Standard (Revised Version 2017)
- Decision on industrial air pollution
- Decision on industrial solid waste management (2012)
- Decision on list of investment to be conducted environment impact assessment (2013);
- Guideline on pollution control (2015).

Source: OIE (n.d.)

Challenges

- Lack of national legislation of E-waste management and disposal
- Lack of capacities and information for E-waste management and disposal, capacity for strengthening of institutions and public information among the responsible institute needed
- There is no E-waste collection system
- At present Lao PDR has not conducted an inventory on E-waste yet
- Insufficient technical knowledge and resources
- E-waste generation rapidly increasing
- Lack of financial assistance

Source: OIE (n.d.)

Brunei

Brunei's Situation

Brunei Darussalam does not have a basic Act on Environment, although it is at the draft stage. It has regulations and guidelines on waste and air pollution and regulations on Hazardous Waste.

With constant technological advancement, people's electronic devices will get replaced quicker

Problems:

- People just lump e-waste with their regular waste [and] in some cases, people have tried to dispose their e-waste through **burning**
- People generally think when their electronics are no longer functioning, they bring them to the **landfill** in Sungai Paku or Sungai Akar

Two companies that handle recycling of e-waste:

- The Green Depot
- Daikyo Environmental Recycling Sdn Bhd

They aim to increase awareness and incentivise customers to donate e-waste

Source: United Nations (2017), Wasil (2018)