E-WASTE

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UNIVERSITI TEKNOLOGI MALAYSIA

ABSTRACT

It can be argued that the technological innovation and advancement of the electronic industry in the 21st century has brought to us humans more advantages compared to its dreaded disadvantages. It is a well-known assumption that these revolutionary electronics invented only gives us an upper hand in civilization advancement. In this context, most of the electronics that we will be referring to are things such as modern-day home appliances, smartphones, electrical vehicles et cetera. However, it has been statistically proven that the number of E-Wastes generated by obsolete electronics has been taking up more space in waste management globally year by year. Furthermore, E-Wastes are known to be a hassle when it comes to properly disposing and recycling it. However, there are strong evidence that tech-giants across the globe that are in this industry is the reason why these problems exist in the first place and why the problem itself is never shed into light. E-Waste will inevitably be an unseen threat to humanity in the future if a solution and counter measures ceases to exist. Countless detrimental effects to the earth are already starting to take form. One of the examples are carbon emission from E-Waste that are inappropriately disposed thar are bringing an even bigger threat to mother earth. No one knows what the aftermath will be if people of this day and age are not taught to partake in the counter measurement of this issue. Nevertheless, today we will be focusing on how E-Waste effects humans and what we can do as a society to improve the current situation.

ABSTRAK

Ia boleh dikatakan bahawa inovasi teknologi dan kemajuan industri elektronik pada abad ke-21 telah membawa kepada kita manusia lebih banyak kelebihan berbanding dengan keburukannya yang digeruni. Ia adalah satu andaian yang terkenal bahawa elektronik revolusioner yang dicipta ini hanya memberikan kita kelebihan dalam kemajuan tamadun. Dalam konteks ini, kebanyakan elektronik yang akan kita rujuk adalah seperti peralatan rumah moden, telefon pintar, kenderaan elektrik dan sebagainya. Walau bagaimanapun, secara statistik telah dibuktikan bahawa bilangan E-Wastes yang dijana oleh elektronik usang telah mengambil lebih banyak ruang dalam pengurusan sisa di seluruh dunia dari tahun ke tahun. Tambahan pula, E-Wastes diketahui menyusahkan apabila melupuskan dan mengitar semulanya dengan betul. Walau bagaimanapun, terdapat bukti kukuh bahawa gergasi teknologi di seluruh dunia yang berada dalam industri ini adalah sebab mengapa masalah ini wujud di tempat pertama dan mengapa masalah itu sendiri tidak pernah didedahkan. E-Waste sudah pasti akan menjadi ancaman yang tidak dapat dilihat kepada manusia pada masa hadapan jika penyelesaian dan langkah balas tidak lagi wujud. Kesan buruk yang tidak terkira banyaknya kepada bumi sudah mula terbentuk. Salah satu contohnya ialah pelepasan karbon daripada E-Waste yang tidak dilupuskan secara tidak wajar malah membawa ancaman yang lebih besar kepada ibu bumi. Tiada siapa yang tahu apa kesudahannya jika orang zaman ini tidak diajar untuk mengambil bahagian dalam ukuran kaunter isu ini. Namun begitu, hari ini kita akan memberi tumpuan kepada bagaimana E-Waste memberi kesan kepada manusia dan apa yang boleh kita lakukan sebagai masyarakat untuk memperbaiki keadaan semasa.

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LIST OF ABBREVIATIONS

E-Waste	-	Electronic and electrical waste.
JAS	-	*"Jabatan Alam Sekitar"* or Department of Environment
Tech-giants	-	Dominant companies in their respective areas of technology.
WHO	-	World Health Organization

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Problem Background

As time progresses, us humans has always been taking big leaps forward when it comes to the ever-advancing technological innovations in the electronics industry. Electronical inventions these days has helped humanity progress at a much faster rate, it helps us go through and complete our daily tasks with ease. However, as soon as these huge piles of electronics are either no longer working, needed, or have become obsolete, a new problem has dawned on us. Therefore, this research paper will be discussing about the new profound problem called E-Waste and its effects not only to us, but to mother nature. We will also be focusing on who and how the effects of E-Waste can be reduced with correct counter measures.

The issues are partially related waste management, but mostly related to the electronics that are not disposed properly. For example, most household electronical appliances are not thrown away properly with correct counter measures. Meanwhile, most electronics that are found in the waste bin turn out to be functional if it were to be given the correct care and fixing, and some of them can even be repurposed as it was still functional. All and all, this has caused E-Waste into becoming an even bigger problem these days. Malaysia's E-Waste management is so out of hand that it has been estimated that the country produces more than 365,000 tonnes of E-Waste every single year, and that amount is heavier than the weight of the Petronas Twin Towers.

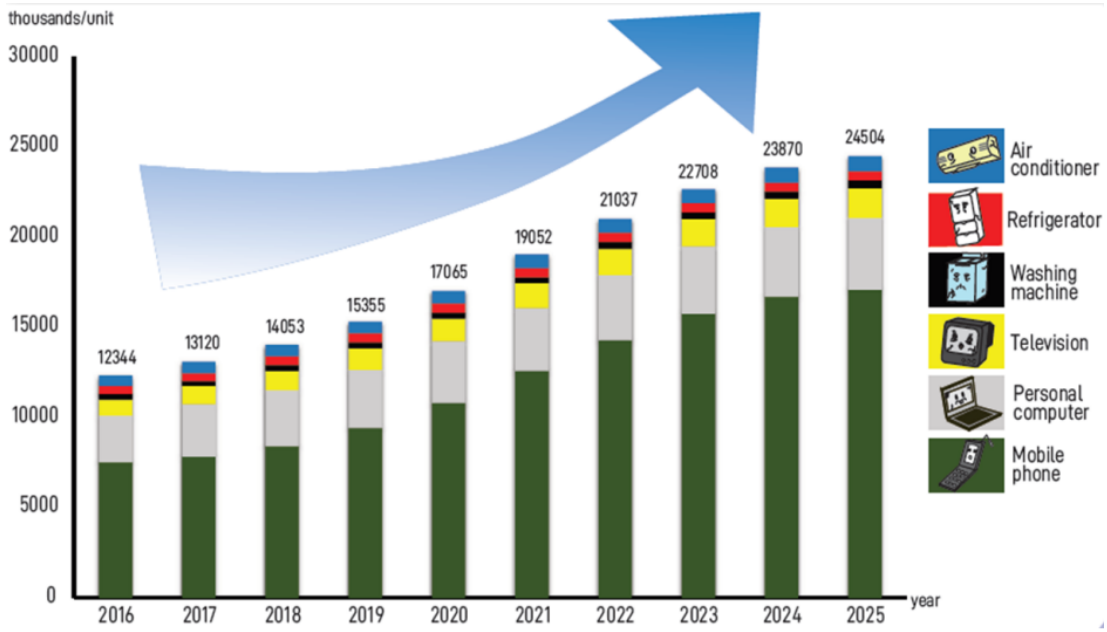

Figure 1.1 - Infographic of E-Waste by Jabatan Alam Sekitar (JAS)

As we can see from Figure 1.1 above, Jabatan Alam Sekitar estimates that the amount of E-Waste produced each year will reach a staggering 24,504 by the year 2025. It might not seem like a huge amount, but the cumulative result suggests otherwise as the tally would be at around 200,173 E-Wastes produced in a period of a decade. Electronics such as mobile phone, personal computer, and television are one of the few E-Wastes that are produced the most each year, and it can be linked to the business practices of tech-giants

1.2 Problem Statement

There are a number of reasons why E-Waste produced each year are only skyrocketing and not slowing down. At the moment, it is currently really difficult to tackle to problem of recycling E-Wastes as there are many limitations to it.

a. 1.3 Research Goal

i. 1.3.1 Research Objectives

The objectives of the research are :

(b) To learn more about the current issues regarding E-waste.

(c) To learn more about why it is so difficult to recycle E-waste.

(d) To learn about how consumers can help counter the issue of E-waste.

(e) To learn more about what industry leading companies can do to help reduce E-waste.

CHAPTER 2

WHY RECYCLING E-WASTE IS DIFFICULT

2.1 Introduction

This chapter will be discussing about why recycling e-waste is difficult and at certain times, even almost impossible at some places. The common practice of recycling common wastes is by breaking it down into its original reusable material. In the case of recycling E-waste, it is very much more complex and different from recycling common wastes. Most E-wastes require breaking down the components into individual recyclable parts, and these parts often contain elements such as cadmium, lead, antimony, nickel, and mercury that requires an even more complicated process to completely separate and recycle it. For the most part, recycling E-waste requires professional training as it is very complex and precise.

2.2 Too Many E-Waste

There are simply too many E-waste produced globally each year. This is due to the ever-growing demand for new electronic appliances. Growing population is also one of the factors for the amount of E-wastes that are increasing yearly. Things such as fast electronic appliances development has also led to rapid replacement of older devices.

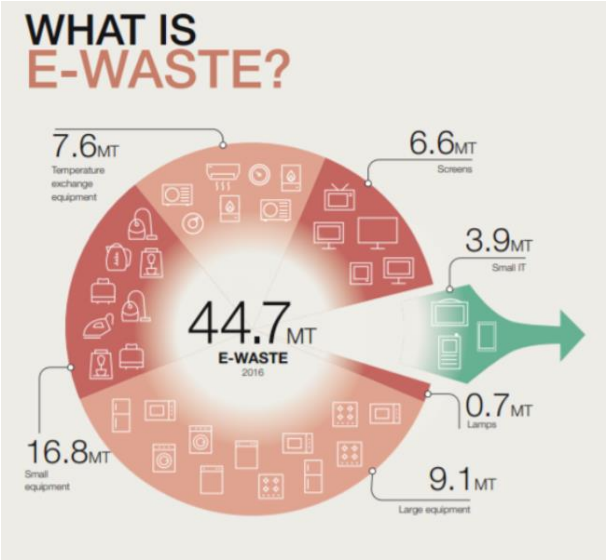

Figure 2.1 - Infographic by World Economic Forum

According to Figure 2.1, there are 44.7 metric tonnes of E-wastes that are produced on the year 2021 across the globe. This is almost as heavy as the Great Wall of China which is 21,196 kilometres. The amount of E-wastes produced outweighs the amount of E-waste we can handle and recycle as a whole, and most of the E-waste produced are just left at the dumpsite without being carefully disposed.

2.3 Lack of Manpower

As we have mentioned previously, recycling E-waste requires complicated steps to break down the components into individual recyclable parts. And these processes require professional training as the elements that are contained in those components are mostly toxic. And as for now, there is just simply not enough people that are active in this industry.

2.4 Toxic Materials

E-waste contains most of harmful elements such as cadmium, lead, antimony, nickel, and mercury which when handled inappropriately, will cause health problems to people who are exposed to it.

2.5 Health Risks

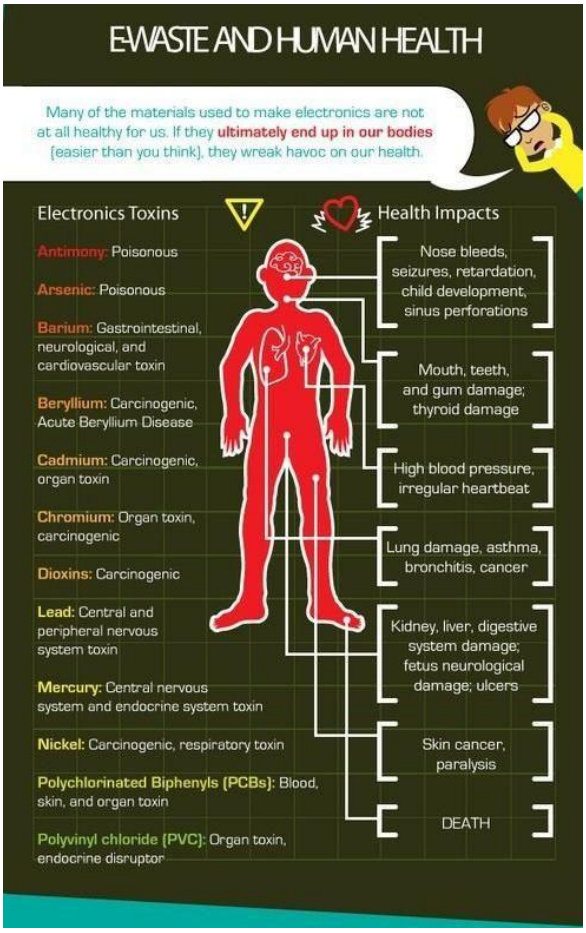

Figure 2.2 – Effects of E-waste on Human Health

Over 1,000 dangerous compounds, including lead, mercury, nickel, brominated flame retardants, and polycyclic aromatic hydrocarbons, pose a risk of exposure to workers trying to extract valuable commodities like copper and gold (PAHs).

When a pregnant woman is exposed to harmful E-waste, it can have long-term effects on the health and development of her unborn child. Negative birth outcomes, such as stillbirth and early deliveries, as well as low birth weight and length, are examples of potential detrimental health implications. Lead exposure from e-waste recycling operations has been linked to significantly lower scores on the neonatal behavioral neurological evaluation, higher rates of ADHD, behavioral issues, changes in children's temperament, sensory integration issues, and lower cognitive and language scores.

Additional negative consequences on children's health associated with e-waste include abnormalities to lung function, pulmonary and respiratory effects, DNA damage, impaired thyroid function, and an increased risk of several chronic diseases later in life, such as cancer and cardiovascular disease.

Figure 2.3 – Children in Ghana collecting E-waste

Many nations have not yet recognized this growing problem as a health hazard. Children's health will suffer tremendously if they do not take action, and there will be a significant financial burden on the health sector in the years to come.

2.6 Lack of Knowledge

People in general are just not taught on how to dispose E-waste correctly at this day and age. Schools should have classes regarding on how to properly dispose E-waste so that it does not affect their own health and the environment. Most people just put E-wastes together with general waste as they do not know how crucial it is to separate both for better waste management.

2.7 Chapter Summary

a) Recycling E-waste is generally difficult for now without initiatives from WHO and the local government.
b) An overwhelming amount of E-waste is produced each year, making the situation even worse.
c) Lack of manpower is caused by disinterests in people regarding managing and recycling E-waste properly.
d) There are many toxic materials contained in a single E-waste that can pose health risks to humans if not disposed correctly.
e) The knowledge on how to properly recycle and manage E-waste is a must in order for our future generations to have a better fight against this issue.

CHAPTER 3

WHAT CONSUMERS CAN DO

3.1 Introduction

As consumers, there are a lot of counter measure we can take in order to help reduce E-waste as consumers are the ones that are partially responsible for the number of E-wastes produced. Consumers should take responsibility and do what they can in order to help fight this issue.

3.2 Self-Repair, Rebuild, and Repurpose

Self-repair is the act of repairing something by oneself in order to prolong the life of a certain product. When it comes to broken electronic appliances or E-wastes, self-repairing is almost always the way to go when it comes to dealing with it. This is because the act of self-repair is much cheaper compared to sending E-waste into the shop for repair. Learning how to self-repair electronics can also be considered as a life skill. By self-repairing, consumers can repurpose E-wastes mindfully while also prolonging the lifespan of the product.

3.3 My E-Waste App

Due of people's increased reliance on electrical and electronic technology in their daily lives, e-waste has become a global issue. Increase in production of electrical and electronic equipment is a result of rapidly developing technology. More e-waste must therefore be managed and disposed of in a proper and appropriate way.

E-waste can be dangerous to life, impair human health, and degrade environmental quality if it is merely disposed of at dump sites, incinerators, or transported to underdeveloped areas since it contains harmful compounds that can harm both the environment and human health. In addition, precious metals and other recyclable items may be present in e-waste.

Figure 3.1 – Instructions on How to Dispose E-Waste Using My E-Waste App

The MyEwaste program supports initiatives under Goal 6 of the Sustainable Development Goals (SDG) of the United Nations and is also a part of efforts being made to develop a circular economy. Users and waste-generators (citizens) are accountable for disposing of their electronic trash at recycling facilities approved by the Department of the Environment in order to ensure the sustainable management of e-waste (Jabatan Alam Sekitar, JAS). The MyEwaste application, which is currently under development, will inform the public about e-waste as well as the location and hours of operation of JAS-registered collection facilities where individuals can bring their e-waste for proper disposal.

3.4 Chapter Summary

f) Consumers can and should take action in playing their role in order to reduce E-waste.

g) Self-repair is almost always the way to go when it comes to dealing with broken E-waste.

h) The Malaysian Government's Department of Environment (JAS) is also playing their role in providing solution to properly dispose E-waste.

CHAPTER 4

WHAT INDUSTRY LEADING COMPANIES CAN DO

4.1 Introduction

Industry leading companies or the so called *"Tech-giants"* such as Google, Apple, and Samsung can help reduce the impacts of E-wastes in a number of ways. This is because most electronical appliances have a planned-obsolescence lifespan, meaning the products that are produced by these companies are meant to break when time comes. Instead of planned-obsolescence and software barriers, these *"Tech-giants"* should instead focus on the Right to Repair of consumers and making products that are easily repaired.

4.2 Right to Repair

Right to Repair is a lawful government legislation that allows consumers to have the ability to repair and modify their own products. Manufacturers such as Google and Samsung often disregard the Right to Repair of consumers by putting software restrictions when consumers try to repair their own products. These obstacles often lead to higher costs that drives consumers to buy another device instead of repairing them.

Figure 4.1 – Apple's Self-Repair Program

Apple has been one of the first few companies that actually do offer Self-Service Repair program to consumers after being pressured by the people. This encourages self-repair practices for consumers and helps keep the longevity of their products. Apple, being one of the *"tech-giants"* can actually help kickstart a catalyst that pressures more manufacturers and companies to include Right to Repair in their products or even make their products more repair friendly with lesser software barriers.

However, it is not without its cons as these Right to Repair services often cause more harm to the environment with increased carbon emission as too many equipment are required to fix their products.

4.3 Modular Electronic Appliances

Modular Electronical Appliances are electronic appliances that contain parts that are modular and easily accessible. This means each part can be swapped out with a new one when it ceases to function properly. This can massively reduce E-waste as only the broken parts are needed to be fixed while the other remaining functioning parts remain intact.

Figure 4.2 – First Mass Produced Framework Laptop

Framework is one of the first few companies that are currently producing Modular Laptops. Each of its parts such as the camera, USB ports, and even the motherboard is replaceable.

4.4 Chapter Summary

a) Industry leading companies and manufacturers can and should provide repairability to consumers.
b) Right to Repair is gaining huge traction, which makes Apple introduce their Self-Repair Program.
c) Modular Electronical Appliances are the future if we want to reduce E-waste as a whole.

CHAPTER 5

CONCLUSION

5.1 Research Outcomes

E-waste are electronic appliances that are no longer needed, working, or are already obsolete. However, it should also be handled or properly disposed with care. This is because E-waste in general is considered as a harmful waste. Malaysia produces E-waste equivalent to the weight of Petronas Twin Towers each year, and it should be a concern to the public.

Fortunately, the Malaysian Government's Department of Environment is taking counter measures in helping to combat the problem of E-waste It is a very tough topic to tackle for now, but it won't be staying in this position soon.

5.2 Contributions to Knowledge

The findings of this thesis paper may contribute to the Department of Environment of Malaysia and aspiring students and consumers who wants to learn more about Right to Repair.

Appendix A REFERENCES

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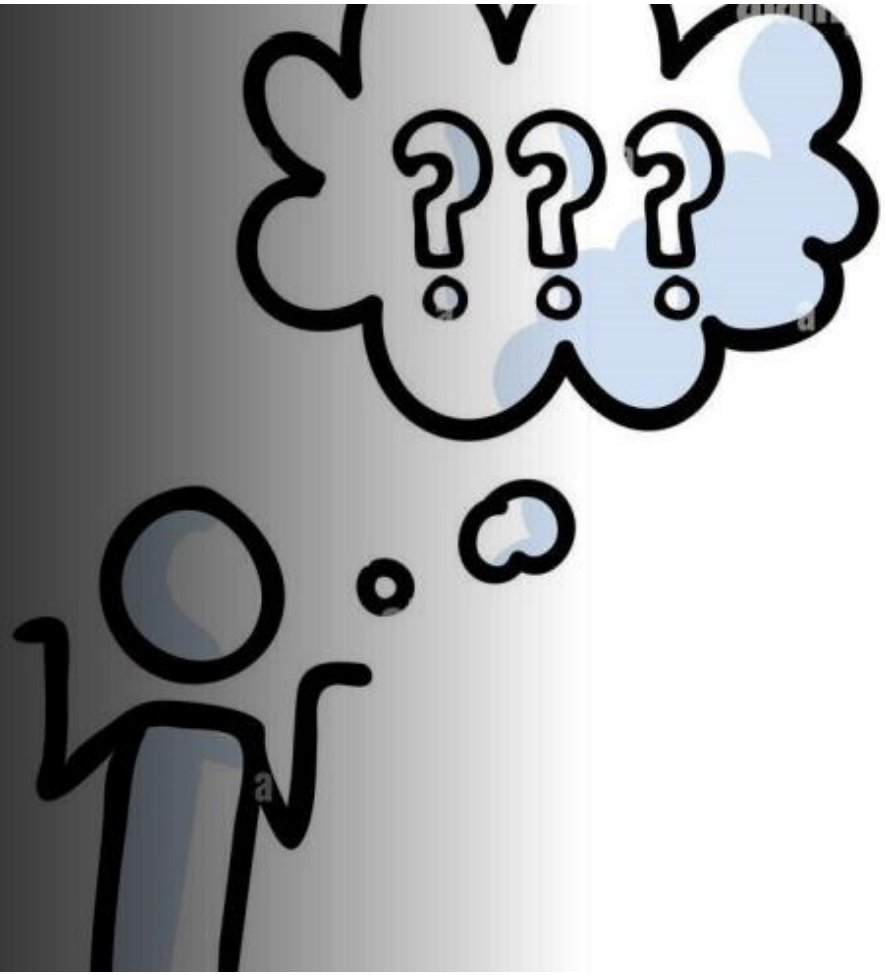
Appendix B Presentation Slides


E-Waste
Never refuse to rebuild, reuse, and repurpose.

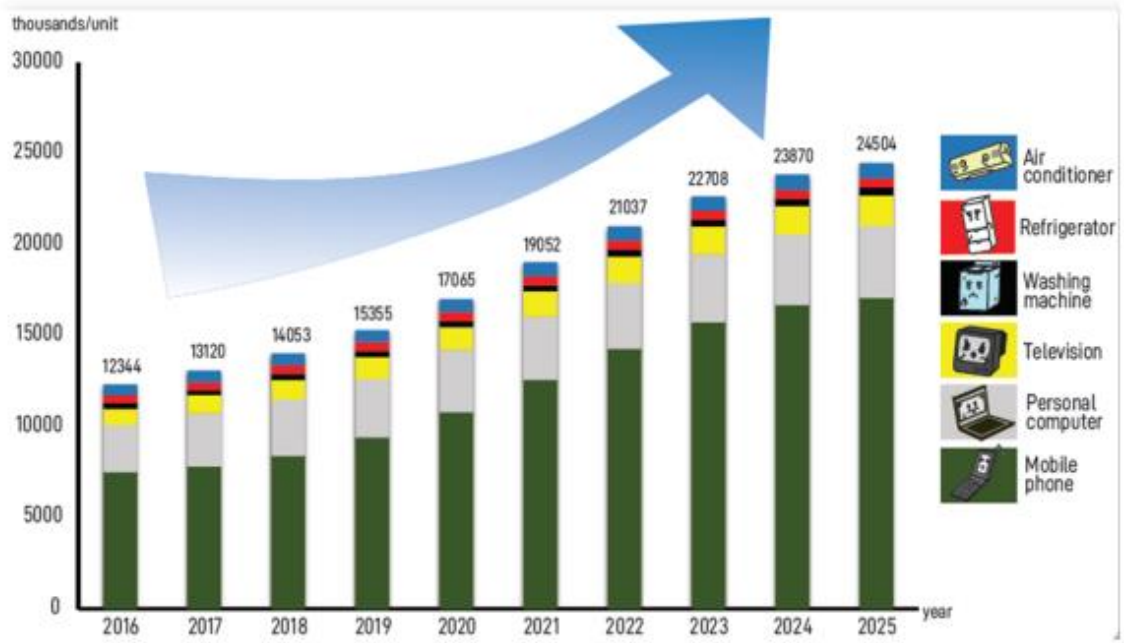
What is E-Waste?

E-Wastes are electronic appliances that are no longer needed, working, or are already obsolete.



It's been estimated that Malaysia produces more than 365,000 tonnes of e-waste every single year — That's heavier than the weight of the Petronas Twin Towers!

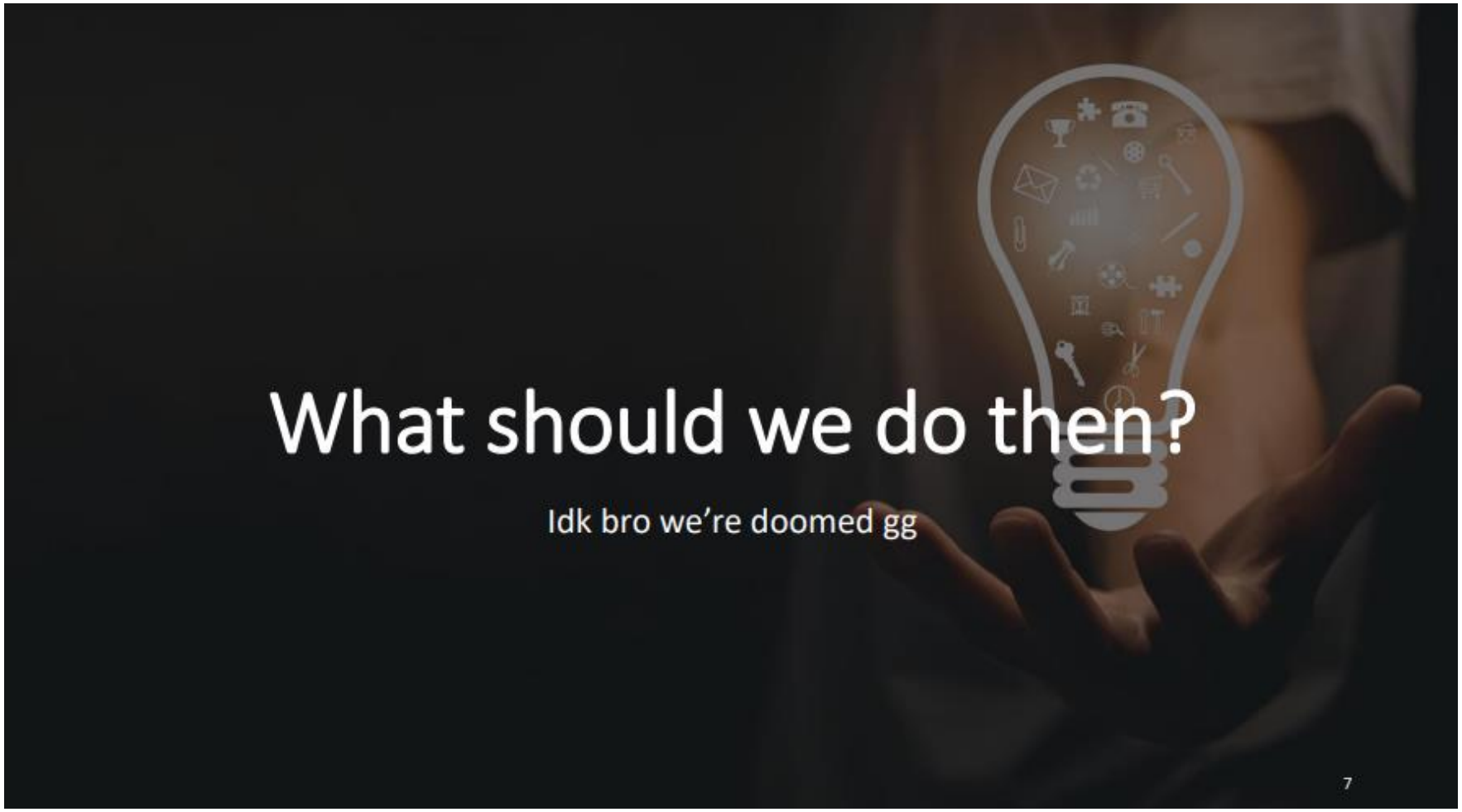
Asia generates the highest volume of e-waste in 2019, around 24.9 Mt, followed by the Americas (13.1 Mt) and Europe (12 Mt), while Africa and Oceania generated 2.9 Mt and 0.7 Mt respectively.



Infographic Jabatan Alam Sekitar

5


Why is it so difficult to recycle E-Waste?
01
Huge amount of it
There is simply too many E-Wastes produced each year.
02
Lack of manpower
There is not enough manpower to keep up with it.
03
Toxic Materials
- Lead
- Lithium
- Mercury
04
Health Risks
Inhaling toxic materials that could lead to blood and kidney cancer.
05
Lack of knowledge
The knowledge on how to properly dispose E-Waste is not widespread.
6


What should we do then?
Idk bro we’re doomed gg
7

Ways to counter E-Waste problem

What we can do

Self-repair or rebuild

MyEwaste

MyEwaste App

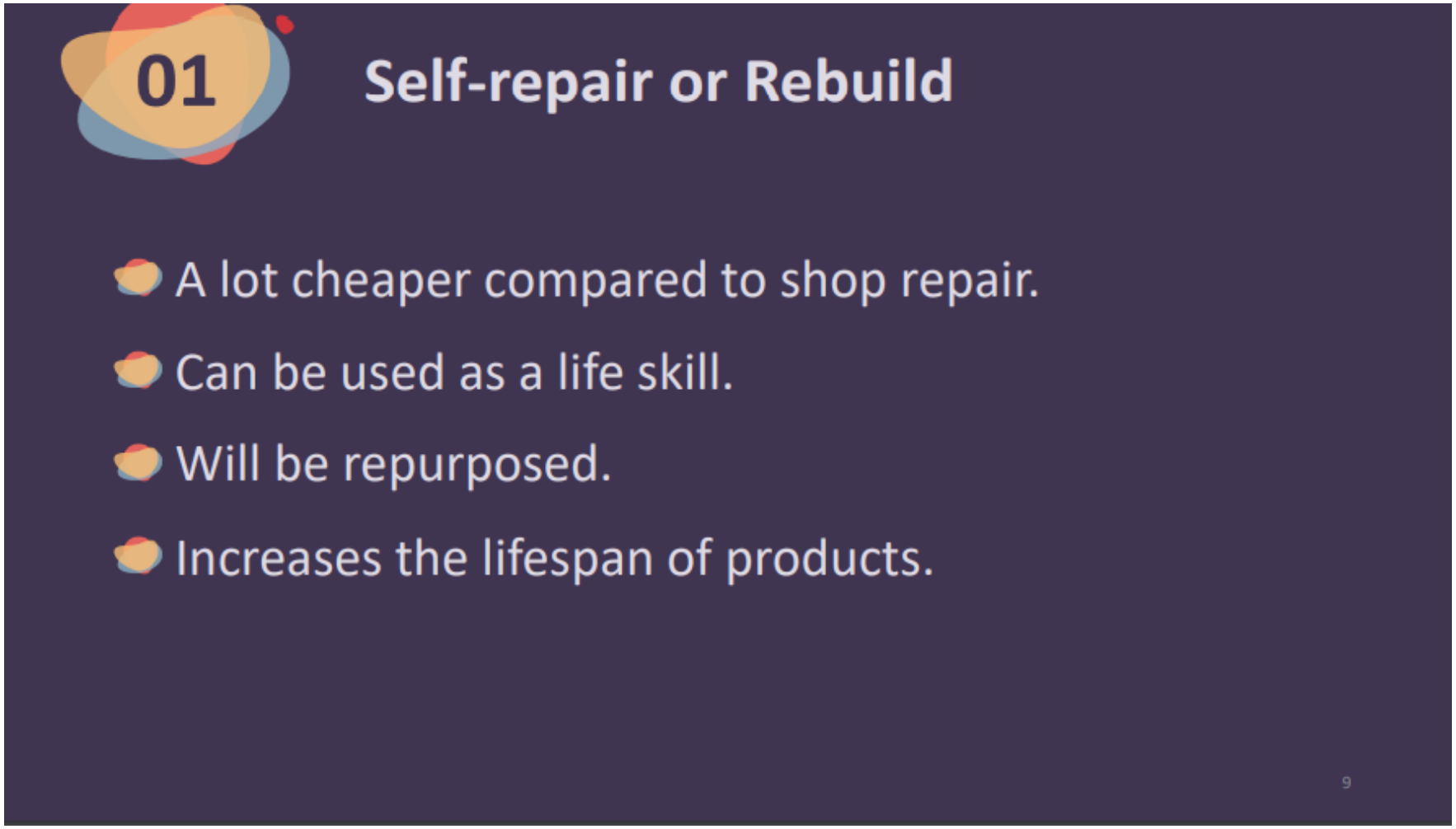
What big companies can do

RIGHT TO REPAIR

Right to Repair

Modular Electronic Appliances

8


01
Self-repair or Rebuild
A lot cheaper compared to shop repair.
Can be used as a life skill.
Will be repurposed.
Increases the lifespan of products.
9

02

MyEwaste App

10


03
Right to Repair
Consumers should have every right in repairing their own products.
Self-repair can only go so far.
Some electrical hardware are software tethered.
Proprietary equipments are needed.
11

Apple's Self-Service Repair

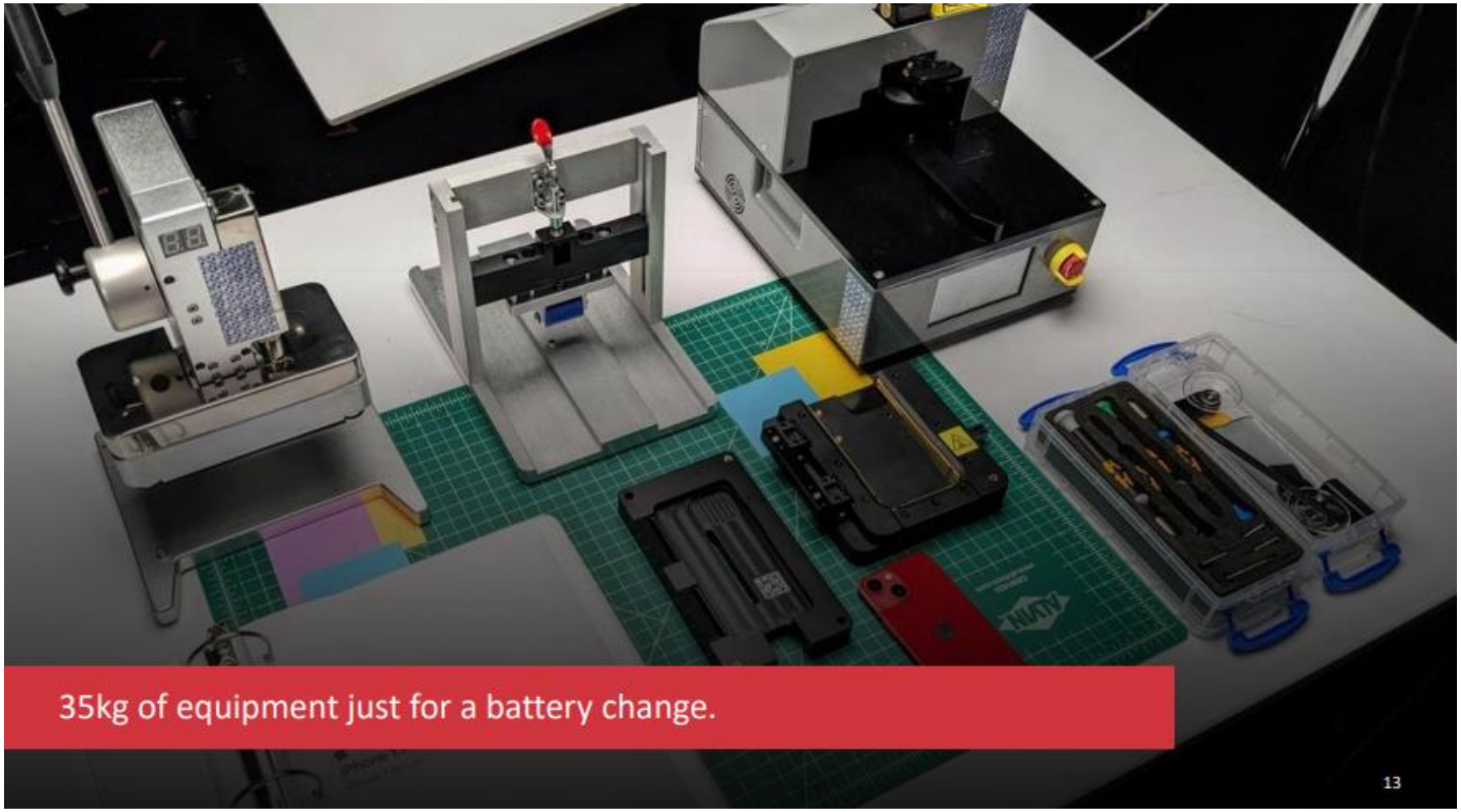
PROS

- Encourages self-repair practice.
- Helps keep the longevity of the product.
- Kickstart Right to Repair in the industry.

CONS

- Increased carbon emission.
- Too many equipments are required.
- Only available in certain regions.

12


35kg of equipment just for a battery change.
13

04

Modular Electronic Appliances

- Framework released a modular laptop.
- Each part can be changed.
- Long lifespan.
- What if all electrical appliances are like this?

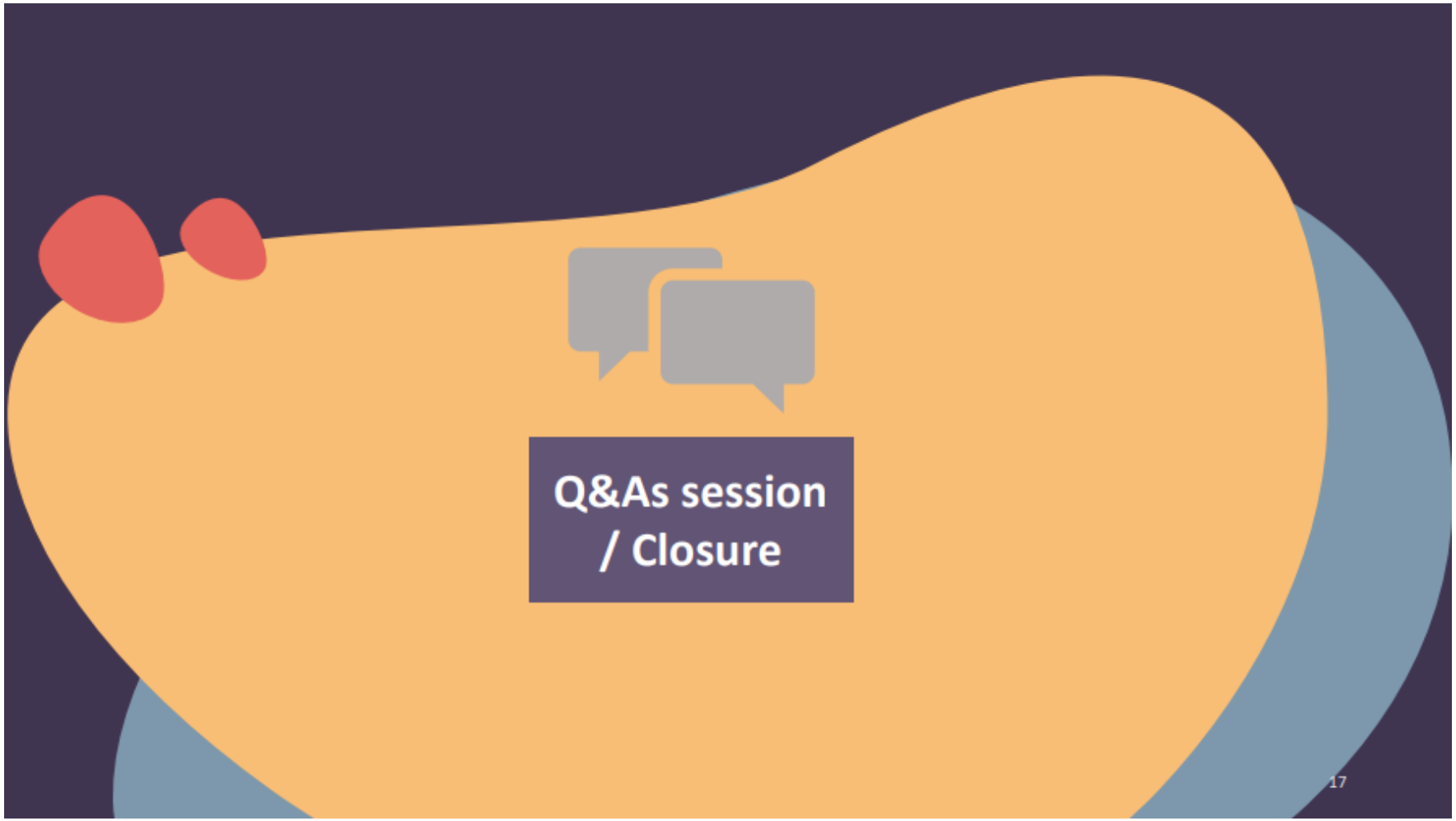
14

Framework Modular Laptop

WHY

Will E-Waste be solved?

16


Q&As session
/ Closure
17

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THANK YOU!

Appendix C Turnitin Originality Report

Turnitin Originality Report

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Li, Jinhui, Xianlai Zeng, Mengjun Chen, Oladele A. Ogunseitan, and Ab L. N. Stevels. ""Control-Alt-Delete": Rebooting Solutions for the E-waste Problem", Environmental Science & Technology

E-WASTE BEN LIM CHOONG CHUEN UNIVERSITI TEKNOLOGI MALAYSIA ABSTRACT It can be argued that the technological innovation and advancement of the electronic industry in the 21st century has brought to us humans more

advantages compared to its dreaded disadvantages. It is a well-known assumption that these revolutionary electronics invented only gives us an upper hand in civilization advancement. In this context, most of the electronics that we will be referring to are things such as modern- day home appliances, smartphones, electrical vehicles et cetera. However, it has been statistically proven that the number of E-Wastes generated by obsolete electronics has been taking up more space in waste management globally year by year. Furthermore, E-Wastes are known to be a hassle when it comes to properly disposing and recycling it. However, there are strong evidence that tech-giants across the globe that are in this industry is the reason why these problems exist in the first place and why the problem itself is never shed into light. E-Waste will inevitably be an unseen threat to humanity in the future if a solution and counter measures ceases to exist. Countless detrimental effects to the earth are already starting to take form. One of the examples are carbon emission from E-Waste that are inappropriately disposed thar are bringing an even bigger threat to mother earth. No one knows what the aftermath will be if people of this day and age are not taught to partake in the counter measurement of this issue. Nevertheless, today we will be focusing on how E-Waste effects humans and what we can do as a society to improve the current situation. ABSTRAK TABLE OF CONTENTS TITLE PAGE ABSTRACT i ABSTRAK iiTABLE OF CONTENTS iii LIST OF TABLES iv LIST OF FIGURES v LIST OF ABBREVIATIONS vi LIST OF APPENDICES vii CHAPTER 1 INTRODUCTION 1 1.1 Problem Background 1 1.2 Problem Statement 2 1.3 Research Goal 3 1.3.1 Research Objectives 3CHAPTER 2 LITERATURE REVIEW 3 2.1 Introduction 3 2.2 Advantages and Disadvantages 3 2.3 Conclusion 5 CHAPTER 3 DISTRACTED AUTONOMOUS CAR USER 6 3.1 Introduction 6 3.1.1 About Tesla Cars 6 3.2 Chapter Summary 7 CHAPTER 4 CONDITIONAL AUTOMATED CARS BETA TESTING IN MALAYSIA 8 4.1 The Big Picture 8 4.2 Chapter Summary 9 CHAPTER 5 CONCLUSION AND RECOMMENDATIONS 10 5.1 Research Outcomes 10 5.2 Contributions to Knowledge 10 LIST OF TABLES TABLE NO. TITLE PAGE LIST OF FIGURES FIGURE NO. TITLE PAGEFigure 1.1 Figure 3.1 Figure 4.1 Levels of Driving Automation 1 Example of Formatting Method 6 Viral Tiktok showcasing Tesla Autopilot hands-free 8 LIST OF ABBREVIATIONS E-Waste - Electronic and electrical waste. JAS - "Jabatan Alam Sekitar" or Department of Environment Tech-giants - Dominant companies in their respective areas of technology. WHO - World Health Organization - LIST OF APPENDICES APPENDIX TITLE PAGE Appendix A References 11 Appendix B Presentation Slides 12 Appendix C Turnitin Originality Report 27 CHAPTER 1 INTRODUCTION 1.1 Problem Background As time progresses, us humans has always been taking big leaps forward when it comes to the ever-advancing technological innovations in the electronics industry. Electronical inventions these days has helped humanity progress at a much faster rate, it helps us go through and complete our daily tasks with ease. However, as soon as these huge piles of electronics are either no longer working, needed, or have become obsolete, a new problem has dawned on us. Therefore, this research paper will be discussing about the new profound problem called E-Waste and its effects not only to us, but to mother nature. We will also be focusing on who and how the effects of E-Waste can be reduced with correct counter measures. The issues are partially related waste management, but mostly related to the electronics that are not disposed properly. For example, most household electronical appliances are not thrown away properly with correct counter measures. Meanwhile, most electronics that are found in the waste bin turn out to be functional if it were to be given the correct care and fixing, and some of them can even be repurposed as it was still functional. All and all, this has caused E-Waste into becoming an even bigger problem these days. Malaysia's E-Waste management is so out of

hand that it has been estimated that the country produces more than 365,000 tonnes of E-Waste every single year, and that amount is heavier than the weight of the Petronas Twin Towers. Figure 1.1 - Infographic of E-Waste by Jabatan Alam Sekitar (JAS) As we can see from Figure 1.1 above, Jabatan Alam Sekitar estimates that the amount of E-Waste produced each year will reach a staggering 24,504 by the year 2025. It might not seem like a huge amount, but the cumulative result suggests otherwise as the tally would be at around 200,173 E-Wastes produced in a period of a decade. Electronics such as mobile phone, personal computer, and television are one of the few E-Wastes that are produced the most each year, and it can be linked to the business practices of tech-giants 1.2 Problem Statement There are a number of reasons why E-Waste produced each year are only skyrocketing and not slowing down. At the moment, it is currently really difficult to tackle to problem of recycling E-Wastes as there are many limitations to it. a. 1.3 Research Goal i. 1.3.1 Research Objectives The objectives of the research are : (b) To learn more about the current issues regarding E-waste. (c) To learn more about why it is so difficult to recycle E-waste. (d) To learn about how consumers can help counter the issue of E-waste. (e) To learn more about what industry leading companies can do to help reduce E- waste. CHAPTER 2 WHY RECYCLING E-WASTE IS DIFFICULT 2.1 Introduction This chapter will be discussing about why recycling e-waste is difficult and at certain times, even almost impossible at some places. The common practice of recycling common wastes is by breaking it down into its original reusable material. In the case of recycling E-waste, it is very much more complex and different from recycling common wastes. Most E-wastes require breaking down the components into individual recyclable parts, and these parts often contain elements such as cadmium, lead, antimony, nickel, and mercury that requires an even more complicated process to completely separate and recycle it. For the most part, recycling E-waste requires professional training as it is very complex and precise. 2.2 Too Many E-Waste There are simply too many E-waste produced globally each year. This is due to the ever-growing demand for new electronic appliances. Growing population is also one of the factors for the amount of E-wastes that are increasing yearly. Things such as fast electronic appliances development has also led to rapid replacement of older devices. Figure 2.1 - Infographic by World Economic Forum According to Figure 2.1, there are 44.7 metric tonnes of E-wastes that are produced on the year 2021 across the globe. This is almost as heavy as the Great Wall of China which is 21,196 kilometres. The amount of E-wastes produced outweighs the amount of E-waste we can handle and recycle as a whole, and most of the E-waste produced are just left at the dumpsite without being carefully disposed. 2.3 Lack of Manpower As we have mentioned previously, recycling E-waste requires complicated steps to break down the components into individual recyclable parts. And these processes require professional training as the elements that are contained in those components are mostly toxic. And as for now, there is just simply not enough people that are active in this industry. 2.4 Toxic Materials E-waste contains most of harmful elements such as cadmium, lead, antimony, nickel, and mercury which when handled inappropriately, will cause health problems to people who are exposed to it. 2.5 Health Risks Figure 2.2 – Effects of E-waste on Human Health Over 1,000 dangerous compounds, including lead, mercury, nickel, brominated flame retardants, and polycyclic aromatic hydrocarbons, pose a risk of exposure to workers trying to extract valuable commodities like copper and gold (PAHs). When a pregnant woman is exposed to harmful E-waste, it can have long-term effects on the health and development of her unborn child. Negative birth outcomes, such as stillbirth and early deliveries, as well as low birth weight and length, are examples of potential detrimental health

implications. Lead exposure from e-waste recycling operations has been linked to significantly lower scores on the neonatal behavioral neurological evaluation, higher rates of ADHD, behavioral issues, changes in children's temperament, sensory integration issues, and lower cognitive and language scores. Additional negative consequences on children's health associated with e-waste include abnormalities to lung function, pulmonary and respiratory effects, DNA damage, impaired thyroid function, and an increased risk of several chronic diseases later in life, such as cancer and cardiovascular disease. Figure 2.3 – Children in Ghana collecting E-waste Many nations have not yet recognized this growing problem as a health hazard. Children's health will suffer tremendously if they do not take action, and there will be a significant financial burden on the health sector in the years to come. 2.6 Lack of Knowledge People in general are just not taught on how to dispose E-waste correctly at this day and age. Schools should have classes regarding on how to properly dispose E-waste so that it does not affect their own health and the environment. Most people just put E- wastes together with general waste as they do not know how crucial it is to separate both for better waste management. 2.7 Chapter Summary a) Recycling E-waste is generally difficult for now without initiatives from WHO and the local government. b) An overwhelming amount of E-waste is produced each year, making the situation even worse. c) Lack of manpower is caused by disinterests in people regarding managing and recycling E-waste properly. d) There are many toxic materials contained in a single E-waste that can pose health risks to humans if not disposed correctly. e) The knowledge on how to properly recycle and manage E-waste is a must in order for our future generations to have a better fight against this issue. CHAPTER 3 WHAT CONSUMERS CAN DO 3.1 Introduction As consumers, there are a lot of counter measure we can take in order to help reduce E-waste as consumers are the ones that are partially responsible for the number of E- wastes produced. Consumers should take responsibility and do what they can in order to help fight this issue. 3.2 Self-Repair, Rebuild, and Repurpose Self-repair is the act of repairing something by oneself in order to prolong the life of a certain product. When it comes to broken electronic appliances or E-wastes, self- repairing is almost always the way to go when it comes to dealing with it. This is because the act of self-repair is much cheaper compared to sending E-waste into the shop for repair. Learning how to self-repair electronics can also be considered as a life skill. By self-repairing, consumers can repurpose E-wastes mindfully while also prolonging the lifespan of the product. 3.3 My E-Waste App Due of people's increased reliance on electrical and electronic technology in their daily lives, e-waste has become a global issue. Increase in production of electrical and electronic equipment is a result of rapidly developing technology. More e-waste must therefore be managed and disposed of in a proper and appropriate way. E-waste can be dangerous to life, impair human health, and degrade environmental quality if it is merely disposed of at dump sites, incinerators, or transported to underdeveloped areas since it contains harmful compounds that can harm both the environment and human health. In addition, precious metals and other recyclable items may be present in e-waste. Figure 3.1 – Instructions on How to Dispose E-Waste Using My E-Waste App The MyEwaste program supports initiatives under Goal 6 of the Sustainable Development Goals (SDG) of the United Nations and is also a part of efforts being made to develop a circular economy. Users and waste-generators (citizens) are accountable for disposing of their electronic trash at recycling facilities approved by the Department of the Environment in order to ensure the sustainable management of e- waste (Jabatan Alam Sekitar, JAS). The MyEwaste application, which is currently under development, will inform the public about e-waste as well as the location and hours of operation of JAS-

registered collection facilities where individuals can bring their e-waste for proper disposal. 3.4 Chapter Summary f) Consumers can and should take action in playing their role in order to reduce E- waste. g) Self-repair is almost always the way to go when it comes to dealing with broken E-waste. h) The Malaysian Government's Department of Environment (JAS) is also playing their role in providing solution to properly dispose E-waste. CHAPTER 4 WHAT INDUSTRY LEADING COMPANIES CAN DO 4.1 Introduction Industry leading companies or the so called "Tech-giants" such as Google, Apple, and Samsung can help reduce the impacts of E-wastes in a number of ways. This is because most electronical appliances have a planned-obsolescence lifespan, meaning the products that are produced by these companies are meant to break when time comes. Instead of planned-obsolescence and software barriers, these "Tech-giants" should instead focus on the Right to Repair of consumers and making products that are easily repaired. 4.2 Right to Repair Right to Repair is a lawful government legislation that allows consumers to have the ability to repair and modify their own products. Manufacturers such as Google and Samsung often disregard the Right to Repair of consumers by putting software restrictions when consumers try to repair their own products. These obstacles often lead to higher costs that drives consumers to buy another device instead of repairing them. Figure 4.1 – Apple's Self-Repair Program Apple has been one of the first few companies that actually do offer Self-Service Repair program to consumers after being pressured by the people. This encourages self-repair practices for consumers and helps keep the longevity of their products. Apple, being one of the "tech-giants" can actually help kickstart a catalyst that pressures more manufacturers and companies to include Right to Repair in their products or even make their products more repair friendly with lesser software barriers. However, it is not without its cons as these Right to Repair services often cause more harm to the environment with increased carbon emission as too many equipment are required to fix their products. 4.3 Modular Electronic Appliances Modular Electronical Appliances are electronic appliances that contain parts that are modular and easily accessible. This means each part can be swapped out with a new one when it ceases to function properly. This can massively reduce E-waste as only the broken parts are needed to be fixed while the other remaining functioning parts remain intact. Figure 4.2 – First Mass Produced Framework Laptop Framework is one of the first few companies that are currently producing Modular Laptops. Each of its parts such as the camera, USB ports, and even the motherboard is replaceable. 4.4 Chapter Summary a) Industry leading companies and manufacturers can and should provide repairability to consumers. b) Right to Repair is gaining huge traction, which makes Apple introduce their Self- Repair Program. c) Modular Electronical Appliances are the future if we want to reduce E-waste as a whole. CHAPTER 5 CONCLUSION 5.1 Research Outcomes E-waste are electronic appliances that are no longer needed, working, or are already obsolete. However, it should also be handled or properly disposed with care. This is because E-waste in general is considered as a harmful waste. Malaysia produces E- waste equivalent to the weight of Petronas Twin Towers each year, and it should be a concern to the public. Fortunately, the Malaysian Government's Department of Environment is taking counter measures in helping to combat the problem of E-waste It is a very tough topic to tackle for now, but it won't be staying in this position soon. 5.2 Contributions to Knowledge The findings of this thesis paper may contribute to the Department of Environment of Malaysia and aspiring students and consumers who wants to learn more about Right to Repair.