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E-waste management in achieving SDGS in Negara Brunei Darussalam: Maqasid Shariah Perspective

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Abstract. 'Electronic waste', 'Waste Electrical and Electronic Equipment' or commonly known as 'E-waste' or 'WEEE' is referred to any electrical object or equipment that no longer possesses any value which has been disposed of by its owner. As other unused items, E-waste, which has not been used and thrown away as waste without being intended for reuse, becomes becomes a big problem to contemporary life. Due to its complex chemical component and inorganic toxic material, E-waste requires special treatment and management different from that of conventional waste. Incorporating e-waste management into the framework of Maqasid of the Shariah provides a holistic approach to achieving Sustainable Development Goals (SDGs) in Brunei. By harmonizing the protection of religion, life, intellect, progeny and wealth with sustainability principles, this approach not only tackles the environmental challenges associated with e-waste but also ensures the well-being of the community in a manner that is in line with the Islamic teachings. To carry out a detailed analysis of e-waste management in achieving SDGs in Negara Brunei Darussalam, a qualitative approach is adopted in order to fulfil the research objectives and a semi-structured interview method is used by the researchers. A total of 10 employees from 6 organizations (inclusive of both government and private sector) were interviewed. The results have shown issues, problems and threats posed by e-waste with time consuming, health concerns, and a lack of awareness to be the main highlights. Aside, an effort from the government body in introducing the 'Extender Producer Responsibility (EPR) scheme' in handling and managing e-waste was also discussed. By nurturing a culture of environmental responsibility, increasing awareness through education and implementing efficient waste management approaches, Brunei can not only address the immediate risks associated with e-waste but also contribute to the global pursuit of the SDGs in a way that is spiritually and materially rewarding.

Keywords. E-waste, Environment Management, SDGs, Well Being, Maqasid Shariah, Brunei Darussalam

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1. Introduction

As modernization takes place, more and more technologies have been introduced most notably electrical or electronic equipment which is usually used in our daily life and these will become e-waste products once not functioning normally (Sthiannopkao, S., & Wong, M. H. 2013). Now, it is a large waste stream, where its massive production causes negative impacts and creates issues regarding its effects on the environment and human health with the reason that it contains toxic and hazardous substances. Due to its environmental effect, electronic waste, which is also known as e-waste, has become one of the major global issues due to its environmental and health consequences (Bhat, V., & Patil, Y. 2014; Bhat. Viraja. 2023). With the rapid pace of technological advancement has contributed to and resulted in an increase in the production and consumption of electrical and electronic devices, as well as a corresponding increase in the volume of e-waste generated. That is why proper management and disposal of e-waste are critical to mitigating its negative effects, making it an important area of focus for sustainable development initiatives and managing Global E-waste is not an exception.

Over the last few years, due to the alarming situation of climate change or global warming not just in the Brunei context but globally the present it can be observed that there is unsustainable progress in managing waste. In Brunei as many developed countries, Waste and E-waste generation in particular is proliferating day by day due to the eminent use of electronic devices as the world including Brunei is heading towards digitalization. In Brunei, the increasing accumulation of e-waste poses significant environmental and public health risks. Improper disposal of e-waste, which often contains hazardous substances such as lead, mercury, and cadmium, can contaminate soil, air and, water, thus harming the ecosystems and human health. This act is also often associated with the lack of awareness among the public about the after effects of improper e-waste disposal.

As the country advances technologically, the need to address e-waste management rises, making it critical to implement effective strategies for collection, recycling and disposal. By aligning e-waste management with the Maqasid of the Shariah and the Sustainable Development Goals (SDGs), Brunei could provide a comprehensive and holistic approach to environmental protection, public health and resource sustainability. In other words, Brunei could create a comprehensive framework that not only focuses on the technical aspects but also integrates both spiritual and ethical considerations.

1.1 What is an Electronic Waste?

As technologies continue to evolve, the life span of most of the devices is depleted which contributed to the increase of electronic waste generated. Thus, addressing the challenges posed by the increase in e-waste is critical to protecting the environment and public health. In light of this fact, Widmer et al. (2005), define: ‘Electronic waste’, ‘Waste Electrical and Electronic Equipment’ commonly known as ‘E-waste’ or ‘WEEE’ refers to any electrical object or equipment that no longer possesses any value that has been disposed of by its owner. Once Electrical or Electronic Equipment (EEE) has been thrown away as waste without being intended for reuse, it becomes e-waste (Forti et al., 2020). In contrast, Perkins et al. (2014)

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would describe electronic waste as “end-of-life electrical” equipment that possesses valuable materials that could be economically recovered through proper recycling.

In light of the above definition, the Department of Environment, Parks and Recreation under the Ministry of Development in Brunei Darussalam, defines e-waste as any discarded electrical and electronic devices. This includes televisions, mobile phones, computers and peripherals, radios, fridges, food processors and blenders, rice cookers, microwaves, air-conditioners, lighting, etc. (access on Monday, 2 September 2024: http://www.env.gov.bn/ Recyclers/ Recycle%20123%20 Handbook%204%20Nov%202015.pdf).

The above definition indicates that the definition of e-waste is very broad and therefore in this research e-waste may be referred to, covered and classified into six waste categories:

1. Temperature exchange equipment, more commonly referred to as cooling and freezing equipment. Typical equipment includes refrigerators, freezers, air conditioners, heat pumps.
2. Screens, monitors. Typical equipment includes televisions, monitors, laptops, notebooks, and tablets.
3. Lamps. Typical equipment includes fluorescent lamps, high intensity discharge lamps, and LED lamps.
4. Large equipment. Typical equipment includes washing machines, clothes dryers, dish-washing machines, electric stoves, large printing machines, copying equipment, and photovoltaic panels.
5. Small equipment. Typical equipment includes vacuum cleaners, microwaves, ventilation equipment, toasters, electric kettles, electric shavers, scales, calculators, radio sets, video cameras, electrical and electronic toys, small electrical and electronic tools, small medical devices, small monitoring and control instruments.
6. Small IT and telecommunication equipment. Typical equipment includes mobile phones, Global Positioning Systems (GPS), pocket calculators, routers, personal computers, printers, telephones.

It has to be mentioned that each product of the six e-waste categories has a different lifetime profile, which means that each category has different waste quantities, economic values, as well as potential environmental and health impacts if recycled inappropriately. Consequently, the collection and logistical processes and recycling technology differ for each category, in the same way as the consumers’ attitudes when disposing of electrical and electronic equipment also vary. Therefore, the success of achieving E-Waste management requires the participation of all stakeholders across cities, towns and communities around the world to refuse, reduce, reuse, rethink, and recycle waste. To be on the right track of accomplishing the SDG’s, the awareness of the stakeholders plays a crucial role in developing Waste-Wise Cities.

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1.2 Maqasid Shariah and E-waste on Preservation of the Environment

There is a close linking between the protection of five values of Maqasid shariah with E-waste management in achieving SDG as Islam is a way of life towards human wellbeing incorporates enduring characteristics and techniques for adjusting to change in line with the flexibility of shariah or dynamics of shariah. The basics of shariah namely aqidah (creed), 'ibadah (worship), and akhlaq (morality and ethics), are fundamental to be fixed and being followed and practised from the very beginning of Islam and seem constantly remain but they may adapt to change in according to situation and circumstance i.e., preservation of the environment, as in lie with shariah principle that necessitates flexibility and adaptation in response to time and place (Nurdeng Deuraseh, (2010); Dusuki & Abdullah, 2007). This is practical if we understand and define the word *Maqasid* as a means or method to apply shariah in today's life. (Nurdeng Deuraseh, 2012). In other words, the Maqasid of the Shariah can be referred to as a high objective of the holistic view of Islam and its application should be in line with what has been voiced by Imam Al Ghazali, on 5 main principles of Maqasid namely:-

1. Protection of Faith
2. Protection of Life
3. Protection of Mind
4. Protection of Progeny
5. Protection of Wealth

Nurdeng Deuraseh (2011)'s study provides evidence that compliance with the principles of Maqasid Shariah can go hand in hand with the meeting of other sets of environmental protection standards. Since Tayyiban and Maqasid shariah are closely related to the safety and development of environment, so e-waste management should be one of the important means to fulfill the mentioned principles of Shariah, especially in relation to the protection of the environment.

While Islam emphasizes the importance of preserving the environment, managing e-waste is not an exception. Even though there is no specific verse in the Quran that touches on a way or method of preserving the environment, there are several verses in the Quran that explain in general the importance of preserving it. As a Khalifah in this world, human beings play a crucial role in handling this issue. (Nurdeng Deuraseh, 2012). This is supported by a qur'anic verse in Surah Al- Baqarah verse 30:

وَإِذْ قَالَ رَبُّكَ لِلْمَلَٰٓئِكَةِ إِنِّى جَاعِلٌ فِى ٱلْأَرْضِ خَلِيفَةً ۖ قَالُوٓا۟ أَتَجْعَلُ فِيهَا مَن يُفْسِدُ فِيهَا وَيَسْفِكُ ٱلدِّمَآءَ وَنَحْنُ نُسَبِّحُ بِحَمْدِكَ وَنُقَدِّسُ لَكَ ۖ قَالَ إِنِّىٓ أَعْلَمُ مَا لَا تَعْلَمُونَ

Translation: 'Remember when your Lord said to the angels, "I am going to place a successive human authority on earth." They asked Allah, "Will You place in it someone who will spread corruption there and shed blood while we glorify Your praises and proclaim Your holiness?" Allah responded, "I know what you do not know".

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The qur'anic verse highlights the purpose of human's creation as caretakers of the Earth on behalf of Allah (SWT) and not masters of this world. Therefore humans must emulae the Prophetic example by preserving the sanctity of all life forms, using the Earth's resources in conscious manner, and preserving the environment of the Earth.

In another verses, Surah Al-Araf verse 56:

وَلَا تُفْسِدُوا۟ فِى ٱلْأَرْضِ بَعْدَ إِصْلَٰحِهَا وَٱدْعُوهُ خَوْفًا وَطَمَعًا ۚ إِنَّ رَحْمَتَ ٱللَّهِ قَرِيبٌ مِّنَ ٱلْمُحْسِنِينَ

Translation: 'Do not spread corruption in the land after it has been set in order. And call upon Him with hope and fear. Indeed, Allah's mercy is always close to the good-doers.

In Surah Qasas verse 77:

وَٱبْتَغِ فِيمَآ ءَاتَىٰكَ ٱللَّهُ ٱلدَّارَ ٱلْـَٔاخِرَةَ ۖ وَلَا تَنسَ نَصِيبَكَ مِنَ ٱلدُّنْيَا ۖ وَأَحْسِن كَمَآ أَحْسَنَ ٱللَّهُ إِلَيْكَ ۖ وَلَا تَبْغِ ٱلْفَسَادَ فِى ٱلْأَرْضِ ۖ إِنَّ ٱللَّهَ لَا يُحِبُّ ٱلْمُفْسِدِينَ

Translation: 'Rather, seek the reward of the Hereafter by means of what Allah has granted you without forgetting your share of this world. And be good to others as Allah has been good to you. Do not seek to spread corruption in the land, for Allah certainly does not like the corruptors"

A better understanding of the above verses in the light of the principle of Maqasid Shariah is closely linked to many SDGs, especially Goal 3 (Good health and Well-being), Goal 6 (Clean water and Sanitation), Goal 11 (Sustainable Cities and Communities), Goal 12 (Responsible Consumption and Production), Goal 14 (Life Below Water), and Goal 8 (Decent Work and Economic Growth). Clearly the above verses of the qur'an, emphasize the importance of preserving the environment as Allah s.w.t. forbids and dislikes those who do corruption to the earth. However, there could be certain factors that could contribute "to spread corruption in the land" as a result of the lack of awareness amongst the people in regard to proper e-waste disposal. Hence, in an effort to achieve these, the implementation of the Maqasid of the Shariah in handling such issues and those surrounding them could play a significant role as well as in achieving the Sustainable Development Goals (SDGs).

1.3 E-waste and the Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) could be understood as the roadmap for securing a healthier and sustainable future for all. In line with the success of Millennium Development Goals, the United Nations (UN) General Assembly in its 70th Session held on 25th September 2015, adopted the document titled "Transforming our World: The 2030 Agenda for Sustainable Development" comprising of 17 Sustainable Development Goals and associated 169 targets. They are:

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1) No poverty
2) Zero hunger
3) Good health and wellbeing
4) Quality education
5) Gender equality
6) Clean water and sanitation
7) Affordable and clean energy
8) Decent work and economic growth
9) Industry, innovation and infrastructure
10) Reduced inequalities
11) Sustainable cities and communities
12) Responsible consumption and production
13) Climate action
14) Life below water
15) Life on land
16) Peace, justice and strong institutions
17) Partnerships for the goals

A better understanding and more data on e-waste will contribute to the achievement of several goals of the 2030 Agenda for Sustainable Development. It will help address the SDGs related to environmental protection and health. It will also address employment and economic growth since the sound management of e-waste can create new areas of employment and drive entrepreneurship. Better management of e-waste is closely linked to Goal 3 (Good health and Well-being), Goal 6 (Clean water and Sanitation), Goal 11 (Sustainable Cities and Communities), Goal 12 (Responsible Consumption and Production), Goal 14 (Life Below Water), and Goal 8 (Decent Work and Economic Growth). E-waste, when treated inadequately, poses serious health issues since it contains hazardous components, including contaminating air, water, and soil, and putting people's health at risk. Dismantling processes that do not utilize adequate means, facilities, and trained people pose additional threats to people and the planet.

At the Millennium Summit in September 2000, the largest gathering of world leaders in history adopted the United Nations (UN) Millennium Declaration, committing their nations to a new global partnership to reduce extreme poverty and setting out a series of time-bound targets, with a deadline of 2015 that had become known as the Millennium Development Goals (MDGs). The MDGs is a global monitoring framework to assess progress in reducing poverty and its-related public concerns of hunger, disease, unmet schooling, gender inequality and environmental degradation. In this regard, Brunei Darussalam as one of the countries that have agreed on the implementation of the sustainable development goals (SDGs) is committed to the successful implementation of the SDGs through various activities and has taken strategic steps. Driven by the vision of His Majesty the Sultan and Yang Di-Pertuan of Brunei Darussalam and in the increasing investments in education, health, and infrastructure, supported by its natural resource endowment, the country had risen to 33 out of 177 nations in United Nation Development Programme's (UNDP) Human Development Index. The MDGs Report 2005 showed that Brunei Darussalam has already achieved almost all of the targets of

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the MDGs. The following is an official report as recorded in website of Department of Economic Planning and Statistics, Ministry of Finance and Economy:

> "Brunei Darussalam, in summary, has already achieved almost all of the MDG targets whereby in the area of poverty, the extreme of its nature has already been eradicated and the country is progressively improving on equity. The government has introduced and implemented various forms of social safety nets not only for the underprivileged but also for the majority of its population. Health indicators have shown that Brunei Darussalam's efforts have matched those of the developed nations. Infectious diseases are remarkably eliminated, whereby to date, the worldwide HIV/AIDS pandemic has had little impact on the country. Educational opportunities are also available for girls and boys alike at all levels. Brunei Darussalam has also managed to safeguard its environment and natural resources in a manner consistent with the ideals of sustainable development. In the international arena, Brunei Darussalam continues to be a part of the global partnership for development and supports technical cooperation for the benefit of lesser developed countries." (access on Monday, 2 September 2024: https://deps. mofe.gov.bn/ SitePages/ Millinieum%20Development% 20Goals%20(MDGs).aspx

1.4 Issues related with E-waste

The emergence of the electronic industry is relatively new, evolving from the start of the 20th century, and is continuing to peak in our modern days, catering to the demand of modern consumers. Consequently, as the new industry persists it breeds a whole new category of waste: electronic waste (E-waste). (Gollakota, A.R., Gautam, S. and Shu, C.M., 2020). Due to its complex chemical component and inorganic toxic material, E-waste requires special treatment and management different from that of conventional waste. According to Meta (2019), E-waste cannot be treated the same as hazardous waste as regulated in the Basel Convention 1989 despite that it covers toxic, poisonous, explosive, corrosive, flammable, ecotoxic and infectious wastes. This is due to the fact that E-waste has its waste characteristics and thus requires its own internal regulation and environment legislation as well as a field of research of its own. Hence, the difficulty of E-waste disposal has become an issue.

Additionally, pressing behind this disposal difficulty is the urgency for E-waste management to cater to the rapid e-waste production due to the electronic industry and consumption. Despite the fact that the electronic industry is relatively new, the annual growth rate of e-waste was estimated to be 3-5%, which is about three times larger than other types of waste (United Nations, 2021). The amount of e-waste generated around the world was estimated at 53.6 million tons in 2019, and the future projection for 2030 yielded 74.7 million tons. Asia generated the highest amount of e-waste in 2019, at 24.9 million tons in the world. Complicating the issue even more is the transboundary movement of the waste: not only is the e-waste are domestically-originated, but a large volume of e-waste is also imported illegally into developing countries motivated by the electronic refurbishing industry. According to the United Nation (2021), 75–80% of e-waste generated around the whole world was exported to developing countries, especially the countries in Africa and Asia.

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With this background author of this research paper has tried to evaluate and analyse E-waste management in achieving SDGS in Negara Brunei Darussalam from a Maqasid Shariah Perspective. Brunei Darussalam is also experiencing the same trends in e-waste issues. Like many other countries, Brunei is seeing an increase in e-waste as a result of rapid technological advancements and increased use of electronic devices. Recent statistics show that the volume of e-waste generated in Brunei has steadily increased, raising concerns about its proper management. As observed during a study conducted by United Nations University in 2015, it was found that an average of 18 kg of e-waste is produced by a single Bruneian per year (United Nations University, 2017). Idris et al. (2024) have also highlighted that in the context of the public in Brunei, there has yet been any research conducted about how the public behavior towards proper e-waste management.

1.5 Threats posed by E-waste

Without proper disposal management, the intrinsic toxic components of electronic devices pose both health and environmental threats, which are intertwined impact-wise. According to Monika and Kishore (2010), electronic equipment possesses a lot of harmful metallic components and the most commonly found in electronic devices is lead. Monika and Kishore (2010) justified that the mass usage of these metals could affect and contaminate the environment. They further explained that lead could enter the body through consumption, liquid, air, and soil, claiming that children are more vulnerable towards it. This is supported by a study conducted by Huo et al. (2007) at an electronic waste recycling town in Guiyu, China where it is to be found that there was a higher lead level found in blood among the children due to open and mass e-waste exposure. On the other hand, Hsu et al. (n.d) managed to breakdown and provide a list of harmful substances commonly found in e-waste and their impact and effects on health as shown in Table 1 below.

Harmful Substance	**Could be found in**	**Means of exposure**	**Health Impacts and Effect**
Lead (Pb)	• Circuit boards • Glass panels	Air, water, soil	• Blood, nervous systems, kidneys • Child brain development
Mercury (Hg)	• Circuit boards • Switches and relays • CRT monitors	Air, water, soil	• Brain, skin, respiratory, heart, liver, kidney • Children's development
Cadmium (Cd)	• Semiconductors • Batteries	Air, water, soil	• Liver, kidney, neurological damage, bone disease, lung cancer
Barium (Ba)	• CRT components	Air, water	• Muscle, heart,

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			blood pressure, liver.
Beryllium (Be)	• Motherboards	Air, water	• Lung (Pneumonia), skin
BFR Brominated flame retardants	• Electronic equipment housings • Circuit boards	Air, water, soil	• Thyroid, nervous system
PVC Polyvinyl chloride	• Cabling • Computer unit housings	Air, water, soil	• Immune system.
PCBs Polychlorinated biphenyls	• Batteries	Air, water, soil	• Cancer, immune system, nervous system,
Hexavalent Chromium (Chromium VI)	• Computer unit housing components	Air, water, soil	• Cancer, respiratory, female reproduction.

Although health is one of the issues or problems that e-waste poses, its impact on the environment is not far from being the root cause of health problems. As mentioned by Hsu et al. (2007) and Monika and Kishore (2010), the harmful substances or components of e-waste if not managed accordingly could contaminate the soil, water, and air; thus leading to long-term ecological damage. This significantly contradicts the Sustainable Development Goals (SDGs) which are understood to act as the roadmap for securing a healthier and sustainable future for all.

1.6 Problem with E-waste

As modernization takes place, more and more technologies have been introduced many electrical or electronic equipment which is usually used in our daily lives. These electrical and electronic things will be considered e-waste products once their parts have been discarded by their owner without the intent of re-use. It has become a large waste stream in today's life, where its massive production causes negative impacts and creates issues regarding its effects on the environment and human health with the reason that it contains toxic and hazardous substances.

Schluep et. al (2009) emphasized the reasoning behind proper e-waste management is to efficiently extract valuable metal that could still be recovered, whilst also disposing of the toxic and hazardous substances that could potentially harm human health or the environment. Indeed such an approach envisages a market potential for e-waste management and can initiate e-waste businesses that can cater to the demand for e-waste disposal in the long-term. According to a study by Ismail and Hanafiah (2021), the potential economic value of e-waste generation in ASEAN countries was evaluated to be US$ 2,019.06 million, higher than 27 developed countries in the European Union valued at US$ 1,286.59 million. However, this result was only evaluated from mobile phones and thus it is estimated to be higher in value if other various electrical components were included in the analysis.

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Despite the ideal of capitalizing on e-waste to generate problem-solving businesses, the first problem faced by e-waste tackling endeavours as well as the potential e-waste market is the lack of public awareness on proper e-waste disposal. Tarek et al. (2024) illustrate using a conceptual framework of barriers in implementing proper e-waste management including four main components, these include lack of knowledge, awareness, cooperation, and facilities. He highlighted that these four components if lacking, would inhibit an effective practice of e-waste management and would further make it difficult to normalize e-waste recycling in general. Furthermore, Pinto (2008) claimed that another factor that could lead to the lack of awareness about the existence and hazards of e-waste is that the waste generated through e-waste is not as large compared to the other common recyclable waste. In the end, in order to stimulate public behavior, public awareness must first be instilled.

On the other hand, in the context of Brunei, public awareness regarding e-waste is moderate although not sufficient enough to stimulate prominent public behavior. In a study conducted by Idris et al. (2024) to understand Bruneian behavior toward e-waste, a total of 351 responses have been collected, out of which 57.3% have claimed to know about electronic waste. Unfortunately, however, the same study also found that 67.4% preferred to store their e-waste at home, 10% disposed of it as general waste less than 3% went to recycle (1.1%) and 2.6 percent sold them as scrap metal. When asked about the reason behind the high number of e-waste stored at home, most of them (58.1%) defended not knowing what to do or where to dispose of their e-waste. This suggests that an awareness of e-waste threats is fairly acknowledged publicly however the awareness of how to dispose is lacking. This is probably due to the lack of e-waste disposal channels in Brunei. This is a common issue, as other countries are also experiencing the same hurdles and they have identified a similar trait that is commonly found lacking when dealing with e-waste, which is a lack of e-waste disposal knowledge among the public (Hsu et al., n.d.).

1.7 Research Objectives

The authorize governmental organization as well as private companies face many challenges in managing E-waste due to consumer behaviour, a deficiency of understanding and awareness as well as a fundamental civic sense among city residents. Without proper management of e-waste and related issues, improper e-waste disposal poses serious environmental and occupational risks. SDG achievement needs a detailed study of awareness across different strata of society and hence the purpose of this research study is to identify the issues, threats and problems of e-waste in incorporating the concept of Maqasid shariah alongside the Sustainable Development Goals (SDGs). Specifically, the objectives of this research could be outlined as follows:-

1) To identify the issues, threat and the problem of e-waste in Negara Brunei Darussalam
2) To inculcate the culture of e-waste awareness in Negara Brunei Darussalam
3) To propose the solutions and suggestions to reduce the problem of e-waste in the perspective of Maqasid shariah in achieving SDGs challenges.

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2. Materials and Methods

A qualitative approach is adopted in order to fulfill the research objectives mentioned. The data were collected through primary data sources and semi-structured interviews were used. This method is chosen due to its effectiveness in providing in-depth understanding when dealing with complex issues through participant experiences and perceptions (Jain, 2021).

A semi-structured interview method is used by the researchers, which means that the questions were designed prior to the interview and based on the relevance of the scope of the interviewee's job descriptions to the research objectives, as well as open-ended questions, which would allow the selected respondents to focus on issues raised by them rather than being limited to or restricted to the researcher's question (Julkifli & Aghwan, 2024). The responses were then gathered, transcribed, organized according to the research objectives and would be analysed using thematic analysis (Creswell, 2014). Thematic analysis is a qualitative method used to observe, manage, and provide insights through 'patterns of meaning' across the data obtained. In other words, it is 'a way of identifying what is common to the way a topic is talked or written about and making sense of those commonalities' (Braun & Clarke, 2012).

A total of 10 employers of 6 active organizations and companies both from the government and private sector were selected and participated in this study. The participants include of Department of Environment, Park and Recreation (JASTRE) from the Ministry of Development Brunei, EnviroIdaman Sdn Bhd located in Sungai Akar Transfer Station, EnviroIdaman Sdn Bhd located in Sungai Paku Engineered Landfill, Daikyo Recycling and Engineering Sdn Bhd, Kawan Bumi and V&N Recycling Sdn Bhd. The interview participants consist of Environmental officers, Chief Executive Officer (CEO), Supervisors and Heads of their respective departments and organisation.

3. Result and Discussion

E-waste management is a common thread linking all the 17 SDGs; hence, this analysis study will focus on the issues, problems, and threats in handling e-waste in Negara Brunei Darussalam. The concept of Halalan Tayyiban with special regard to Tayyiban (clean and pure) takes into account in protection of the environment, alongside health, food safety, animal rights, social justice and welfare in the food and non-food production, fair business practices, and ethics. It is seen as a more comprehensive system that aims to accomplish SDGs, making it universally acceptable. Tayyiban, therefore, can be a selling point for businesses giving the Tayyiban industry a long-term strategic advantage. This study also seeks to recommend strategies to leverage the strengths and opportunities and resolve the weaknesses as well as overcome the threats.

Table 2 represents a total of ten interviewed employers from six organizations inclusive JASTRE, Ministry of Development, EnviroIdaman Sdn Bhd located in Sungai Akar Transfer Station, EnviroIdaman Sdn Bhd located in Sungai Paku Engineered Landfill, Daikyo

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Recycling and Engineering Sdn Bhd, Kawan Bumi and V&N Recycling Sdn Bhd and majority of these employers (70%) were from the private sector.

Table 2 Organisation and Companies Demographic Background

Name of Company	Company Specialization	Employer No. (n)	Gender of employers	Position within the company
Kawan Bumi	Paper, Plastic and E-waste	1	Male	Chief Executive Officer
V&N Recycling Sdn Bhd	Metal	2	Male	Supervisor
EnviroIdaman, Sungai Akar Transfer Station	General Waste and E-waste	3 4	Female Male	HR and Admin Executive Operational Executive
EnviroIdaman, Sungai Paku Engineered Landfill	General Waste and E-waste from government	5 6	Male Male	Branch Manager Health and Safety Officer
Daikyo Recycling Sdn Bhd	Metal, Paper and E-waste	7	Female	Admin Executive
JASTRE, Ministry of Development	Policy Maker	8 9 10	Male Male Female	Environment Officers

3.1 Time Consuming

E-waste management presents a number of challenges, the most significant of which is time consumption. This section examines three major factors that contribute to the time-consuming nature of e-waste management: the intensive dismantling process, slow return of investment, and complex documentation processes.

3.1.2 Intense Dismantling Process and the Need of Expert

Improper dismantling leads to inadequate treatment posing serious health issues. Dismantling electronic waste is often a meticulous and labor-intensive process. Effective e-waste recycling necessitates the disassembly of electronic devices or equipment to isolate hazardous materials from valuable components. This procedure necessitates a high level of precision and the need for expertise to ensure that all components are handled correctly, which can be both time-consuming and resource-intensive. Two participants from the private sector who running recycling companies during the interview have stressed these issues noting:

“Another issue with E-waste is that we cannot export it as it is, we have to do dismantling and store it into a bag. Most importantly, making sure it did not leaks” - Employer 7 Interview - Female employer from Daikyo Environmental and Recycling Sdn Bhd

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"E-waste dismantling involves a lot of work" Employer 1 - Male employer from Kawan Bumi

Beside the intense dismantling process, the number of labor should also be highlighted. The recycling companies highlighted the limited number of laborers in dismantling e-waste is also an issue and it is very difficult to employ more laborers in the country. They believe that in order to speed up the dismantling process, more laborers are required.

"To speed up the dismantling process, we need more labor, but normally we only have one labor working on e-waste dismantling" Employer 7 Interview - Female employer from Daikyo Environmental and Recycling Sdn Bhd

"I would say the dismantling process of E-waste is very dangerous, and it requires more man power to dismantled it" Employer 2 - Male employer from V&N Recycling Sdn Bhd

"We need more laborers to handle e-waste. However, when we apply for visas, most often the application gets rejected. As an example, we apply for 10 labors, but they only approved for 2 labors, this is an issue, we have less labor to operate" Employer 2 - Male employer from V&N Recycling Sdn Bhd

On the other hand, Employer 8, from JASTRE believes distinctly claiming that to achieve efficient dismantling procedures, the need of a special skill set is required from the laborer.

"When dismantling e-waste, it needs a special skill set" Employer 8 Interview - Male employer from JASTRE, Ministry of Development

However, Employer 8, from JASTRE further emphasized the recycling companies unwillingness and reluctance to send their labor for training is also an issue:

"Some of the recycling companies do not want to invest in training. That might be a problem" Employer 8 Interview - Male employer from JASTRE, Ministry of Development

The dismantling of electronic waste is a complex and labor-intensive process that presents significant challenges for recycling. The perspective of various employers or stakeholders demonstrates the multifaceted nature of these challenges. Employers from Daikyo Environmental and Recycling Sdn Bhd and Kawan Bumi underscore the time-consuming and resource-intensive nature of this task. The requirement to handle hazardous materials with caution to avoid and prevent leakage further complicates the process.

Furthermore, the complexity of these issues is added by the shortage of skilled laborers, as noted by several employers. The difficulty in recruiting a sufficient workforce, compounded by visa application rejections, and some companies' reluctance to invest in specialized training all contribute to the slow dismantling process. Moreover, Employer 8 from JASTRE emphasizes the importance of specialized skill sets for effective dismantling, as well as training, which is not always prioritized by recycling companies.

Addressing these challenges would require a multifaceted approach in every aspect. Increasing the investment in labor training, integrating efficient recruitment strategies, and

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developing more efficient dismantling technologies could further streamline the process. Furthermore, fostering collaboration among stakeholders to improve workforce capabilities and infrastructure is pivotal for overcoming the barriers to efficient e-waste management. By addressing these issues, recycling companies could become more efficient and effective in handling and managing growing numbers of e-waste.

3.1.2 E-Waste and Investment Return

A better understanding and more data on e-waste will contribute to the achievement of several goals of the 2030 Agenda for Sustainable Development. It will help address the SDGs related to SDG No 1: No poverty; SDG No. 2: Zero hunger and SDG No. 3: Good health and wellbeing. This is because E-waste management could become an investment that will also address employment and economic growth since the sound management of e-waste can create new areas of employment and drive entrepreneurship.

Aside from toxic metals like lead and cadmium, e-waste contains many valuable metals of economic value such as silver and gold. Heavy metals, whether hazardous or valuable are finite resources, contributing the most economic value in electronic scrap. Valuable metals recovery locked in e-waste has been one of the most attractive activities from a financial standpoint. That is why many e-waste companies in Brunei collect the e-waste for the mentioned purpose but lately, they have faced several challenges since their investment in this sector has not profited as anticipated. As we know, every business demanded making a profit and would try to avoid suffering from loss. Businesses would prioritize products that could potentially generate more revenues in comparison to products that demanded less. Another challenge associated with e-waste management is the slow return on investment. As quoted by employers from Kawan Bumi and Daikyo Environmental and Recycling Sdn Bhd:

“I think our company will not sustain if we focus solely on e-waste, as I mentioned earlier it took us four years to fill a forty-foot container. In other words, we only earn in every four years and this does not make sense, that is why we are accepting other recycling material as well” - Employer 7 Interview - Female employer from Daikyo Environmental and Recycling Sdn Bhd.

“It took us more than a year to fill a forty foot container” - Employer 1 Interview - Male employer from Kawan Bumi

Beside, Kawan Bumi also highlighted in term of profit making, E-waste is rank last before paper and plastic:

“If I compared E-waste, Paper and Plastic waste in terms of profit making. I would rank first, Paper. Second, Plastic and Third, E-waste” - Employer 1 Interview - Male employer from Kawan Bumi

Kawan Bumi explained the reason behind it by comparing it with the time taken to fill in a forty foot containers with paper or plastic with e-waste:

“Within a month, I could fill around ten containers of Paper and a few containers for Plastic, but for e-waste, it might take a year or more to fill in one full container” - Employer 1 Interview - Male employer from Kawan Bumi

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The slow return on investment in e-waste management addresses the challenge the recycling industry faces. As highlighted by Daikyo Environmental and Recycling Sdn Bhd and Kawan Bumi, the time required to fill one shipment container, which normally takes several years, has made it difficult for companies to rely solely on e-waste to generate their revenue. This slow profit cycle forces recycling companies to diversify into other materials, such as paper and plastic, which could offer quick and higher profit returns compared to e-waste.

Even though managing e-waste is important in sustaining and protecting the environment, e-waste is ranked last in terms of profitability compared with other recyclable materials. The time and resources required to fill in one shipment container of e-waste are highly unbalanced and these could be justified through the profits generated by the recycling companies. The comparison to paper and plastic recycling, which are proven to provide multiple full containers in a shorter period of time, emphasizes the financial challenges of e-waste management.

In order to improve the sustainability of e-waste recycling, it is important to explore strategies that could shorten the profit cycle of e-waste management. This could include increasing the amount of e-waste processed, investing in more efficient collection and processing methods, or creating incentives to make e-waste recycling more attractive. Without these considerations, the slow return on investment will persist and hinder the growth of e-waste management in the country.

3.1.3 Complex Documentation Process

In many countries, the exportation procedure involves the submission of documents. However, the documentation process for e-waste management is frequently complex and time-consuming, requiring strict regulations and detailed record-keeping to ensure compliance with environmental and safety standards. This complex process necessitates precise tracking of e-waste from collection to disposal, which can be time-consuming and resource-intensive for businesses. As mentioned by Daikyo Environmental Sdn Bhd:

“We need to write a letter and make a report to Jastre before every shipment to the importing countries. This process consumes so much time and may take up to a year” - Employer 7 Interview - Female employer from Daikyo Environmental and Recycling Sdn Bhd

Employer 7 further elaborated:

“We need to comply with the government regulation and there’s a lot of documentation required. Whenever we submit the documentation and there is a correction needed, they would pass it back to us and ask us to re-write it again. Only after everything is good, we can proceed” - Employer 7 Interview - Female employer from Daikyo Environmental and Recycling Sdn Bhd

Employer 8 from JASTRE acknowledges this situation and expresses his thoughts regarding the issue from the perspective of a competent authority, noting:

“As competent authorities (in Brunei), we have to deal with other competent authorities from respective importing companies or transit countries. When we receive requests from the local recycling companies about export permits, we do our prior informed consent with these transit

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countries. What took it long is these countries are out of our hands in terms of getting their approval. Once these countries give us approval, only then can we issue the export permit." Employer 8 Interview - Male employer from JASTRE, Ministry of Development

The complex documentation process involved in e-waste management presents a significant challenge amongst recycling companies, as highlighted by Daikyo Environmental and Recycling Sdn Bhd. The strict requirement of documentation, which involves making detailed reports and other compliance, can lead to substantial delays, which would extend the process up to a year or more. These challenges not only consume much time but, at the same time, hinder the business flow, which complicates overall business operations.

On the other hand, from the perspective of regulatory bodies, JASTRE, the challenge is intensified in coordinating with competent authorities from importing and transit countries, which can cause delays in the issuance of export permits. These external dependencies are frequently beyond the control of JASTRE, which adds another layer of complexity to acquiring export permits. Addressing these documentation processes is crucial in ensuring efficient and smooth business operations.

3.2 Hazardous

According to several studies and research, all e-waste contains many dangerous and poisonous components such as lead, mercury, cadmium, chromium, arsenic, polyvinyl chloride, and many other compounds that require particular handling and EOL treatment. Electrical and electronic equipment is essential to a country's development, but proper disposal of e-waste is vital **(**Sthiannopkao, S., & Wong, M. H. 2013; Pinto, V. 2008**).** Thus, electronic waste's growing complexity and volume have raised concerns about its potential hazards, particularly the toxic substances found in many electronic components.

The term "Hazardous" often refers to "a potentially damaging physical event, phenomenon and/or human activity, which may cause loss of life or injury, property damage, social and economic disruption or environmental degradation." (Schneiderbauer and Ehrlich, 2004). According to the interviewed participants, E-waste is more hazardous in comparison with general waste, as improper e-waste management or disposal could cause an explosion, open fire, and threaten human life. As stated by the employers in regard to the hazard that e-waste could pose:

"E-waste is much more dangerous, because e-waste could leak mercury" Employer 5 Interview– Male employer in EnviroIdaman, Sungai Paku Engineered Landfill

"E-waste when thrown or disposed of improperly to general waste machinery could potentially cause explosion" Employer 4 Interview - Male employer in EnviroIdaman, Sungai Akar Transfer Station.

"Previously, improper e-waste disposal have cause open fire in landfill at Sungai Paku, and it takes us three days to completely extinguished the fire… this have forced us to shut down our operation for a while, and this have complicate the public" Employer 3 Interview - Female employer in EnviroIdaman, Sungai Akar Transfer Station

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"..what we also need to do and which is important is to ensure that the motherboard (E-waste) does not enter the landfill, what will happen if that occurs is that overtime, the harmful chemical inside it will spill out, this is obviously hazardous to the environment." Employer 1 Interview - Male employer in Kawan Bumi

It cannot be denied that managing e-waste is crucial in sustaining the environment and protecting human health. This aligned with one of the Maqasid of the Shariah especially objective number two; the Protection of Life and could be associated with SDGs Goal 3 (Good Health and Well Being). The protection of life involves providing security, preserving the environment, and protecting one's health. Improper e-waste management was against all these as it posed a threat to all security, environment, and health. As an example, as mentioned by one of the interviewees, one of the harmful chemicals that could leak through improper e-waste disposal is mercury. According to Table 1, mercury could not only contaminate the soil but it could also contaminate both the water and the air. Soil, water, and air are important resources not only to humans but also to other living things. Furthermore, it could also affect human health, affecting certain organs including the brain, respiratory system, kidneys, heart, and the liver. All of these are the crucial organs of the human body, and if not taken seriously could potentially cause death. Moreover, this chemical is prone and known to hinder child development as stated in Table 1. Taking all these into consideration, the hazard that e-waste posed not only could affect one's life, but it could harm future generations by hindering children's development, and one's intellect as it could damage the brain, scraping one's wealth through extensive medical treatment expenses and what most importance is that it against the Islamic virtue of making corruption to the earth. These were all against the five Maqasid of the shariah and are not inclined toward achieving SDGs.

3.3 Community Consciousness

3.3.1 Lack of Awareness

One more important target of SDGs is the reduction of the adverse per capita environmental impact of cities which can be achieved with improved awareness of SDGs. SDG goals: Goal 3 (Good health and Well-being), Goal 6 (Clean water and Sanitation), Goal 11 (Sustainable Cities and Communities), Goal 12 (Responsible Consumption and Production) needs proper knowledge and management of e-waste.

There is a close linking between awareness of E-waste and SDG's achievement. It has been globally noted several times that improper disposal leads to inadequate treatment posing serious health issues (Borthakur, A., & Govind, M. 2017). In this regard, educating the public about the dangers of e-waste is critical to promoting responsible disposal and recycling practices. Despite this need, many organizations struggle to implement effective training and awareness programs. Cultivating one's awareness of the harm that e-waste could pose is pivotal to handling and managing issues that surround it. However, most of the employers have highlighted a significant lack of awareness regarding e-waste disposal. As noted by the participants:

"There is not much awareness regarding e-waste. There are sometime we hear it in the radio, but it is not frequent" Employer 7 - Female employer in Daikyo Recycling Sdn Bhd

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"E-waste awareness in Brunei is moderate, one of the factor most probably because there is less e-waste in Brunei compared to the neighboring countries" Employer 1 - Male employer in Kawan Bumi

"I would say the level of awareness about e-waste in Brunei is less" - Employer 2 - Male employer in V&N Recycling Sdn Bhd.

"I believe there is still a lack of knowledge (regarding e-waste)" Employer 3 - Female employer in EnviroIdaman, Sungai Akar Transfer Station

"The level of awareness (on e-waste) is low, especially garbage dump near the residential area, they normally dispose their e-waste there, and this is improper" - Employer 4 - Male employer in EnviroIdaman, Sungai Akar Transfer Station

"When it comes to e-waste, I still think people are not aware of it" Employer 8 - Male employer in JASTRE, Ministry of Development

In relation, one of the employers believed that efforts had already been made to raise public awareness regarding e-waste through radio and television broadcasting and making good use of social media platforms; however, the results have been less significant.

"I observed that even though there is effort on raising awareness through radio broadcasting and social media, I can still find people dispose their E-waste at the general waste sites" Employer 3 - Female employer in EnviroIdaman, Sungai Akar Transfer Station

On the other side, one of the interviewed employers responded in a distinct perspective and highlighted that public awareness is not the main issue but more toward the public convenience to dispose of their e-waste and hence one of the reasons why they would prefer to wait for a recycling event to be held in each district to dispose of their e-waste.

"I think awareness is not the main issue, it's just that practically, the public used to be very comfortable that they are not really used to being disposed of from afar. So when they know there's a recycling day event in each district, they take it as an opportunity instead of going to Sungai Akar. They know there is a depot center, it's just that it's not convenient for them." Employer 9 - Male employer in JASTRE, Ministry of Development

This argument is later supported by a justification from Employer 8 from JASTRE, which mentions that a higher record number of e-waste is collected during recycling events compared to normal working days.

"When we held recycling events, we would collect more compared to the normal working day, even though the depot is open every day." Employer 8 - Male employer in JASTRE, Ministry of Development.

3.3.2 Raising E-waste Awareness in the Perspective of Maqasid of the Shariah

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One more important target of SDGs is the reduction of the adverse per capita environmental impact of cities which can be achieved with improved awareness. Thus, raising awareness on E-waste is not only crucial but it aligns significantly with the Maqasid of Shariah, especially objective three; Protection of Intellect. The protection of the Intellect could be achieved through development, preservation, and the utilization of the mind and it could be related to 'proper thinking, education, and modern skill' in today's world (Shihan, Amanullah & Zaroum, 2023). When dealing with E-waste, the protection of the intellect comes to preserve one's mind through instilling understanding and knowledge when regarded into issues, threats, and problems posed by e-waste which is then supported by the other four Maqasid of the Shariah simultaneously. In order to achieve this, suggestions imposed by the employers suggested increasing more awareness through exposure toward the existence of recycling companies to the public, organizing roadshows at schools and institutions, optimizing the use of social media, and most importantly government involvement.

Since E-waste is being generated everywhere and hence it is particularly important to properly manage e-waste. To achieve the SDGs there is a need to improve awareness leading to better and formal collection, recycling rates, and reduction of e-waste dumped in dumpsites. Awareness also helps in purchasing products having chemicals with tolerable limits leading to sound management of chemicals and all waste throughout the life cycle. With this in mind, the interviewees stressed with suggestions in the following words:

"I think the public needs more awareness, conduct talks, go to schools and provide education. I think education is very important… and then make awareness through local newspaper and social media, and other effort would should also emphasizes that e-waste is actually toxic, because not many are aware its toxic" Employer 7 – Female Employer from Daikyo Environmental and Recycling

"I think we need to educate the public, we should organize a roadshow. What I meant by roadshow is not solely organizing the event at one place, but we become more mobile. As an example, why don't we try and organize a visit to each school in Brunei to spread knowledge and awareness on E-waste. I believe the children can be easily nurtured and they can apply for it in the future" Employer 3 - Female employer from EnviroIdaman, Sungai Akar Transfer Station.

"I think we should make good use of social media to spread awareness" Employer 4 - Male employer from EnviroIdaman, Sungai Akar Transfer Station.

"We can increase more awareness by letting the public know that there is a company in Brunei that accepts E-waste.. and let them know and understand the threat e-waste posed" - Employer 1 - Male employer from Kawan Bumi

"I think the government first needs to put initiative in terms of conducting campaigns in regard with e-waste, for example making advertising campaigns on e-waste" Employer 6 – Male employer in EnviroIdaman, Sungai Paku Engineered Landfill.

These suggestions, need a proper knowledge and management of e-waste, from the employers mainly highlight the importance of providing knowledge and education on e-waste

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to the public that in line with SDG goals: Goal 3 (Good health and Well-being), Goal 6 (Clean water and Sanitation), Goal 11 (Sustainable Cities and Communities), Goal 12 (Responsible Consumption and Production). Even though most of the suggestions look aligned with SDG Goals as well as aligned with the third objective of the Maqasid Shariah (protection of mind), through awareness it could also justify the other four of the Maqasid of the Shariah. For example, the protection of faith could be instilled in the public through education by instilling religious knowledge about the importance of preserving the environment in the context of Islam. The protection of life could be inculcated through education on the impacts and threats e-waste could impose on the environment and one's health. The protection of progeny could be preserved by promoting education on e-waste to the younger generation to prepare them for the future. Finally, the protection of wealth could be protected through promoting the concept of repurposing to reuse and resell e-waste as what has been suggested or highlighted by the employers during the interview.

"We have customers who went to our sites during the weekend just to get some CPUs, and we will sell it at a lower price. They will then fix the CPUs and resell it back to others. Normally, e-waste material is actually repairable" Employer 7 - Female Employer in Daikyo Environment and Recycling Sdn Bhd

Most importantly, when asked about re-use e-waste, the interviewee said:

"Repurposed back electronic devices or waste" Employer 6 - Male employer in EnviroIdaman, Sungai Paku Engineered Landfill

"I think one of the solution is to reuse (e-waste) or repurpose it" Employer 10 - Female employer in JASTRE, Ministry of Development

3.4 Addressing the Informal Sector

3.4.1 Challenges and Implications of Informal Sectors in E-waste Management

Among the aims of e-waste approach in Brunei Darussalam is to achieve the environmentally sound management of chemicals and all waste throughout the life cycle, in accordance with agreed-upon international frameworks, and to significantly reduce their release into air, water, and soil to minimize their adverse impacts on human health and the environment.

Study shows that e-waste is often processed in the informal sector, and many e-waste disposal and recycling jobs are unsafe and not protected by formal regulation (Brett et al. 2009; Leung, et al. 2008). The informal sector plays a significant role in various industries, including waste management, by offering flexible and accessible services that cater to immediate needs. The term 'informal sectors' refers to an individual or organization whose establishment or presence is not regulated. In other words, it 'comprises all unregistered and unlicensed enterprises' (Swaminathan, 1991). Although this sector provides convenience to the public such as door-to-door garbage collection services, it cannot be denied from an economic point of view that it brings more negative than positive impacts (De Paula & Scheinkman, 2007). Three of the interviewed employers have raised issues regarding the informal sector stating:

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"Another problem with e-waste is that there are people out there who offer door-to-door collection service. (Once they collected the e-waste), they would then dismantle it, separate the valuable metal and the unwanted part would normally be disposed of on the side of the village's road or at the water village" Employer 1 - Male employer in Kawan Bumi

"There are groups of what we call the informal sector which are mostly run by foreign workers, where they offer door-to-door waste collection. This informal sector is also part of the problem (when regard with e-waste), because we don't know where the waste go once they collect it" Employer 10 - Female employer in JASTRE, Ministry of Development

"We start off from the waste collectors. Preferably, these collectors should register under us, because when they register, they will be listed in our website, in a way they are more regulated. However, at the same time there are still companies that are not registered under us as registration is not mandatory yet. So these (informal) collectors, we are not certain on how they conduct their business. We are not certain whether or not they use the right vehicle, whether they have the proper equipment or are they properly regulated" Employer 8 - Male employer in JASTRE, Ministry of Development

The responses from the participants highlighted the uncertainty and improperness of handling e-waste in most of the informal sectors. The way their business is conducted remains vague as no proper regulation regulates them, as the policy has not been mandatory for a waste collector company to register. Furthermore, another claim has been made that these sectors would often be caught dumping unwanted parts of e-waste on inappropriate dumping sites such as roadsides. The participant from Kawan Bumi also stressed about the activity these sectors often conducted, mentioning that these sectors would not hesitate to dispose of their e-waste into the river. Such action contradicts with SDGs mainly with Goal 6 (Clean Water and Sanitisation) and Goal 14 (Life below water) and solutions were needed to handle these issues surrounding the informal sectors.

3.4.2 Regulatory Measures and Enforcement for Managing Informal E-Waste Collection and Encouragement of Collaborative Effort

Stakeholders must address the problems caused by informal waste management practices, and a structured approach is required. To ensure proper waste management, regulatory measures must be implemented, and oversight must be strengthened.

One of the solutions proposed in handling the informal sectors is by making the mandatory registration of waste collection companies to the relevant authority, that is, JASTRE. Besides, enforcing the law on the uncontrolled disposal of e-waste needs to be strengthened. These actions would not only help regulate the companies, but the transparency of how they conduct their business would be clear and, at the same time, would reduce the habit of disposing of e-waste in inappropriate places.

On the other hand, it is worth taking into account the authorized recycling companies that are registered as they lack the convenience that the informal sector offers to the public, such as the door-to-door collection.

"One of the reasons why people are reluctant to dispose of their e-waste is because they have to throw it themselves, for example, they are reluctant because they have to use their own cars

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even though the depot is there. At the same time, the recycling company also do not offer or willing to take it from them as its far from reach" Employer 8 - Male employer in JASTRE Ministry of Development

"We only provide collection and transportation (of E-waste) when we have a lot" Employer 7 - Female employer in Daikyo Environmental and Recycling

A suggestion of a joint collaborative effort between these companies would also be encouraged to bridge the gaps and make it convenient for more people to dispose of their e-waste persistently. For example, these informal sectors could send their unwanted e-waste parts to the authorized recycling companies for further proper disposal, as they might not have adequate facilities or machinery compared to the authorized recycling companies. Moreover, the authorized recycling companies could also work collectively with these informal sectors to take over certain processes, such as dismantling. This collaborative effort would reduce the intense labour and would also speed up the dismantling process, which would normally be time-consuming. Hence, not only should the government sector play a role, but the private sector should also be significant in an effort to manage e-waste properly.

3.5 Initiatives and Efforts by the Government in Handling E-waste in Brunei

The study shows that e-waste is often processed in the informal sector, and many e-waste disposals and recycling jobs are unsafe and not protected by formal regulation (Brett et al. 2009; Leung et al. 2008). It is, therefore, necessary for countries to formalize the environmentally sound management of e-waste and to take advantage of the business opportunities it offers. To materialize SDGs on E-waste management, the Government of Brunei, in accordance with agreed international frameworks, and to significantly reduce their release into air, water, and soil in order to minimize their adverse impacts on human health and the environment, has taken the following initiatives.

3.5.1 One-Stop Disposal Center

In Brunei, the volume of e-waste is relatively small compared to other countries. Despite the low amount of e-waste generated, the government of Brunei is still putting their initiative and efforts in order to control e-waste disposal in the country. One of the notable initiatives is the establishment of a one-stop e-waste disposal center in Sungai Akar Transfer Station (SATS), which is open to the public and in Sungai Paku Engineered Landfill (SPEL), which is accepting e-waste from the government. As what has been stated by Employer 1:

"In Brunei, E-waste has two official disposal sites, one is located in Sungai Akar and the other is in Sungai Paku. They will leave a large 40 foot container on the site. E-waste collected will be gathered inside it and we and Daikyo are the only authorized company by JASTRE to collect it once it is full, while the other could not. This is because they already gave us approval and license to collect. After collection, we will make a report and report it to them" Employer 8 - Male employer in JASTRE Ministry of Development

The public could dispose of their e-waste in a designated container for e-waste prepared by JASTRE in SATS, while government bodies could dispose of e-waste in SPEL.

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Following that, the waste will be collected by a registered recycling company such as Kawan Bumi and transported to their facility, where they will make a detailed report to be reported to JASTRE and do their dismantling procedure.

This initiative shows the government's alertness to potential hazards posed by e-waste. It also shows the effort to make the disposing and collecting experience convenient for both the public and recycling companies by providing a one-stop center in SATS and SPEL. Addressing this effort is pivotal in integrating efficient e-waste management.

3.5.2 Extended Producer Responsibility Scheme

Not limited to a one-stop center, another initiative taken by the government is to introduce the Extended Producer Responsibility (EPR) scheme in Brunei. This is highlighted by Employer 8 from JASTRE in regard to EPR:

"Extended Producer Responsibility is a scheme, where the producer of the waste is responsible in terms of disposing of the waste. They should bear the cost and be responsible for the waste that they have generated. As an example, in a country like Singapore, the authorized sellers of electrical waste reach an agreement with their government, or with their consumers that if they want to dispose of the waste, the sellers will take it from them. They would sell it to you, but once you want to dispose of it, 'I will take it and bear responsibility for the collection of the disposal'. So this scheme will facilitate that habit of throwing away e-waste " Employer 8 - Male employer in JASTRE Ministry of Development

This effort signifies Brunei's recognition of the need for sustainable waste management practices, particularly e-waste management. Implementing EPR in Brunei would be a positive step forward, holding waste producers accountable for their products' environmental impacts throughout their product life cycle. Not only does Brunei promote awareness about recycling or the environmental impacts to the public, but now they are putting effort into shifting the responsibility of e-waste management from the public to producers.

However, the successful implementation of EPR in Brunei would need a well-defined regulatory framework, effective enforcement mechanisms, and close cooperation between government agencies, private agencies, producers, and consumers. Even though the initiatives contain a lot of potential, ongoing efforts will be required to address the challenges, such as raising awareness among both producers and consumers, developing e-waste recycling infrastructure, and ensuring compliance.

4. Conclusion

The above discussion reveal that there is the main reason behind improper handling of E-waste by consumers who do not know about basic treatment of E- waste. If consumers from rural and semi-urban areas are provided with knowledge and awareness regarding E-waste, people will understand and realize the concept of reuse, recycle and repair, which will not only enhance the proper management of E-waste but also the proper disposal of E-waste in the geographical areas could be accelerated. This will result in no harm to livelihood, environment and ultimately will lead to sustainable development towards the achievement of SDG's in the long

run. Brunei Darussalam, which is stated in the constitution as an Islamic state, has attempted several means to inculcate the culture of khalifah of Allah s.w.t as stated in the Quran in Surah al-Baqarah, verse no, by implementing Islamic value in its political management such as Brunei as Negara Baldatun Tayyibatun Warabbun ghafur. In this regard, incorporating e-waste management into the Maqasid of the Shariah framework is crucial since it provides a holistic approach to achieving Sustainable Development Goals (SDGs) in Brunei. By harmonizing the protection of religion, life, intellect, progeny, and wealth with sustainability principles, this approach not only tackles the environmental challenges associated with e-waste but also ensures the community's well-being in a manner that is in line with Islamic teachings.

Since E-waste is being generated everywhere and hence it is imperative to properly manage e-waste. To achieve the SDGs, there is a need to improve awareness, leading to better and more formal collection, recycling rates, and reduction of e-waste dumped in dumpsites. Beside consumers' awareness in purchasing products having chemicals with tolerable limits leading to sound management of chemicals and all waste throughout the life cycle, collaborative efforts and initiatives between government and private sectors, including the society to establish comprehensive policies and practices to minimize the negative impacts of e-waste are crucial. Looking through the Maqasid Shariah perspective in managing e-waste transcends technical or environmental concerns because it represents a moral and ethical obligation that aligns with the principles of Islam. By nurturing a culture of environmental responsibility, increasing awareness through education and implementing efficient waste management approaches, Brunei can not only address the immediate risks associated with e-waste but also contribute to the global pursuit of the SDGs in a spiritually and materially rewarding way. It may suggest that to achieve e-Waste management, it requires the participation of all stakeholders across cities, towns and communities worldwide to refuse, reduce, reuse, rethink, and recycle waste. To be on the path of accomplishing the SDGs, the awareness of the stakeholders plays a crucial role in developing Waste-Wise Cities.

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