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## E-WASTE AND CLIMATE CHANGE: ADDRESSING LEGAL GAPS IN MALAYSIA'S ENVIRONMENTAL AND CLIMATE GOVERNANCE FRAMEWORK

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### Abstract:

Electronic waste (e-waste) is a rapidly growing waste stream that presents significant challenges to environmental sustainability and climate governance. It contributes to climate change through both direct and indirect pathways. Direct climate impacts result from potent greenhouse gas (GHG) emissions from open burning, unregulated landfilling, and informal dismantling, while indirect impacts arise from virgin metal extraction driven by low recycling rates and constant device turnover. Despite these climate linkages, regulatory responses in many jurisdictions, including Malaysia, continue to treat e-waste primarily as a hazardous-waste management issue rather than a climate governance concern. Against this backdrop, this article adopts a doctrinal legal methodology to critically examine Malaysia's environmental and climate governance framework relating to e-waste. It analyses national legislation, policy instruments, and relevant international obligations, including circular economy and Extended Producer Responsibility (EPR) initiatives. The analysis identifies structural legal gaps, including fragmented institutional coordination, inadequate regulation of household e-waste, weak oversight of informal processing activities, and the absence of binding EPR mechanisms. It further demonstrates that existing enforcement practices remain predominantly reactive rather than preventive and climate aligned. The article advances the original argument that Malaysia's e-waste regime must be reconceptualised as part of climate governance rather than

treated solely within a hazardous-waste paradigm. The article proposes targeted statutory and institutional reforms, including the codification of EPR obligations, strengthened inter-agency coordination, and the integration of climate considerations into scheduled waste regulation to align waste governance with Malaysia's Nationally Determined Contributions. By reframing e-waste through a climate governance lens, this study contributes a coherent doctrinal pathway towards a more integrated and climate-responsive regulatory framework in Malaysia.

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Basel Convention; Climate Governance; Electronic Waste (E-Waste); Environmental Law; Environmental Quality Act 1974; Extended Producer Responsibility (EPR); Malaysia.



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## Introduction

Electronic waste (e-waste), or Waste Electrical and Electronic Equipment (WEEE), refers to discarded electrical and electronic devices and is among the fastest-growing waste streams globally (Forti et al., 2020; Baldé et al., 2024). In 2022, an estimated 62 million tonnes of e-waste were produced globally. Only 22.3% was documented as formally collected and recycled (Baldé et al., 2024). The rapid expansion in the consumption of electrical and electronic equipment has intensified e-waste generation, creating significant environmental, public health, and governance challenges (Forti et al., 2020; Baldé et al., 2024). Moreover, improper e-waste management exacerbates climate impacts through energy-intensive recycling processes, informal treatment practices, pollution, and the loss of secondary raw materials, which perpetuates reliance on carbon-intensive primary resource extraction (Baldé et al., 2024; Forti et al., 2020; Yong et al., 2019). These interconnections demonstrate that e-waste is not merely a waste management issue but also a climate-relevant regulatory concern that requires integrated environmental and climate governance responses.

Malaysia presents a compelling case for examining this intersection. Official data indicate that Malaysia generated approximately 2.62 million metric tonnes of e-waste between 2005 and 2023 (Malay Mail, 2025). The scale of the problem was particularly evident during the 2020 Movement Control Order (MCO), when annual e-waste generation peaked at 904,008.90 metric tonnes. More recent data reveal persistent governance weaknesses. In 2022, Malaysia generated 286,205.84 metric tonnes of e-waste nationwide; however, only 65,280.14 metric tonnes were collected, and merely 13,759.98 metric tonnes were recovered in 2023, resulting in a recovery rate of 21.1 per cent (Malay Mail, 2025; Global E-Waste Monitor, 2024). These figures reflect not only deficiencies in waste management systems but also missed

opportunities for climate mitigation, as low recycling rates perpetuate emissions-intensive production and uncontrolled pollutant releases.

Despite these challenges, e-waste in Malaysia continues to be regulated primarily through a pollution-control lens. Although Malaysia is a party to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, compliance and enforcement challenges persist, particularly regarding illegal imports of e-waste (Department of Environment, 2024; Basel Action Network, 2024). At the national level, regulatory instruments remain fragmented and unevenly implemented, with notable gaps in the governance of household e-waste and limited oversight of informal recycling activities (Yong et al., 2019; Department of Environment, 2025). A substantial proportion of e-waste processing continues to occur in the informal sector, leading to unsafe handling practices and heightened environmental pollution (Yong et al., 2019; Baldé et al., 2024).

This regulatory fragmentation is particularly significant in light of Malaysia's climate commitments under the Paris Agreement and its Nationally Determined Contributions (NDCs), which implicitly depend on improved resource efficiency and waste-sector mitigation.

Recent national policy frameworks nevertheless signal growing governmental recognition of Extended Producer Responsibility (EPR) as a tool for improving waste governance. The Twelfth Malaysia Plan (2021–2025) prioritises EPR as part of Malaysia's transition towards sustainable consumption and circular-economy practices, while the Circular Economy Blueprint for Solid Waste (2025–2035) promotes lifecycle responsibility, material recovery, and reduced reliance on virgin-resource extraction. From a climate governance perspective, these policy developments are significant, as EPR-based approaches can incentivise higher recovery rates and reduce emissions associated with raw material extraction and manufacturing. However, these initiatives remain largely policy-driven and have not been fully translated into binding statutory obligations governing e-waste management. The absence of enforceable EPR mechanisms illustrates a broader disconnect between climate-relevant waste policy and Malaysia's environmental legal framework.

Accordingly, this paper analyses Malaysia's environmental and climate governance framework for e-waste by examining its legal framework, policy instruments, and relevant international obligations. It advances the central argument that e-waste regulation must be reconceptualised as a climate governance issue rather than treated solely within a pollution-control paradigm. Adopting a doctrinal legal methodology, the study assesses the extent to which existing regulatory mechanisms address the climate implications of e-waste and identifies structural legal gaps that hinder the effective integration of waste regulation and climate governance. In doing so, the article seeks to determine how Malaysia can strengthen its environmental and climate governance framework to ensure a more coherent and climate-responsive approach to e-waste management.

### **Literature Review: Legal and Climate Governance Perspectives on E-Waste in Malaysia**

The literature review involved an extensive search of several databases, including Google Scholar, Web of Science, Scopus, LexisNexis, the Current Law Journal (CLJ), and the databases of key international organisations, such as the Basel Convention and the United Nations Environment Programme (UNEP). Moreover, the Department of Environment's websites have also been viewed. The search strategy aimed to identify peer-reviewed articles,

books, reports, and conference proceedings that address e-waste, its environmental impacts, existing management strategies, and proposals for sustainable practices.

The literature increasingly views electronic waste (e-waste) as a complex concern encompassing governance, sustainability, and climate imperatives (Baldé et al., 2024; Forti et al., 2020). Early research focused on the toxic dangers associated with e-waste, such as lead, mercury, and cadmium, leading to pollution-oriented regulatory solutions centred on hazardous waste measures (Islam et al., 2019; Yong et al., 2019). This early research placed e-waste primarily in the context of environmental health discourse, with a focus on contamination risks and specific environmental impacts.

More recent literature, however, places e-waste within broader climate governance frameworks. Researchers underscore the greenhouse gas (GHG) emissions associated with landfilling, informal recycling, and inefficient material recovery, all of which contribute to carbon-intensive virgin resource extraction (Baldé et al., 2024; Fawole et al., 2023). From a legal standpoint, this advancement expands the purview of environmental legislation to encompass climate governance, revealing how deficiencies in waste management regulations indirectly lead to systemic emissions (Forti et al., 2020; Yap, 2025). As a result, e-waste legislation is increasingly regarded as a tool for both pollution control and climate mitigation.

Based on Malaysian literature, a rapidly rising e-waste problem was also identified, driven by technological use, urbanisation, and economic expansion. Empirical studies show that trash creation rates are increasing while collection and recovery systems remain insufficient, indicating a structural mismatch between waste production and regulatory capacity (Mohamad et al., 2022). These findings indicate that existing governance structures have struggled to keep up with the size and complexity of e-waste flows.

Behavioural research further indicates that household participation in e-waste recycling remains limited and is shaped by factors such as awareness, perceived convenience, and moral obligation (Akhtar et al., 2014; Mohamad et al., 2022). Although these studies do not constitute legal analyses per se, they provide important evidence of systemic governance shortcomings. Low collection and recycling rates should not be viewed solely as behavioural deficiencies; rather, they reflect weaknesses in regulatory design, institutional coordination, and enforcement mechanisms.

In terms of legislation, Malaysian e-waste governance is governed by hazardous waste restrictions under the Environmental Quality Act 1974 (EQA), which defines e-waste as scheduled waste (SW110) under the Environmental Quality (Scheduled Waste) Regulations 2005. Research studies indicate that this system provides some regulatory oversight of industrial and commercial e-waste, including licensing requirements, handling standards, and disposal regulations (Ismail & Hanafiah, 2019; Yong et al., 2019). This framework, however, exemplifies a conventional pollution control strategy that prioritises minimising environmental impacts over integrating climate mitigation objectives (Ismail & Hanafiah, 2019; Fawole et al., 2023; Yong et al., 2019). Shad et al. (2020) further argue that Malaysia's reliance on general hazardous waste provisions reflects a traditional pollution-control paradigm rather than a comprehensive lifecycle governance model.

Malaysia's e-waste governance has increasingly been framed within the broader sustainability discourse. Yusof et al. (2023) highlight that e-waste management must be understood not merely as a waste-disposal issue but as part of sustainable development strategies that encompass environmental protection, resource efficiency, and long-term socio-economic resilience. The authors emphasise that, although Malaysia has developed regulatory instruments under the Environmental Quality Act 1974 and its subsidiary regulations, implementation challenges persist due to institutional fragmentation, limited public participation, and weak enforcement coordination.

Regional and international literature also examines transboundary e-waste flows through the lens of the Basel Convention, frequently positioning Malaysia as a key destination for illegal imports despite its party status since 1993 (Herat & Agamuthu, 2012; Basel Action Network, 2024). Literature highlights ongoing tensions between Basel Convention obligations and domestic enforcement capacity, noting that while Malaysia is a party to the Convention, monitoring weaknesses and enforcement constraints undermine its full effectiveness (Shad et al., 2020). This enforcement gap contributes to Malaysia's vulnerability to illegal imports and misdeclared shipments. Moreover, literature also highlights monitoring failures that weaken the Convention's domestic effectiveness, revealing a disconnect between international obligations and enforcement under the Environmental Quality Act 1974 (Department of Environment, 2024). Recent enforcement actions, including the large seizures at Port Klang in 2025 and 2026, reveal that people still evade the rules by lying about their activities and avoiding compliance. From a climate perspective, these lapses facilitate emissions-intensive informal processing, undermining gains in material recovery and weakening potential contributions to Malaysia's NDC targets (Baldé et al., 2024).

Recent literature increasingly promotes Extended Producer Responsibility (EPR) and circular economy instruments as transformative legal tools for strengthening e-waste governance (Hanafi et al., 2025; Yap, 2025; Yong et al., 2019). Shad et al. (2020) specifically recommend that Malaysia adopt structured EPR mechanisms similar to those implemented in Japan and Switzerland, emphasising producer take-back obligations and lifecycle accountability. EPR shifts end-of-life responsibility to producers by incentivising design-for-repair, take-back systems, and higher recycling standards, thereby increasing resource efficiency (Hanafi et al., 2025; Yong et al., 2019).

Nevertheless, a Malaysian study indicates that EPR remains largely a policy aspiration rather than a binding statutory requirement, as reflected in national planning instruments such as the Twelfth Malaysia Plan (2021–2025) (Yong et al., 2019; Economic Planning Unit, 2021). As a result, regulatory gaps continue in the industrial, residential, and transboundary dimensions of e-waste regulation.

Although the current research has explored the sustainability aspects and institutional frameworks of Malaysia's e-waste governance (Yusof et al., 2023), doctrinal focus has been restricted to positioning e-waste regulation within the nation's climate governance structure. This conceptual gap motivates the present study.

## Methodology

This study employs a qualitative doctrinal legal research approach to examine Malaysia's e-waste governance framework critically. The research adopts a doctrinal content analysis, involving statutory interpretation, policy analysis, and limited comparative legal review, to evaluate the coherence and climate responsiveness of the existing regulatory regime.

Primary legal sources analysed include the Environmental Quality Act 1974, the Environmental Quality (Scheduled Wastes) Regulations 2005, the Environmental Quality (Prescribed Premises) (Scheduled Waste Treatment and Disposal Facilities) Regulations 1989, the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015, and the Customs Act 1967. These instruments are examined using both literal and purposive interpretation to assess the extent to which current provisions incorporate lifecycle management and climate-mitigation considerations.

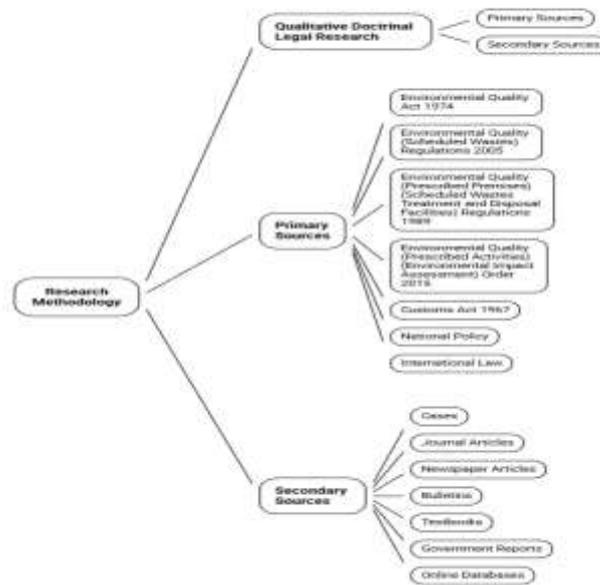
The study further reviews key national policy instruments, including the National Solid Waste Management Policy (NSWMP), the Eleventh Malaysia Plan (2016–2020), the Twelfth Malaysia Plan (2021–2025), the Circular Economy Blueprint for Solid Waste (2025–2035) and the Nationally Determined Contribution (NDC) under the Paris Agreement. At the international level, the analysis engages with the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (1989) and the Basel Convention Ban Amendment (2019) to evaluate Malaysia's compliance and implementation gaps.

The analytical lens of the study is grounded in climate governance and regulatory coherence theory, enabling assessment of whether Malaysia's e-waste regime functions as an integrated climate-relevant regulatory framework or remains confined within a traditional pollution-control paradigm.

Secondary sources, including reported cases, journal articles, government reports, policy documents, and reputable media reports, are systematically reviewed to provide contextual and interpretive support. These materials were identified through structured searches of LexisNexis, Current Law Journal (CLJ), Web of Science (WoS), Scopus, and official government databases.

The temporal scope of the reviewed legal and policy materials spans 2005 to 2025, reflecting the modern evolution of Malaysia's e-waste governance framework. Through this multi-layered doctrinal analysis, the study evaluates structural legal gaps and the extent to which Malaysia's existing framework aligns with emerging climate-responsive waste governance standards.

**Research Methodology Flowchart**



**Findings and Discussion**

***Definition of E-Waste***

Electrical and electronic waste, or e-waste, refers to electrical or electronic equipment that is waste, including all components, sub-assemblies and consumables that are part of the equipment at the time the equipment becomes waste (UNEP, 2019). Article 2 of the Basel Convention defines "waste" as "substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law." The Basel Convention classifies WEEE as harmful waste due to its hazardous and poisonous materials.

***A Brief Overview of Malaysia’s E-Waste Generation and Management***

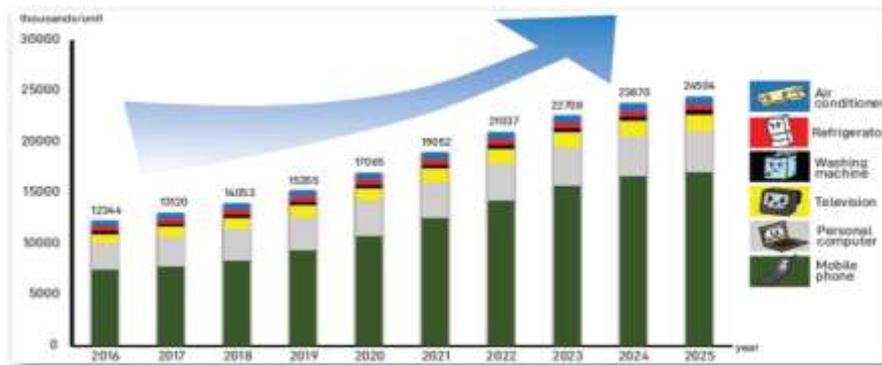
To establish a framework for the subsequent doctrinal analysis, Table 1 provides a comprehensive overview of E-Waste Generation and Management in Malaysia (2005–2023), Figure 1 projects E-Waste Generation in Malaysia, and Figure 2 illustrates State-Level E-Waste Generation in Malaysia (2015–2023), as reported by the Department of Environment. Collectively, these figures provide the empirical foundation for assessing Malaysia's environmental and climate governance framework, which regulates e-waste, as adequate.

**Table 1: Overview of E-Waste Generation and Management in Malaysia (2005–2023)**

Indicator	Statistic	Year / Period
Total e-waste generated	2.62 million metric tonnes	2005–2023
Highest recorded annual generation	904,008.90 mt	2020 (MCO period)

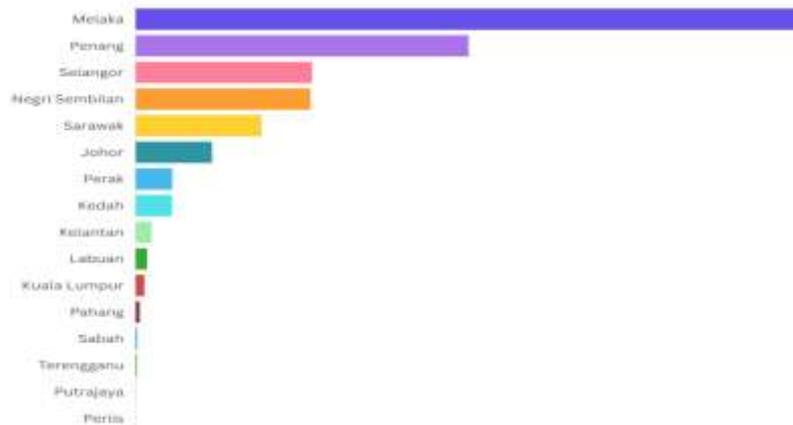
E-waste generated (nationwide)	286,205.84 mt	2022
E-waste collected (nationwide)	65,280.14 mt	2023
E-waste recovered	13,759.98 mt	2023
Recovery rate	21.1%	2023
Projected discarded units	24.5 million units	2025 (projection)

Source: Compiled from Department of Environment Malaysia (2022, 2023) as reported in Malay Mail (2025)



**Figure 1: Projection of E-waste Generation in Malaysia**

Source: Department of Environment Malaysia (2022)



**Figure 2: State-Level E-Waste Generation in Malaysia (2015-2023)**

Source: Department of Environment Malaysia

### *E-Waste Enforcement Cases in Malaysia*

Table 2 demonstrates that enforcement efforts between 2025 and 2026 have intensified, involving multi-agency coordination and substantial seizures. However, the recurrence of large-scale violations suggests that Malaysia's regulatory framework remains reactive and enforcement-dependent rather than preventive and structurally integrated.

**Table 2: Major E-Waste Enforcement Cases and Applicable Legal Provisions in Malaysia**

Year	Case Summary	Quantity	Legislation/ Relevant Section	Source
2025	Nationwide PDRM–DOE crackdown (Op Hazard phase): 538 arrests across 90 illegal e-waste processing factories involving unlicensed dismantling of precious metals.	RM3.8 billion was seized from 22.9 million kilograms of e-waste.	Licensing of Trades, Businesses and Industries By-Laws; Environmental Quality Act 1974 (EQA), ss. 18, 34B; Immigration Act 1959/63.	<i>Malay Mail</i> (20 February 2025).
2025	Sarawak DOE “Op Hazard”: Equipment Operation Detention (POK) orders issued against multiple premises for illegal e-waste storage and pollution-related offences.	175.393 metric tonnes (MT) of e-waste; 98.48 MT of other materials.	EQA 1974, ss. 18 (licensing), 34B (scheduled waste prohibition), 38(1)(a) (pollution control/detention), 38(1)(c) (seizure).	<i>Sarawak Tribune</i> (25 February 2025).
2025	Pahang Customs seized misdeclared e-waste and aluminium scrap falsely declared as “copper concentrate” to evade permit requirements.	46,726 kg e-waste (MYR 700,890); 105,760 kg aluminium scrap (MYR 3.7 million); total approx. MYR 4.4 million.	The Customs Act of 1967, specifically s. 135(1)(a), prohibits false declarations and smuggling offences, while the Environmental Quality Act of 1974 mandates the import permit requirement.	<i>AL Circle News</i> (4 July 2025).
2026	MCBA Port Klang's “Op Green Shield” blitz uncovered illegal transboundary e-waste shipments across multiple containers inspected.	Over 700 tonnes.	EQA 1974, s. 34B; Environmental Quality (Scheduled Wastes) Regulations 2005; Basel Convention (Annexes II & VIII).	<i>New Straits Times</i> (13 February 2026).
2026	Seizure of 195,720 kg of smuggled e-waste imported from U.S. ports at the Malaysian entry point.	195,720 kg.	EQA 1974, s. 34B; Environmental Quality (Scheduled Wastes) Regulations 2005.	<i>The Star</i> (12 February 2026).

### ***National Legal Framework and Policies Governing E-Waste in Malaysia***

Malaysia's legal framework governing e-waste is primarily derived from general environmental legislation rather than a dedicated e-waste statute. Regulation is largely channelled by classifying e-waste as scheduled waste under subsidiary legislation, with a focus on control, licensing, and disposal rather than lifecycle management. While this approach provides regulatory oversight for industrial and commercial e-waste, it remains structurally inadequate for addressing household e-waste and informal processing activities (Ismail & Hanafiah, 2019; Yong et al., 2019). The absence of binding obligations for producers, consumers, and local authorities leads to regulatory fragmentation, allowing environmentally unsound and climate-inefficient practices to persist outside formal oversight.

**Table 3: Malaysia's Legal Instruments Governing E-Waste and Identified Climate Governance Gaps**

<b>Legislation</b>	<b>Regulatory Focus</b>	<b>Relevant Section/Regulation</b>	<b>Climate Governance Gap Identified</b>
Environmental Quality Act 1974 (Act 127)	Pollution prevention and environmental control	s 18–22 (licensing and control of prescribed premises); s 34A (EIA requirement); s 37 (enforcement powers)	Climate mitigation objectives are absent. The Act regulates environmental harm but does not frame e-waste management as a tool for emissions reduction, material circularity, or climate governance.
Environmental Quality (Scheduled Wastes) Regulations 2005	Hazardous waste classification and control	reg 3; First Schedule (SW110 – e-waste); reg 4–9 (storage, transport, treatment, disposal)	Recovery under reg 8 is permissive rather than mandatory. No recovery targets or emissions-related standards are in place, limiting the climate mitigation potential.
Environmental Quality (Prescribed Premises) (Scheduled Wastes Treatment and Disposal Facilities) Regulations 1989	Licensing and regulation of waste treatment facilities	reg 3 (licensing); reg 7 (conditions of licence); reg 9 (operational compliance)	The focus is on facility compliance, not on lifecycle emissions or low-carbon treatment technologies. Climate outcomes remain incidental rather than regulatory objectives.
Customs Act 1967 (as applied to e-waste imports)	Control of illegal imports	s 31 (prohibited goods); s 133 & s 135 (seizure and offences)	Low enforcement enables illegal e-waste inflows, informal processing, and emissions-intensive recycling, undermining climate mitigation efforts.
Environmental Quality (Prescribed Activities)	Environmental Impact Assessment	First Schedule & Second Schedule (prescribed activities requiring EIA)	The EIA process does not mandate a comprehensive climate impact assessment

Legislation	Regulatory Focus	Relevant Section/Regulation	Climate Governance Gap Identified
(Environmental Impact Assessment) Order 2015	(EIA) requirement prescribed industrial activities	approval prior to commencement); issued pursuant to s.34A EQA	to or carbon accounting for waste facilities, and it does not systematically embed climate mitigation measures in approval conditions.

Source: Reorganised from the Environmental Quality Act 1974 (EQA), the Environmental Quality (Scheduled Wastes) Regulations 2005, the Environmental Quality (Prescribed Premises) (Scheduled Wastes Treatment and Disposal Facilities) Regulations 1989, the Customs Act 1967 and the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015.

**Table 4: National Policies on E-Waste Governance in Malaysia**

National Policy Instrument	Year	Policy Objective	Relevance to Waste Governance	E-Climate Governance Link	Identified Limitation
National Solid Waste Management Policy (NSWMP)	2006	Establish an integrated, systematic, and sustainable solid waste management framework.	It promotes the 3R (Reduce, Reuse, Recycle) principles, which are indirectly relevant to household waste collection and waste diversion.	It encourages resource efficiency and landfill reduction, thereby indirectly reducing emissions.	It does not specifically regulate e-waste; it lacks binding producer responsibility mechanisms.
Eleventh Malaysia Plan (2016–2020)	2015	Advance green and sustainable resource management.	Recognised need for improved waste governance and circular economy transition.	Linked environmental sustainability to low-carbon development strategies.	E-waste is addressed broadly; no specific statutory reform is implemented during the plan period.
Twelfth Malaysia Plan (2021–2025)	2021	Strengthen environmental sustainability and accelerate the transition to a circular economy.	The policy explicitly promotes Extended Producer Responsibility (EPR) for waste streams, including e-waste.	The policy aligns waste governance with Malaysia's climate-mitigation and sustainable-consumption objectives.	EPR, or Extended Producer Responsibility, remains policy-driven and has not yet been codified as binding statutory obligations for e-waste, which refers to discarded electronic devices.
Circular Economy	2025	Promote lifecycle	The blueprint encourages	The blueprint supports	This non-binding blueprint lacks

National Policy Instrument	Year	Policy Objective	Relevance to Waste Governance	E-Climate Governance Link	Identified Limitation
Blueprint for Solid Waste (2025–2035)		responsibility, material recovery, reduced reliance on virgin resources.	structured recovery and accountability for streams.	emission reduction through increased e-waste recycling efficiency and material substitution.	direct enforcement mechanisms and statutory integration.
Nationally Determined Contribution (NDC) under the Paris Agreement	3.0 2025	Commit to reducing economy-wide carbon intensity and enhancing climate action in Malaysia.	The potential to reduce waste-sector emissions (including improved waste recovery) contributes indirectly to NDC targets.	The policy aligns national climate mitigation commitments with international obligations.	The policy does not explicitly incorporate e-waste mitigation strategies, and there is no direct linkage to waste regulatory instruments.

Source: Reorganised from the National Solid Waste Management Policy (NSWMP), the Eleventh Malaysia Plan (2016–2020), the Twelfth Malaysia Plan (2021–2025), the Circular Economy Blueprint for Solid Waste (2025–2035) and the Nationally Determined Contribution (NDC) under the Paris Agreement.

### *International Legal Framework and the Limits of Basel Convention Implementation*

**Table 5: International Legal Framework and the Limits of Basel Convention Implementation**

International Instrument	Year	Brief Description of Initiatives	Limitations
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	1989 (Malaysia ratified in 1993)	Establishes a legally binding framework regulating transboundary movement of hazardous waste through the Prior Informed Consent (PIC) procedure; environmentally sound management (ESM); obligates Parties to minimise hazardous waste generation and prevent illegal traffic (Articles 4, 6, and 9)—certain categories of e-waste fall under hazardous waste classifications.	Enforcement depends heavily on national implementation capacity; challenges persist in detecting misdeclared shipments and illegal imports; monitoring and verification gaps undermine full compliance; climate mitigation considerations are not explicitly embedded within the Convention’s regulatory design.
Basel Convention Ban Amendment	Adopted 1995; entered	Prohibits the export of hazardous waste from Annex VII (developed) countries to	Continued illegal or disguised shipments indicate weaknesses in enforcement

International Instrument	Year	Brief Description of Initiatives	Limitations
	into force 2019	Annex VII (developing) countries for recycling, strengthening protection against waste dumping in developing states.	and verification; reliance on or documentation-based control mechanisms allows waste circumvention; and there is limited integration of lifecycle emissions or climate governance considerations into implementation frameworks.

Source: Reorganised from the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal and the Basel Convention Ban Amendment.

### ***Legal Insights from Comparative E-Waste Governance Models***

Malaysia's regulatory approach is fundamentally different from other jurisdictions that have effectively integrated e-waste management into broader climate and sustainability governance, as evidenced by a comparative analysis of national and international e-waste governance frameworks. The Republic of Korea (South Korea) and the European Union (EU) are particularly relevant in this regard, as they provide legally advanced and contextually appropriate examples of climate-responsive e-waste regulation.

The Circular Economy Action Plan, which is strengthened by the EU's governance framework, demonstrates how e-waste regulation can be integrated into binding Extended Producer Responsibility (EPR) obligations, mandatory collection and recovery targets, and lifecycle-based regulatory design. This framework is anchored in the Waste Electrical and Electronic Equipment (WEEE) Directive. It is essential that this framework explicitly links e-waste management to climate mitigation by reducing reliance on virgin material extraction and lowering lifecycle greenhouse gas emissions through improved recovery efficiency.

Meanwhile, South Korea offers an alternative comparative perspective, demonstrating that climate-integrated e-waste governance is feasible in a rapidly industrialising Asian economy that operates outside the EU's supranational legal framework. South Korea enforces legally enforceable producer responsibilities through its law on Resource Circulation of Electrical and Electronic Equipment and Vehicles and related resource circulation legislation. Comprehensive enforcement mechanisms and quantified recycling obligations safeguard these responsibilities. South Korea, in contrast to Malaysia's pollution-control-oriented regime, regards e-waste as a strategic resource stream within national sustainability and climate governance. This approach operationalises emissions reductions and material efficiency through binding legal instruments. In contrast, Malaysia's current e-waste governance framework primarily lies in hazardous waste control under the Environmental Quality Act 1974 and the Environmental Quality (Scheduled Wastes) Regulations 2005. This framework is characterised by limited producer responsibility, weak regulation of household e-waste, and an absence of explicit climate mitigation objectives. This contrast underscores that Malaysia's regulatory deficiencies are not the result of legal incapacity but rather from the continued treatment of e-waste as a pollution issue rather than a climate-relevant regulatory domain, when compared with the EU and South Korean models. The comparative analysis thereby supports the study's primary argument that legally integrated, climate-responsive e-waste governance is both feasible and normatively justifiable. Malaysia needs to establish a comprehensive and inclusive Extended Producer

Responsibility framework that is customised to its local context, incorporating data, innovative technologies, the informal sector, and regional harmonisation (Yap, 2025).

### ***Challenges and Future Directions***

Despite statutory controls and policy commitments, Malaysia's e-waste governance framework continues to face structural and operational challenges that impede effective integration with climate-mitigation objectives (Baldé et al., 2024; Forti et al., 2020). Addressing these challenges requires not only improved enforcement but also systemic legal reform.

One of the most significant regulatory gaps is the absence of comprehensive, binding legislation governing household e-waste (Ismail & Hanafiah, 2019; Yong et al., 2019). While industrial and commercial e-waste is regulated under the Environmental Quality Act 1974 (EQA) and its subsidiary regulations, household e-waste remains inadequately integrated within the statutory framework (Ismail & Hanafiah, 2019). This regulatory omission creates enforcement blind spots and contributes to leakage into informal or unregulated disposal pathways (Baldé et al., 2024; Yong et al., 2019).

Future reform must prioritise the introduction of a compulsory statutory take-back scheme supported by a binding Extended Producer Responsibility (EPR) regime (Ismail & Hanafiah, 2019; Yap, 2025). A legally enforceable EPR system would shift end-of-life responsibility to producers, requiring them to finance and organise collection, recovery, and recycling systems (Hanafi et al., 2025). Such a framework would enhance material recovery rates, reduce reliance on landfills, and contribute to emissions reductions by substituting for virgin resource extraction (Baldé et al., 2024). Codifying EPR (Extended Producer Responsibility) in primary legislation would align Malaysia's waste governance with circular-economy principles and strengthen its climate-mitigation commitments.

Despite the implementation of awareness campaigns and recycling initiatives, behavioural change remains limited (Akhtar et al., 2014; Mohamad et al., 2022). Public participation in formal e-waste collection systems remains inconsistent, partly due to perceived inconvenience, limited access to collection infrastructure, and limited understanding of the environmental and climate implications (Mohamad et al., 2022).

Future directions should therefore extend beyond informational campaigns to institutionalise accessible collection mechanisms, financial incentives, and regulatory nudges. Strengthening public engagement is not merely a behavioural concern but a governance imperative, as effective household participation directly influences recovery rates and climate mitigation outcomes (Baldé et al., 2024).

Despite Malaysia's obligations under the Basel Convention and the Basel Ban Amendment, unlawful transboundary movements of e-waste remain a recurring issue (Basel Action Network, 2024; Hashim et al., 2024). Misdeclaration of shipments and illicit trade networks expose weaknesses in monitoring, inter-agency coordination, and customs enforcement (Hashim et al., 2024; DOE, 2024).

Future directions should include enhanced digital tracking systems and stronger coordination between customs and environmental authorities. Additionally, climate considerations should be embedded in transboundary waste assessments, recognising that illegal imports contribute to emissions-intensive informal processing (Baldé et al., 2024).

The persistence of informal e-waste dismantling activities remains a structural challenge in Malaysia. Yusof et al. (2023) observe that informal recycling practices, including open burning, crude metal extraction, and improper disposal, continue to pose serious risks to soil, water, and air quality. These practices undermine environmental protection objectives and contribute indirectly to greenhouse gas emissions and climate-related externalities.

Perhaps the most structural challenge is the limited integration of climate change considerations within Malaysia's e-waste regulatory framework. Existing legislation primarily focuses on pollution control and hazardous waste management, with minimal explicit references to greenhouse gas mitigation or lifecycle emissions (Forti et al., 2020; Baldé et al., 2024).

Future reform should embed climate impact assessments within licensing approvals, environmental impact assessments (EIAs), and recovery targets. Establishing mandatory material recovery benchmarks aligned with emissions-reduction objectives would transform e-waste governance from a reactive compliance model into a climate-responsive regulatory regime (Wang et al., 2024).

## Conclusion

This article demonstrates that Malaysia's e-waste challenge extends beyond conventional hazardous waste management and must be understood as a climate governance concern. Through a doctrinal analysis of national legislation, policy instruments, and international obligations, the study reveals that the current regulatory framework remains predominantly pollution-centric and insufficiently aligned with Malaysia's climate commitments under the Paris Agreement and its Nationally Determined Contributions (NDCs). The findings indicate that structural legal gaps, particularly the absence of binding Extended Producer Responsibility (EPR) obligations, fragmented institutional coordination, weak regulation of household e-waste, and limited integration of lifecycle emissions considerations continue to constrain the development of a coherent and climate-responsive e-waste governance regime. Addressing these deficiencies requires not merely incremental enforcement improvements but a fundamental recalibration of Malaysia's environmental law framework toward integrated, climate-aligned waste governance.

The findings identify several structural weaknesses. First, household e-waste remains inadequately regulated under binding legislation, creating enforcement blind spots and facilitating leakage into informal and unregulated processing channels. Second, institutional coordination among environmental, customs, and enforcement authorities remains fragmented, weakening the domestic implementation of transboundary waste controls. Third, although policy frameworks such as the Twelfth Malaysia Plan and the Circular Economy Blueprint articulate Extended Producer Responsibility (EPR) and circular economy principles, these commitments have yet to be codified into enforceable statutory obligations. Finally, climate considerations remain largely implicit within waste regulation, with limited integration of

lifecycle emissions, greenhouse gas mitigation benchmarks, or alignment with Malaysia's Nationally Determined Contributions (NDCs).

From a theoretical perspective, this study contributes to environmental law scholarship by advancing the proposition that e-waste governance must be situated within climate governance discourse. By demonstrating the emissions implications of informal dismantling, low material recovery rates, and continued reliance on virgin resource extraction, the article extends traditional hazardous waste regulation analysis toward an integrated, lifecycle-based regulatory perspective. It underscores the need to align environmental regulatory designs with decarbonisation objectives.

From a practical standpoint, the analysis highlights the urgency of structural statutory reform. Codifying binding EPR obligations, introducing compulsory take-back schemes, establishing measurable recovery targets, strengthening inter-agency coordination, formalising informal-sector participation, and embedding explicit climate criteria in scheduled waste regulations are critical steps toward a coherent, climate-responsive governance model. Such reforms would recalibrate Malaysia's approach from reactive enforcement to preventive, lifecycle-oriented regulation consistent with circular-economy principles.

This study is subject to certain limitations. As a doctrinal analysis, it prioritises legal interpretation and policy coherence rather than the empirical measurement of emission reductions or behavioural outcomes. The lack of quantitative lifecycle assessment restricts the accuracy of evaluating climate mitigation impacts. Moreover, while comparative insights are incorporated, the study does not empirically assess the effectiveness of implementation across jurisdictions.

Therefore, future research should adopt interdisciplinary methodologies that integrate legal analysis with climate modelling, environmental economics, and governance evaluations. An empirical assessment of greenhouse gas reductions throughout the lifecycle associated with improved recovery rates, an analysis of the socio-economic implications of statutory EPR adoption, and an evaluation of formalisation strategies for informal recyclers would further substantiate the reform proposals advanced herein.

In conclusion, Malaysia's e-waste challenge reflects not merely a regulatory compliance issue but a broader governance misalignment between hazardous waste control and climate mitigation. Bridging this divide requires cohesive statutory integration, strengthened institutional coordination, and explicit alignment with national decarbonisation commitments. Only through such structural recalibration can e-waste governance meaningfully contribute to sustainable development and long-term climate resilience.

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