

Extended Producer Responsibility for WEEE in Nigeria: A Theory-Based Evaluation

Aliyu Umar Sadiq

Supervisor

Jessika Richter

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Abstract

Waste Electrical and Electronic Equipment (WEEE) generation resulting from rapid digitization and increasing electronic device use poses significant environmental and public health risks, particularly in developing countries. In response, Nigeria established an Extended Producer Responsibility (EPR) programme for WEEE, which is currently being implemented. However, its effectiveness in achieving intended outcomes remains largely unknown. Although previous studies have examined specific aspects of WEEE and EPR in Nigeria, no comprehensive evaluation of the programme has been conducted. This thesis therefore evaluates the effectiveness of Nigeria's EPR programme through a Theory-Based Evaluation (TBE) framework, extended to include unintended outcomes. The study systematically compares policy design (espoused theory) with actual implementation practice (theory-in-use) to determine Nigeria's EPR effectiveness based on the interactions between policy context, implementation mechanisms, and outcomes. A qualitative multi-method design was adopted, drawing on semi-structured interviews with 13 stakeholder groups, and content analysis of the main policy documents. Interview data were analysed using a two-cycle deductive and inductive coding processes aided by NVivo and followed by thematic analysis. In addition, a complementary quantitative data analysis and field observations supported the data triangulation process. The findings indicate that Nigeria's EPR programme demonstrates partial effectiveness. While the policy design aligns considerably with classical theoretical EPR expectations, substantial gaps exist between intended policy design and actual implementation realities. Core anticipated outcomes—including improved downstream infrastructure, effective material loop closure, design-for-environment, and environmentally sound waste management—remain significantly unattained, while feedback mechanism has considerably improved. The study also identified unintended livelihood displacement and environmental and health risks not previously captured within the TBE framework and policy design. These findings extend existing knowledge on EPR evaluation within developing-country contexts. The study concludes that EPR effectiveness cannot be understood through policy design alone, but must be evaluated through the interaction between context, implementation mechanisms, and actual outcomes in practice.

Keywords: Extended Producer Responsibility, WEEE, Theory-Based Evaluation

Executive Summary

1. Problem Definition and Research Questions

E-waste has become the fastest-growing waste stream globally due to rapid technological advancement and increasing consumption of EEE (Forti et al., 2020). Despite growing environmental and public health concerns associated with unsafe Waste Electrical and Electronic Equipment (WEEE) management, formal collection and recycling rates remain low, particularly in developing countries characterised by weak regulatory capacity, inadequate infrastructure, and dominant informal recycling systems (Balde et al., 2024; Shahabuddin et al., 2023). In response, Nigeria adopted the Extended Producer Responsibility (EPR) programme. However, WEEE the challenges persist (Ezeudu, 2024; Odeyingbo et al., 2025). Despite this challenge, no study has comprehensively evaluated Nigeria's EPR programme by systematically comparing the intended policy design with actual implementation realities across stakeholder groups.

This thesis therefore aims to evaluate the effectiveness of Nigeria's EPR programme for WEEE through a systematic comparison between policy design and implementation realities.

To achieve this aim, the following research questions were addressed:

- RQ1: To what extent is Nigeria's EPR programme for WEEE effective based on policy design and actual implementation?
 - RQ1a: How is Nigeria's EPR programme designed in terms of context, implementation mechanisms, and expected outcomes, and to what extent does it align with established EPR theory?
 - RQ1b: How and why does Nigeria's EPR programme operate in practice, and to what extent does implementation align with intended policy design and theoretical expectations?
 - RQ1c: What unintended outcomes have emerged from the implementation of Nigeria's EPR programme for WEEE?

2. Research Design, Materials, and Methods

First, a purposeful literature review was conducted to establish the conceptual framework and evaluation criteria guiding the study (Figure 00-1). The framework was primarily informed by Theory-Based Evaluation (TBE) (Fitz-Gibbon & Morris, 1996; Weiss, 1997), while extensions were made to incorporate unintended outcomes emerging from EPR implementation. The framework enabled the evaluation of Nigeria's EPR programme not only in terms of outcomes, but also in relation to its intended policy design and actual implementation practices. In applying the framework, both the policy design logic (espoused theory) and implementation realities (theory-in-use) were reconstructed based on three core evaluation components: context (situational theory), implementation mechanisms (causal theory), and outcomes (normative theory), following Hansen & Vedung (2010). Effectiveness was adopted as the primary evaluation criterion.

This study employed a qualitative design complemented by quantitative data to evaluate the implementation of Nigeria's EPR programme for WEEE. This approach was particularly appropriate, as it enabled in-depth, context-rich insights into complex policy and organisational processes that could not be adequately captured through quantitative indicators alone (Creswell & Creswell, 2018; Patton, 2002). The research adopted a multi-method data collection approach comprising semi-structured interviews with 13 stakeholder groups across Nigeria's EPR value chain, document analysis of the three principal EPR policy documents, secondary quantitative data on WEEE management performance, and field observations across four WEEE processing sites in Lagos, Nigeria. Policy documents were analysed using directed qualitative content analysis, while interview data were interpreted through thematic analysis aided by NVivo software. Secondary quantitative data and field observations further complemented the analysis through triangulation, thereby strengthening the credibility and robustness of the findings.

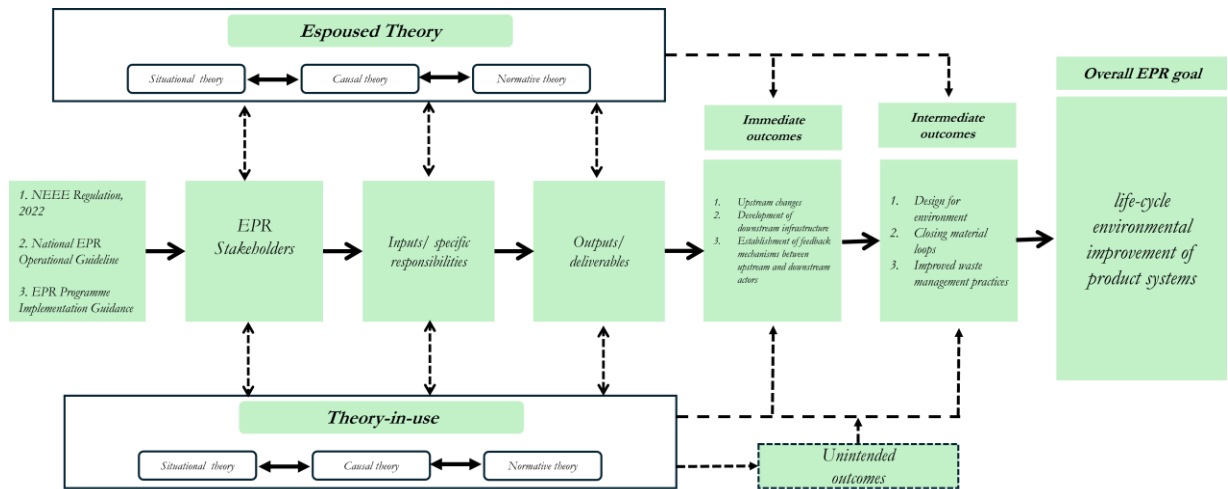


Figure 0-1 Conceptual Framework

Source: Author's Illustration (2026)

3. Key Findings

Regarding the main research question (RQ1), the findings suggest that Nigeria's EPR programme demonstrates partial effectiveness. Environmentally harmful informal dismantling practices continue to undermine the programme's primary environmental objectives, while circular economy outcomes such as improved product design and material loop closure remain weak due to limited producer influence, inadequate feedback mechanisms, and insufficient advanced recycling infrastructure. The findings further suggest that formal recyclers and collectors remain financially disadvantaged because environmental compliance costs reduce their ability to compete with informal actors for WEEE recovery. Additionally, the complexity and operational influence of the informal sector were significantly underestimated within the original EPR design.

In response to RQ1a, the study found that Nigeria's EPR policy design aligns considerably with broader empirical EPR theory, particularly in relation to stakeholder responsibilities and intended outcomes. However, the policy design insufficiently accounts for contextual realities

such as informal sector dominance, weak institutional coordination, and the economic dynamics shaping WEEE flows within Nigeria.

In response to RQ1b, the findings reveal a substantial gap between intended policy design and implementation realities. In practice, implementation remains constrained by weak producer financial compliance, fragmented governance arrangements, limited enforcement capacity, weak traceability systems, and the continued dominance of informal recovery networks, resulting in weaker alignment between intended policy expectations and actual outcomes.

Regarding RQ1c, the study identified unintended outcomes associated with EPR implementation, including the increased economic value of WEEE, which has unintentionally incentivised environmentally harmful dismantling practices, as well as potential livelihood disruptions arising from formalisation efforts within the informal sector.

4. Conclusions and Recommendations

Although the programme demonstrates considerable theoretical coherence in policy design and some operational progress in implementation, significant gaps persist between intended policy expectations and actual implementation realities. A central finding of this study is that implementation outcomes are strongly shaped by contextual factors that were insufficiently accounted for within the original EPR design. Consequently, while the EPR programme is operational to some extent, its implementation mechanisms remain inadequate for substantially achieving the programme's intended outcomes.

The study recommends strengthening producer financial compliance while exploring the international transfer of “missing” EPR fees linked to imported UEEE as a complementary financing mechanism for improving downstream WEEE management infrastructure in Nigeria. The findings further highlight the need for stronger integration of informal sector realities within the EPR programme through more inclusive monitoring and enforcement approaches. In addition, the study recommends a strategic review of Nigeria's EPR framework to better integrate circular economy principles, strengthen environmentally sound recycling systems, and improve long-term material loop closure.

Empirically, the study provides the first comprehensive evaluation of Nigeria's EPR programme for WEEE through a systematic comparison between policy design and implementation realities. Methodologically, it demonstrates the relevance of a multi-method and multi-stakeholder evaluation approach for assessing EPR programmes in developing-country contexts. Theoretically, the study extends the application of the TBE framework by incorporating unintended outcomes and further highlights the importance of contextualising EPR expectations within the socio-economic and institutional realities of developing countries.

Table of Contents

LIST OF FIGURES.....	VII
ABBREVIATIONS.....	VII
1 INTRODUCTION.....	1
1.1 PROBLEM STATEMENT.....	2
1.2 RESEARCH AIM AND OBJECTIVES	2
1.3 SCOPE AND DELIMITATIONS	3
1.4 ETHICAL CONSIDERATIONS	3
1.5 AUDIENCE.....	4
1.6 DISPOSITION.....	5
2 LITERATURE REVIEW.....	6
2.1 PRINCIPLES AND AND DESIGN OF THE EXTENDED PRODUCER RESPONSIBILITY	6
2.1.1 <i>Origins and Early development of the Extended Producer Responsibility (EPR) principle</i>	<i>6</i>
2.1.2 <i>Producer Responsibility: Financial and Operational.....</i>	<i>8</i>
2.1.3 <i>Approaches to Extended Producer Responsibility (Mandatory Vs. Voluntary)</i>	<i>9</i>
2.1.4 <i>Extended Producer Responsibility in the Waste Electrical and Electronic Equipment's (WEEE) Sector.....</i>	<i>9</i>
2.2 EXTENDED PRODUCER RESPONSIBILITY IN PRACTICE	10
2.2.1 <i>Extended Producer Responsibility Structure and Priorities.....</i>	<i>10</i>
2.2.2 <i>Extended Producer Responsibility Structure and Priorities.....</i>	<i>12</i>
2.2.3 <i>Upstream and Downstream Extended Producer Responsibility Performance</i>	<i>13</i>
2.2.4 <i>Key Enablers of Extended Producer Responsibility Performance</i>	<i>14</i>
2.2.5 <i>Barriers to Extended Producer Responsibility</i>	<i>15</i>
2.3 EXTENDED PRODUCER RESPONSIBILITY IN DEVELOPING-COUNTRY CONTEXT	16
2.3.1 <i>Challenges and Gaps in Extended Producer Responsibility Implementation in Developing Countries</i>	<i>16</i>
2.3.2 <i>Enablers of Extended Producer Responsibility in Developing Countries.....</i>	<i>17</i>
2.3.3 <i>Barriers to Extended Producer Responsibility Performance in Developing Countries.....</i>	<i>18</i>
2.4 RATIONALE FOR CONCEPTUAL FRAMEWORK.....	19
2.4.1 <i>Theory-Based Evaluation (Intervention/ProgrammeTheory)</i>	<i>19</i>
2.4.2 <i>Existing Frameworks Based on Theory-Based Evaluation (Intervention/ProgrammeTheory)</i>	<i>20</i>
2.4.3 <i>Defining Extended Producer Responsibility Evaluation Criterion (Effectiveness)</i>	<i>21</i>
2.4.4 <i>Empirical Application of Theory-Based Evaluation Framework Based on Effectiveness Criterion</i>	<i>22</i>
2.4.5 <i>Description of the Conceptual Framework.....</i>	<i>23</i>
3 METHODOLOGY.....	25
3.1 RESEARCH DESIGN.....	25
3.2 METHOD FOR DATA COLLECTION.....	26
3.2.1 <i>Document Gathering.....</i>	<i>26</i>
3.2.2 <i>Semi-Structured Interviews.....</i>	<i>26</i>
3.2.3 <i>Quantitative Data Gathering.....</i>	<i>27</i>
3.2.4 <i>Field Observation</i>	<i>27</i>
3.3 METHOD FOR DATA ANALYSIS.....	28
3.3.1 <i>Document Analysis</i>	<i>28</i>
3.3.2 <i>Interview Analysis</i>	<i>28</i>
3.3.3 <i>Quantitative Data Analysis</i>	<i>28</i>
3.3.4 <i>Data Triangulation</i>	<i>29</i>
3.4 REFLEXIVITY	29
4 RESULTS.....	30
4.1 CONTEXT OF EXTENDED PRODUCER PROGRAMME FOR WEEE IN NIGERIA	30
4.2 IMPLEMENTATION OF EXTENDED PRODUCER PROGRAMME FOR WEEE IN NIGERIA.....	32

4.2.1	<i>Collection, Recovery and Material Processing</i>	32
4.2.2	<i>Awareness, Education and Capacity Building</i>	33
4.2.3	<i>Data Management, Monitoring and Reporting</i>	34
4.2.4	<i>Financing Mechanism and Economic Responsibility</i>	34
4.2.5	<i>Import Control and Transboundary WEEE Flows</i>	35
4.2.6	<i>Informal Sector Integration and Support</i>	35
4.2.7	<i>Product Standards, Quality Control and Social Compliance</i>	36
4.2.8	<i>Regulatory Enforcement and Compliance</i>	36
4.3	IMMEDIATE OUTCOMES OF NIGERIA’S EXTENDED PRODUCER PROGRAMME FOR WEEE	37
4.3.1	<i>Upstream Changes</i>	37
4.3.2	<i>Improvement in Downstream Infrastructure</i>	38
4.3.3	<i>Feedback Mechanisms Between Upstream and Downstream Actors</i>	40
4.4	INTERMEDIATE OUTCOMES OF NIGERIA’S EXTENDED PRODUCER PROGRAMME FOR WEEE	41
4.4.1	<i>Design for Environment</i>	41
4.4.2	<i>Closing Material Loop</i>	42
4.4.3	<i>Improved Waste Management</i>	42
4.5	UNINTENDED OUTCOMES OF NIGERIA’S EXTENDED PRODUCER PROGRAMME FOR WEEE	44
4.6	REFLECTIONS OF FINDINGS TO THE STUDY APPROACHES USED	45
5	DISCUSSION	46
5.1	UNDERSTANDING NIGERIA’S EPR IN THE CONTEXT OF PREVIOUS STUDIES	46
5.2	REFLECTIONS OF FINDINGS TO THE STUDY APPROACHES USED	51
6	CONCLUSION	52
6.1	PRACTICAL IMPLICATIONS AND RECOMMENDATIONS FOR NON-ACADEMIC AUDIENCES	52
6.2	IMPLICATIONS AND RECOMMENDATIONS FOR ACADEMIC AUDIENCES	53
6.3	PERSONAL CLOSING REFLECTION	54
	BIBLIOGRAPHY	55
	APPENDIX A OVERVIEW OF DATA COLLECTION	61
	APPENDIX B: LITERATURE REVIEW MAPPING TABLE	62
	APPENDIX C: RECONSTRUCTED EPR DESIGN LOGIC	63
	APPENDIX D: INTERVIEW CONSENT FORM	71
	APPENDIX E: INTERVIEW PROTOCOL	73
	APPENDIX F: PARTICIPANTS AND INTERVIEWS INFORMATION	75
	APPENDIX G: NVIVO CODE BOOK	77
	APPENDIX H: VISUALIZATION OF INTERVIEW RESULTS: BARRIERS AND ENABLERS TO NIGERIA’S EPR	80

List of Figures

Figure 0-1 Conceptual Framework.....	III
Figure 2-1 EPR global adoption adoption	8
Figure 2-2 EPR reconstruction steps	20
Figure 2-3 Empirical EPR Evaluation framework.....	21
Figure 2-4 Conceptual framework.....	23
Figure 3-1 Visualization of the desearch design	26
Figure 4-1 Simplified reconstructed EPR policy design.....	30
Figure 4-2 Specific EPR contexts in practice.....	32
Figure 4-3 Specific stakeholder EPR roles in practice.....	37
Figure 4-4 E-waste exposure at collection facility.....	40
Figure 4-5 WEEE collection and recycling data	44

Abbreviations

CRT	Cathode Ray Tubes
EEE	Electrical and Electronic Equipment
EoL	End-of-Life
EPR	Extended Producer Responsibility
GEF	Global Environment Facility
NEEE	National Environmental (Electrical/Electronic Sector)
OECD	Organisation for Economic Co-operation and Development
PPP	Polluter-Pays Principle
PRO	Producer Responsibility Organization
TBE	Theory-Based Evaluation
UEEE	Used Electrical and Electronic Equipment
UPR	Ultimate Producer Responsibility
WEEE	Waste Electrical and Electronic Equipment

1 Introduction

Rapid digitization has significantly increased the generation of Waste Electrical and Electronic Equipment (WEEE), while waste management systems have struggled to keep pace. WEEE, also referred to as electronic waste (E-waste), results from the use and disposal of electrical and electronic equipment (EEE) and has increased substantially at both global and local levels, constituting a major environmental concern (Shahabuddin et al., 2023). This trend is largely driven by rapid technological advancement (Cole et al., 2019; Toral-López et al., 2018). As a result, WEEE has become the fastest-growing waste stream globally (Forti et al., 2020; Maes & Preston-Whyte, 2022). According to the *Global E-waste Monitor*, approximately 62 billion kilograms of WEEE were generated globally in 2022, yet only about 22.3% was formally collected and recycled (Balde et al., 2024). Compared to 2010 levels, global WEEE generation has nearly doubled within just 12 years and is projected to reach 82 billion kilograms by 2030.

Moreover, WEEE has been associated with significant environmental and public health challenges (Parvez et al., 2021; Rautela et al., 2021; Awasthi et al., 2016; Grandjean and Landrigan 2014; Masud et al., 2019). A global review of 186 studies reported elevated concentrations of heavy metals in environmental mediums, while 54 studies found increased levels of harmful pollutants in the human body, largely attributable to crude and unsafe WEEE management practices (Rautela et al., 2021). This situation has been mostly observed in developing countries including Nigeria (Srivastav et al., 2023), particularly affecting children and pregnant women (Parvez et al., 2021). These findings point to the pervasive nature of poor WEEE management. Despite the fact that only 78 countries, globally, have established WEEE-related legislation, implementation, especially in developing countries, has been widely considered ineffective (Shahabuddin et al., 2023).

The WEEE crisis is particularly pronounced in developing countries such as Nigeria, largely due to transboundary flows of WEEE from developed to developing regions (Apoorva & Arpit 2023; Odeyingbo et al., 2019; Sthiannopkao & Wong, 2013), which further exacerbate environmental and health impacts (Balde et al., 2024). Recent estimates indicate that Nigeria generates approximately 500 million kilograms of WEEE annually, the highest volume in West Africa (Balde et al., 2024). This growing burden has been attributed in part to illegal and poorly regulated imports, which often consist of near End-of-life (EoL) or non-functional EEE that rapidly becomes waste upon arrival (European Commission, 2025; Odeyingbo et al., 2019). It is also estimated that up to 70% of Used Electrical Electronic Equipments (UEEE) imported into Africa are effectively WEEE, with Nigeria serving as a major destination (Apoorva & Arpit, 2023). Nigeria therefore represents a critical case for examining how developing countries attempt to manage WEEE.

In response to the WEEE challenge, Nigeria adopted the Extended Producer Responsibility (EPR) framework in 2014 in line with the National Environmental (Electrical/Electronic Sector) (NEEE) Regulation S.I No. 23 of 2011. It is a policy approach that places the financial and/or physical responsibility on producers for the management of their products across their life cycle, including WEEE (OECD, 2016). However, the initial framework remained largely inactive until the amendment and gazetting of the NEEE Regulation, 2022, which strengthened and operationalized the EPR programme by clearly defining stakeholder roles and enforcing compliance mechanisms (Odeyingbo et al., 2025). The rapid growth of WEEE thus indicates an imbalance between global production and uneven regulatory capacity. While policy instruments such as EPR have diffused internationally, their effectiveness in achieving defined objectives depends on the context of a given country and its institutional capacity, as well as enforcement mechanisms. In developing-country contexts the translation of EPR from

regulatory design to environmental outcomes cannot be assumed. Nigeria's adoption of EPR therefore represents a test case for assessing whether its actual implementation aligns with the policy design, which is critical for addressing WEEE challenges.

1.1 Problem Statement

Despite Nigeria's established EPR programme, WEEE management challenges persist, suggesting that the programme's expected outcomes remain only partially achieved, or in some areas unattained (Ezeudu, 2024; Odeyingbo et al., 2025). Evaluating the extent to which these outcomes have been achieved requires attention not only to policy objectives, but also to the implementation conditions shaping EPR performance in practice. This is particularly important in Nigeria and other developing-country contexts, where dominant informal sectors, weak enforcement capacity, infrastructure deficits, fragmented data systems, and limited institutional coordination strongly influence how EPR operates (Woggsborg & Schröder, 2019; Cass Talbott, 2022; Odeyingbo et al., 2025).

Nevertheless, no study has previously evaluated Nigeria's EPR programme comprehensively. Existing studies in Nigeria and comparable developing-country contexts remain fragmented in scope and focus. Some studies emphasize policy and government perspectives while giving limited attention to the experiences and roles of other actors across the EPR value chain (Pongajow et al., 2025). Others focussed mainly on stakeholder perceptions without systematically comparing policy design with implementation realities (Ezeudu, 2024). In addition, the social dimensions of EPR, particularly the role of informal actors in WEEE collection and recovery, remain insufficiently integrated into previous evaluations despite their significant influence on EPR performance (Woggsborg & Schröder, 2019; OECD, 2016; Ezeudu, 2024; Odeyingbo et al., 2025). Similar implementation challenges have also been observed in Kenya, South Africa, China, and Ghana, where informal systems coexist with, and in some cases undermine, formal EPR arrangements (Odeyingbo et al., 2025; Pongajow et al., 2025). As a result, existing studies provide little to no understanding of how the interactions between context, implementation mechanisms, and stakeholder practices shape EPR outcomes in developing-country settings. Yet, understanding these interactions is essential for evaluating EPR effectiveness beyond simple goal attainment, particularly in contexts where social, economic, institutional, and market conditions strongly shape implementation realities (Ezeudu, 2024; Odeyingbo et al., 2025).

A comprehensive understanding of the strengths and weaknesses of Nigeria's EPR programme is therefore necessary to improve its implementation, understand how its challenges and successes relate to those of other developing countries, contribute to the still limited body of literature on EPR in developing-country contexts, and identify practical improvements relevant not only to Nigeria but also to similar contexts beyond the country.

1.2 Research Aim and Objectives

This study aims to evaluate the effectiveness of Nigeria's EPR programme for WEEE through a systematic comparison between the policy design and the actual implementation realities across its stakeholder groups, while providing theoretical and practical recommendations.

In order to achieve this aim, this thesis will answer the following questions.

RQ1:

To what extent is Nigeria's EPR programme for WEEE effective based on policy design and actual implementation?

Sub-questions

RQ1a:

How is Nigeria's EPR programme designed in terms of context, implementation mechanisms, and expected outcomes, and to what extent does it align with the empirically established theory?

RQ1b:

How and why does Nigeria's EPR programme for WEEE operate in practice, and to what extent does it align with intended policy design and the theoretical expectations?

RQ1c:

What unintended outcomes have emerged from the implementation of Nigeria's EPR programme for WEEE?

The relevance of this study is twofold. From a practical perspective, it provides recommendations for key stakeholders, including policymakers and practitioners, aimed at strengthening Nigeria's EPR programme to better achieve its intended objectives. From an academic perspective, the study contributes to the literature by serving as the first empirical applications of TBE for EPR evaluation in Nigeria. In doing so, it helps validate the applicability of the framework and its evaluation criteria within the Nigerian context and, by implication, in other developing country contexts.

1.3 Scope and Delimitations

As outlined above, this study focuses on evaluating Nigeria's existing EPR programme for EEE. While EEE constitutes the general scope of the evaluation, particular attention is given to WEEE. Geographically, the study is limited to Nigeria, based on empirical evidence identifying the country as one of the most affected by WEEE in West Africa (Balde et al., 2024). The evaluation of policy effectiveness primarily emphasises environmental effectiveness, although aspects of social effectiveness are also considered. However, social effectiveness does not constitute the central focus of the evaluation. Given existing quantitative data limitations in the study area, secondary quantitative data and observations are used mainly for triangulation to complement findings from primary stakeholder interviews, rather than as a core evaluation criterion. This study does not examine upstream stages such as raw material extraction, nor downstream processes such as metal recovery and refining. While the findings may hold relevance for other developing-country contexts facing similar WEEE challenges, the study does not undertake comparative cross-country analysis. Finally, the evaluation criteria applied in this study are adapted from existing empirical research; therefore, the primary focus is on evaluation and contextual validation rather than on developing new evaluation criteria.

1.4 Ethical Considerations

The research was partially funded by the Central European University student research grant. Specifically, the grant supported the author's travel to Nigeria during the data collection

process. The research design has been independently developed by the author with the support of the supervisor, without influence from any other external actors. To ensure academic integrity and transparency, all ideas, texts, figures, and other materials that are not the author's own are clearly and accurately attributed through appropriate referencing. The study has been conducted with a commitment to accuracy and honesty, and care has been taken to avoid selective use of evidence or the omission of findings that may contradict initial assumptions or expectations.

Participation in interviews for this study was entirely voluntary. All participants were informed about the purpose of the research, the nature of their participation, the expected duration of the interview, and their right to decline to answer any question or to withdraw from the study at any point without any negative consequences. Informed consent was obtained from all participants prior to data collection. The consent form included an option for participants to indicate whether they wish to be identified by name and/or organisation, as well as whether they consented to audio or video recording for analytical purposes. To minimise any potential implications for participants, the identities of respondents, including names and organisational affiliations, were anonymised in the study. Where direct quotations are used, they are reported in a manner that prevents the identification of individual participants. All empirical data, including interview recordings, transcripts, and consent forms, were stored securely in password-protected folders accessible only to the researcher. Any sensitive information is handled with strict confidentiality, and anonymisation codes are stored separately from the interview data. No raw interview data was and will be made publicly available.

Given that this study applied an existing evaluation framework, there is a likelihood of subjectivity during interviews, particularly where questions are structured around predefined effectiveness criteria. However, it is equally important to identify additional effectiveness dimensions or unintended outcomes of the EPR programme from the perspectives of stakeholders. To minimise bias and allow for the emergence of such additional data, the interviews were designed to be semi-structured and open-ended. Participants were explicitly informed that there are no right or wrong answers, in order to encourage honest and reflective responses (Creswell & Creswell, 2018). In summary, this research design has been reviewed against the criteria for research requiring an ethics board review at Lund University and has been found not to require a statement from the ethics committee.

1.5 Audience

This thesis is generally relevant to policymakers, researchers, and stakeholders involved in the design, implementation, and evaluation of EPR programmes in Nigeria and other developing countries. Specifically, it is relevant to Nigerian government and key regulatory institutions, including the National Environmental Standards and Regulations Enforcement Agency (NESREA), the Federal Ministry of Environment, and the E-waste Producer Responsibility Organization of Nigeria (EPRON), the designated Producer Responsibility Organization (PRO) for the EEE sector. The findings of this study will provide evidence-based insights into existing gaps within the implementation of the EPR programme across key stakeholder groups, as well as the extent of alignment between policy design and implementation realities. Ultimately, the study will offer practical recommendations aimed at addressing observed implementation gaps and strengthening the overall effectiveness of Nigeria's EPR programme in achieving its intended outcomes.

Secondly, the findings from this thesis are relevant to researchers as the study will contribute to the existing body of knowledge on EPR programme evaluation and further validate the applicability of the evaluation framework used within a developing-country contexts. In

addition, the integration of unintended outcomes into the framework, arising from stakeholder implementation practices, provides nuanced insights that are valuable for future EPR evaluation research.

1.6 Disposition

This thesis is organised into six chapters.

Chapter 1 introduces the research topic and presents the research problem, aim, objectives, scope, relevance of the study, and the audience for whom the thesis is intended. It also provides background on WEEE challenges, EPR policy development in Nigeria, and an overview of the framework used.

Chapter 2 presents the literature review on EPR based on existing knowledge from across the world, including literature specific to developing-country contexts. It also provides the rationale for the conceptual framework used in the study.

Chapter 3 outlines the research design, methodology, and methods used for data collection and analysis, while also providing justification for each method.

Chapter 4 presents the findings of the study. The chapter systematically examines the context, implementation mechanisms, immediate outcomes, intermediate outcomes, and unintended outcomes of Nigeria's EPR programme for WEEE, while providing answers to the research questions.

Chapter 5 discusses the findings in relation to existing literature. It also reflects on how the methodological and conceptual framework choices influenced the results and introduced limitations to the study.

Finally, Chapter 6 concludes the thesis by summarising the key insights from the study, outlining both practical and academic implications, and providing recommendations for academic and non-academic audiences. It further highlights areas for future research.

2 Literature Review

This chapter provides an empirical overview of EPR since its inception. It first examines the conceptual development of EPR, including the various forms and approaches to its implementation. It then reviews the literature on EPR evaluation, key challenges, and contemporary debates globally, followed by similar discussions specific to developing countries with similar context like Nigeria. Additionally, the section also provides a justification of the conceptual framework, theories and evaluation criterion adapted in this research.

2.1 Principles and Design of the Extended Producer Responsibility

2.1.1 Origins and Early development of the Extended Producer Responsibility (EPR) principle

The EPR principle was first formally formulated in 1990 by Lindhqvist (2000). However, the underlying ideas were not entirely new. Before the formal articulation of EPR, recycling systems were already in place even before the 1980s, particularly for EoL products with a market value (OECD, 2016). These systems faced challenges and limitations, hence failing to achieve socially optimal recycling outcomes. By the late 1980s, the high volume and increasing complexity of waste streams overwhelmed municipal waste management capacities in many industrialised countries. This pressure was further intensified by public resistance to new disposal facilities, commonly described as the “*Not In My Back Yard*” (NIMBY) concept (OECD 2016. p21). At the same time, waste management remained largely dominated by the public sector, limiting the involvement of private-sector technical and managerial expertise. These situations established the foundation for a new policy approach that would later become EPR (OECD, 2016).

In simple terms, Lindhqvist (2000) defined EPR as:

“EPR is a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the product to various parts of the entire life cycle of the product, and especially to the take-back, recycling and final disposal of the product.”

According to Lindhqvist (2000), EPR first appeared in a report to the Swedish Ministry of the Environment that year. This coincided with a period when several European countries were organizing and beginning to implement policy instruments aimed at improving the management of EoL products (Lindhqvist, 2000). However, the roots of EPR predate its formal articulation and can be traced back to the 1970s and 1980s, when dissatisfaction with traditional waste management systems began to grow. At that time, responsibility for waste management was primarily placed on consumers and public authorities, a model increasingly seen as insufficient in addressing rising environmental concerns (Lindhqvist, 2000).

Policymakers gradually recognized that environmental impacts were linked not only to waste treatment practices but also to product design and manufacturing decisions. In countries such as Sweden and Germany, early policy discussions emphasized the need to involve producers in addressing waste and recycling challenges (Lindhqvist, 2000; Mallick et al., 2024). This extended responsibility beyond production processes to include the management of products at their EoL stage (Lindhqvist, 2000). These debates laid the foundation for EPR as a policy

principle aimed at shifting environmental responsibility upstream to producers, in line with the Polluter-Pays Principle (PPP) (Lindhqvist, 2000). Several studies have been done on the application of EPR from a whole lifecycle perspective with findings showing more achievement of downstream goals such as increase of waste collection rates compared to upstream (Compagnoni, 2022; Mallick et al., 2024; Massarutto, 2014).

Definition of EPR has remained consistent. Organisation for Economic Co-operation and Development (OECD) similarly defines EPR as *‘an environmental policy approach in which a producer’s responsibility for a product is extended to the post-consumer stage of a product’s life cycle including its final disposal’* (OECD 2001, cited by Gupt and Sahay 2015).

The adoption of EPR across European countries occurred through different policy approaches. Germany was the first country to implement EPR on a large scale in 1991 through the *Ordinance on the Avoidance of Packaging Waste* (Gupt & Sahay, 2015; Walls, 2006). Although the term “EPR” was not immediately used, the legal reforms reflected its core logic by transferring responsibility to the beginning of the production chain (Lindhqvist, 2000). Subsequently, Switzerland became the first country to introduce EPR regulation specifically targeting WEEE in 1998 (Wang et al., 2017).

Early EPR implementation across other European countries also reflected diverse policy strategies. As highlighted by Lindhqvist (2000), Denmark initially resisted the concept due to concerns about producer costs and the effectiveness of voluntary approaches, though later discussions acknowledged the need for mandatory elements to ensure compliance. In contrast, France adopted a shared-responsibility model in which producers financially supported local authorities in managing packaging waste, while the Netherlands relied largely on voluntary measures, with the possibility of government intervention if voluntary efforts proved insufficient.

The growing localization of EPR principles into national packaging waste policies across several European countries eventually set the stage for the European Union (EU) to establish regional directives addressing packaging waste and other product streams (Lindhqvist, 2000). Other waste streams soon became considered for the adoption of EPR (OECD, 2024). The WEEE Directive (Directive 2002/96/EC) was introduced in specific response to growing environmental and economic concerns associated with WEEE (Compagnoni, 2022). This adoption was strongly supported as a necessary measure to address the significant challenges it posed (Huisman et al., 2008). With the advancement of EPR over the past few decades, the policy has been widely adopted (Fig. 2-1), particularly across OECD countries, with over 400 EPR programmes currently in operation worldwide (OECD, 2016). While it is acknowledged that assessing the impacts of EPR programmes is constrained by data inadequacies, methodological challenges, and limited comparability due to variations in EPR design across jurisdictions, existing evidence nevertheless shows an association between EPR programmes and increased waste diversion from final disposal, higher recycling rates, and significant financial contributions from producers (OECD, 2016). Globally, producer contributions mobilised through EPR schemes have been estimated at approximately EUR 300 billion (OECD, 2016).

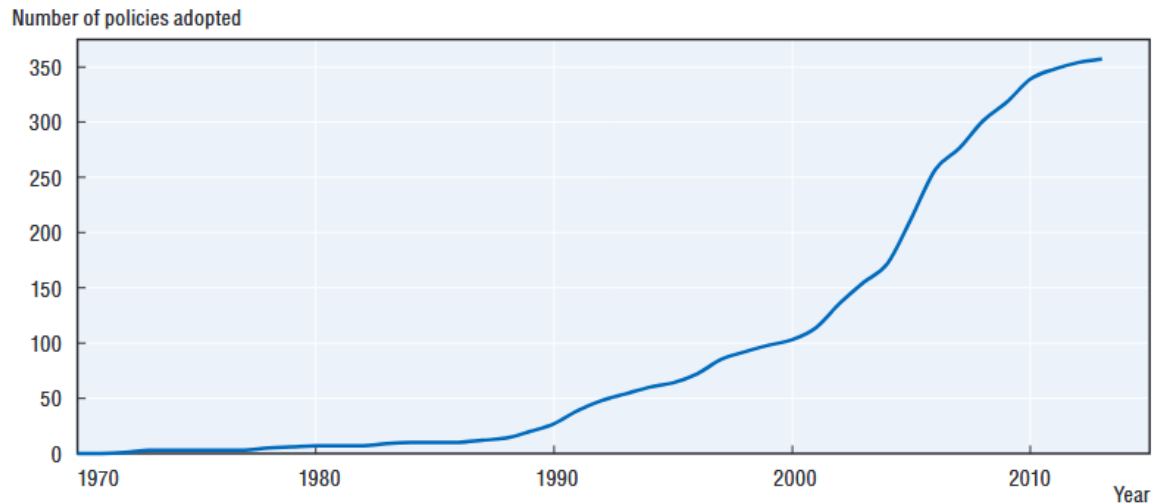


Figure 2-1 EPR global adoption adoption

Source: Adapted from Kaffine & O'Reilly, (2013), as modified by OECD (2016)

This historical overview indicates that EPR originated in Europe and other developed countries, more specifically in Sweden, and while its significance was widely acknowledged, its operationalization was debated and adapted differently across countries. Many nations localized the principle to fit their contexts with the expectation that such adaptation would enhance its effectiveness in achieving the primary objectives.

What this historical evolution demonstrates is that EPR is not fixed but a but a flexible policy instrument whose implementation varies across different contexts. As such, evaluating EPR performance requires attention not only to the formal adoption of policy, but also to how responsibilities are assigned and implemented amongst stakeholders according to local conditions.

2.1.2 Producer Responsibility: Financial and Operational

In recent years, EPR has gained global attention from its place of origin, Europe, across other developed and developing countries.

As previously defined by the OECD, EPR extends producer responsibility beyond the point of sale to the post-consumer stage. This responsibility shifting, with the goal of ensuring that producers account for environmental concerns during their product design is achieved by Government through the EPR approach (OECD, 2024). Although national governments are usually in charge of EPR policy implementation and oversight, sub-national governments in the United States of America (USA) have established and led the implementation of EPR (OECD, 2024).

Studies widely suggest that the EPR can operate in both financial and operational forms (Lindhqvist, 2000; OECD, 2024). In financial EPR, public authorities manage the collection and treatment of waste while producers cover the associated costs through fees paid to compliance schemes. These fees are expected to fund services such as collection, recycling, awareness campaigns, and support for eco-design rather than functioning as taxes (OECD, 2024). This makes it possible for a shared responsibility approach to EPR (Lindhqvist, 2000). On the other hand, operational EPR is designed to allow producers themselves to organize

and manage collection and recovery systems while also incurring the operational costs. This is usually, not exclusively, achieved collectively through PRO's and subject to performance targets such as collection and recycling rates (OECD, 2024). In practice, many schemes combine both approaches. However, the OECD (2024) emphasises that EPR alone cannot address all environmental impacts and argues that it is most effective when complemented by broader policy instruments through an *"integrated and coordinated approach"* (p. 6).

2.1.3 Approaches to Extended Producer Responsibility (Mandatory Vs. Voluntary)

It was noted by Lindhqvist (2000) that even the early advancement of EPR amongst European countries faced different approaches, such as voluntary and mandatory. This approach remains the same today (Mallick et al., 2024). EPR systems are considered to be mandatory when the Government establishes laws that makes it compulsory for all producers to be financially responsible for managing the waste of their products (OECD, 2024). Contrary to this, voluntary EPR exist when producers willingly commit to or are encouraged to take on initiatives for managing the waste associated with their products such as product stewardship or Corporate Social Responsibility (CSR) initiatives (OECD, 2024).

Studies note that mandatory EPR are usually more effective compared to voluntary based on improved monitoring and enforcement which compels all producers to participate, while also allowing expansion to many waste streams (OECD, 2024). Brinkmann et al. (2022) argues that mandatory EPR schemes are necessary to create measurable impact (p. 3). However, for EPR to be effective despite adopting a mandatory system, governments must establish *"consistent and credible"* strategies for enforcing EPR obligations such as registration of producers and official accreditation of producer responsibility organisation (OECD, 2016). Conversely, voluntary systems of EPR are taken seriously by a few companies with a focus on specific product categories mostly influenced by available incentive for taking back products or potential profitability in doing so (OECD, 2016).

Nonetheless, studies have further shown that both approaches can have meaningful impact on product waste management, but voluntary impacts are often tied to adoption of mandatory requirements eventually. For instance, EPR voluntary effort in South Africa was ineffective for revenue generation; however, it facilitated the establishment of a mandatory EPR scheme in 2021 (Brinkmann et al., 2022). Based on the above, voluntary EPR programmes may be effective in achieving product waste management objectives in some contexts (OECD, 2016). However, mandatory EPR programmes are generally considered more effective (Brinkmann et al., 2022; OECD, 2024). This is largely because companies are often driven more by profit motives than environmental stewardship, increasing the likelihood of non-compliance under voluntary systems.

2.1.4 Extended Producer Responsibility in the Waste Electrical and Electronic Equipment's (WEEE) Sector

Although EPR did not begin in the WEEE sector, it soon became necessary for adoption due to the environmental impact associated with it. As noted earlier, in Europe, the WEEE Directive (Directive 2002/96/EC) was introduced in direct response to growing environmental and economic risks associated with WEEE (Compagnoni, 2022; Huisman et al., 2008). The Directive established the basis for EPR for WEEE, particularly across EU member states.

Beyond Europe, several countries have progressively adopted or are developing EPR systems specifically targeting WEEE. In Latin America and the Caribbean (LAC), countries such as Chile and Mexico (both OECD members), as well as Brazil, Argentina, and Colombia, have taken steps toward implementing their first EPR systems, primarily focusing on the large and potentially hazardous WEEE streams (OECD, 2016). In Asia, China introduced an EPR programme for WEEE in 2012, while Malaysia and Thailand are working toward establishing similar programmes, although these initiatives largely rely on voluntary producer participation (OECD, 2016). This growing global diffusion of EPR for E-waste indicates an increasing recognition of the relevance to addressing the environmental and economic implications of rapidly growing electronic consumption and waste generation globally.

In Africa, EPR had relatively less adoption despite increasing environmental concern of WEEE. Most of the WEEE in many African countries were managed by the informal recyclers despite their practices being unsafe and environmentally harmful (OECD, 2016). South Africa was considered the pioneer of EPR system in the continent through a comprehensive Waste Management Act introduced in 2009 that mandate EPR measures on a “*product-by-product basis*” (OECD, 2016). Similarly, other countries have taken steps toward formalizing EPR for WEEE. Nigeria, for instance, has adopted an EPR programme for the EEE sector (NESREA, 2014, 2022).

Collectively, these distinctions demonstrate that EPR performance largely depends on its system design and the institutional realities within a given context. Variations in financial versus operational responsibility, as well as mandatory versus voluntary arrangements, significantly shape implementation dynamics. Evaluating EPR performance therefore requires attention to how its design and structural features interact with implementation processes and contextual conditions. The following sections examine how such variations have influenced EPR evaluation across both developed and developing countries.

2.2 Extended Producer Responsibility in Practice

This section reviews the empirical literature on EPR practices globally. This section focuses more on practical elements of EPR programme including structure, evaluation approaches, overall performance, priority policy areas, key enabling factors, and existing implementation barriers.

2.2.1 Extended Producer Responsibility Structure and Priorities

The origin of EPR in Europe has given it a structural advantage in terms of public acceptance and capacity and has contributed to its relative success in achieving policy objectives. This has been the case for many developed countries. In Europe, the EU Waste Framework Directive (WFD) mandates producers to bear responsibility for the waste management of their products across the entire product life cycle (Mallick et al., 2024). Several studies have evaluated EPR using a life-cycle perspective, reinforcing this broader framing beyond EoL management (Compagnoni, 2022).

It is important to note that scholars argue that “*EPR itself is not a policy instrument, but rather a policy principle that can be implemented through various policy instruments,*” and that no single instrument can independently achieve substantial success in EPR implementation (Mallick et al., 2024). Instead, EPR effectiveness depends on the application of multiple, interconnected policy instruments. While many EPR programmes continue to focus primarily on waste management, scholars increasingly argue that EPR should evolve into an “*interface policy*”—one that adopts an interdisciplinary approach to improving circularity across the entire product life

cycle, from resource extraction to recycling, reuse, and disposal (Compagnoni, 2022; Gupt & Sahay, 2015; Mallick et al., 2024; Massarutto, 2014). Building on this, Cai & Choi (2021) proposed a more comprehensive EPR framework that integrates policy, product design, processes, supply chains, and technology to improve sustainability outcomes. Despite the growing number of proposed frameworks and practical applications across different regions, there remains no collectively agreed “best” EPR model (Mallick et al., 2024; Massarutto, 2014).

One of the most important features of EPR programme concerns how responsibility for waste management is allocated between producers and other actors. Currently, most EU EPR programmes are predominantly financial in structure, whereby producers pay a fee per product placed on the market to cover the cost of waste management at EoL (Niza et al., 2014). These fees are typically managed through PRO’s. In Portugal, for example, the government and PROs have established systems to monitor products sold and ensure compliance with fee payment obligations by manufacturers (Niza et al., 2014). Assigning financial responsibility to producers has been identified as a key facilitator of EPR success (Gupt & Sahay, 2015). In contrast, Colombia’s EPR system places both financial and operational responsibility on producers and importers (Park et al., 2018). Beyond financial arrangements, regulatory provisions have also been identified as critical to EPR effectiveness (Gupt & Sahay, 2015). In Europe, EPR performance has further been influenced by broader policy agendas such as the EU Green Deal (Mallick et al., 2024).

Despite these common features, important differences exist in how developed countries approach EPR structure. Japan and Canada, for instance, operate physical and financial EPR systems respectively (Portugaise et al., 2023). Such variation is not unusual, as even during the early stages of EPR adoption, European countries differed considerably in their implementation approaches (Lindhqvist, 2000). However, Portugaise et al. (2023) also argue that despite these formal distinctions, physical and financial EPR programmes often converge in practice during implementation. This contradiction between policy design and implementation reality is a recurring theme in EPR literature and is addressed further in the conceptual framework used in this study.

Beyond financial arrangements, responsibility sharing and governance structure during EPR programme implementation is another important determinant of its performance. Scholars argue that concentrating responsibilities within a single authority increases the risk of institutional overload and compromised oversight (OECD, 2016; Park et al., 2018; Sienkiewicz et al., 2012). In contrast, the United Kingdom’s EPR model illustrates how shared responsibility arrangements are implemented through competing PROs (OECD, 2016). Generally, EPR responsibilities in most EU countries are distributed across producers (who provide financing), PROs (which coordinate compliance and partnerships), and government authorities (which ensure oversight), although the specific allocation and weight of these responsibilities vary (OECD, 2016).

Country-specific differences further illustrate this diversity in governance. In Finland, municipalities are considered critical EPR stakeholders and are mandated to transfer collected E-waste to recyclers affiliated with the EPR programme (Kalimo et al., 2015). This contrasts with countries such as France, where municipalities are not assigned the same role within EPR implementation (Leclerc & Badami, 2024). These variations highlight that, despite broad agreement on EPR principles, there is still no consensus on the most effective and efficient approach to allocating roles and responsibilities among stakeholders (Leclerc & Badami, 2024). From a broader perspective, EPR programmes vary across contexts, making it difficult to apply uniform evaluation criteria without accounting for contextual differences. These

variations become even more pronounced when comparing EPR implementation in developed countries with experiences in developing countries.

2.2.2 Extended Producer Responsibility Structure and Priorities

It is widely agreed that EPR has been useful in addressing WEEE; however, significant debates persist globally regarding appropriate evaluation approaches, whether EPR is more effective downstream or upstream, and what “*effectiveness*” means across different national contexts. Most countries continue to associate EPR success with increased WEEE recovery and recycling rates. Europe, in particular, has experienced substantial improvements in WEEE collection following EPR implementation, with an estimated increase of about 30% between 2011 and 2018 based on Eurostat data (Compagnoni, 2022).

Nevertheless, other scholars question whether these improvements can be attributed solely to EPR. Compagnoni (2022) argues that in many developed countries, collection and recycling rates were already increasing prior to the introduction of EPR schemes. At the same time, EPR is likely to have contributed indirectly by stimulating “*producer–recycler interactions*” and fostering “*collaborative downstream innovation*” (Micheaux & Aggeri, 2021). Evidence from Portugal similarly shows improvements in downstream recycling and waste management performance, although the study acknowledges its inability to establish a clear causal link between EPR alone and the observed outcomes (Niza et al., 2014). More broadly, the recycling sectors in developed countries appear to have strengthened following the introduction of EPR, particularly due to better-organised cooperation between producers and recyclers (Massarutto, 2014). These arguments point out that while EPR has been beneficial in several respects, the actual scope and magnitude of its contribution remain contested.

Beyond just recycling rates and questions of causality, scholars also highlight limitations in how EPR performance is evaluated and criticize the narrow indicators used in the evaluation. High recycling rates do not necessarily translate into effective recovery of secondary raw materials, particularly where material quality is compromised (Ahlers et al., 2021; Dimitropoulos et al., 2021). This challenge is compounded by the absence of harmonised performance indicators at the EU level to assess recycling quality across Member States (Ahlers et al., 2021; Dimitropoulos et al., 2021). In response, several scholars advocate for more holistic evaluation approaches. Mallick et al. (2024), for example, proposed EPR evaluation indicators that extend beyond environmental performance to include governance dimensions, arguing that governance quality is critical for long-term EPR success. Similarly, Börner & Hegger (2018) identified four key governance indicators for assessing E-waste management performance: comprehensive stakeholder inclusion, strategic collaboration among stakeholders, clear allocation of responsibilities, and a focus on knowledge sharing and performance management. These dimensions, however, are often overlooked in conventional EPR evaluations. Efforts to harmonise such indicators are reflected in the framework proposed by Mallick et al. (2024) for EPR design and operationalisation, although this framework remains largely based on EU regulatory and institutional contexts. On the other hand, a handful of studies have undertaken more comprehensive evaluations of EPR that examine not only policy outcomes but also the policy design and implementation mechanisms that shape these outcomes (Manomaivibool, 2008; Richter & Koppejan, 2016; Tojo, 2004). These studies are discussed further in the conceptual framework section of this research.

EPR has also been assessed based on the underlying regulatory motivations for its establishment. Lodhia et al. (2017) evaluated Australia’s EPR programme through the lens of public interest theory, arguing that regulation is intended to address market inefficiencies and serve the public good. This contrasts with alternative views that regulation may be shaped by

powerful vested interests (Stigler, 1971, cited in Lodhia et al., 2017). Such perspectives draw attention to how underlying policy assumptions and regulatory motivations can shape EPR design and, ultimately, its effectiveness. Despite the multidimensional nature of EPR and the need for comprehensive evaluation, Cai & Choi (2021) note a relative lack of quantitative empirical studies on EPR for WEEE, with qualitative evaluations dominating the literature. They argue that quantitative evidence is nonetheless essential for strengthening EPR evaluation.

In a nutshell, these debates highlight that even in global contexts, especially OECD countries, where institutional capacity, infrastructure, and data availability are relatively strong, EPR effectiveness remains difficult to evaluate. This reinforces the importance of critically examining how evaluation frameworks are constructed and applied, particularly when considering their transferability to non-EU or developing-country contexts such as Nigeria, where local conditions and implementation realities differ substantially.

2.2.3 Upstream and Downstream Extended Producer Responsibility Performance

Although EPR is conceptually intended to influence the entire product life cycle across both upstream and downstream stages, empirical evidence suggests that its most pronounced impacts have occurred downstream. Downstream EPR focuses on the post-consumer phase of products, particularly waste management, with the primary objectives of diverting waste from final disposal and reducing associated environmental impacts (Atasu, 2019; Compagnoni, 2022; Kalimo et al., 2015). In contrast, upstream EPR targets earlier stages of the product life cycle, notably product design and production, with the aim of preventing waste generation at source through eco-design and material efficiency (Compagnoni, 2022).

Several scholars argue that EPR has been more effective in addressing downstream WEEE targets, especially collection and recycling, than in driving upstream changes (Compagnoni, 2022; Portugaise et al., 2023; Walls, 2006). This limited upstream effectiveness has been attributed to insufficient allocation of individual responsibility to producers, which constrains their incentive and capacity to systematically adopt eco-design strategies (Compagnoni, 2022). Moreover, Portugaise et al. (2023) note that certain design-stage decisions promoted under EPR may reduce material use or transport emissions but can inadvertently compromise recyclability at EoL. As a result, producers often perceive EPR primarily as a compliance obligation rather than a strategic opportunity, further limiting its upstream impact.

Empirical evidence from comparative studies buttresses this pattern. Using common evaluation variables across upstream and downstream stages, Gupta and Sahay (2015) found that countries such as the Netherlands, Switzerland, Japan, and South Korea demonstrate strong downstream EPR performance. This success is attributed to well-organised take-back systems, clear allocation of physical and financial responsibilities, PRO-led collection and recycling, high recovery and recycling targets, retailer take-back obligations, municipal involvement, and clearly defined recycling fees. In contrast, limited upstream impacts in these contexts were linked to weak or insufficient incentives for design-for-environment (Gupta & Sahay, 2015).

However, this predominantly downstream orientation is not uncontested. Tojo (2004) argues that EPR can support manufacturers' strategies that enhance upstream performance, although such outcomes depend heavily on enabling policies, enforcement mechanisms, and the specific objectives embedded within EPR design. Moreover, Lodhia et al. (2017) found that Australia's high recycling performance was partly driven by strong upstream coordination and

partnerships among stakeholders, which helped improve the efficiency of recycling systems and the movement of processed secondary materials to manufacturers. This collaborative approach aligns with the responsibility-sharing framework proposed by Park et al. (2018). Nevertheless, the findings are limited to television and computer waste and cannot be generalised across all E-waste categories. Similarly, Japan's EPR system has demonstrated measurable upstream effectiveness, largely due to strict enforcement, high levels of automation, and product redesign requirements (Gupt & Sahay, 2015). In essence, these cases suggest that in developed countries, EPR has demonstrated consistent downstream impact, while upstream impacts remain more variable and context dependent.

The implication for EPR evaluation is that effectiveness cannot be assumed uniformly across the product life cycle. Instead, evaluation frameworks must explicitly account for the underlying assumptions embedded in EPR policy design, which vary across countries and determine whether upstream, downstream, or both dimensions should be prioritized in assessment. Such differentiation becomes particularly important in developing-country contexts, where structural constraints may disproportionately shape one dimension over the other. Without such differentiation, evaluations risk overstating EPR performance or overlooking critical limitations in life-cycle impact.

2.2.4 Key Enablers of Extended Producer Responsibility Performance

The performance of established EPR systems is shaped by a range of enabling and constraining factors, many of which have been examined extensively in literature. Regarding the former, several structural and institutional factors have been identified as enabling conditions for effective EPR implementation in developed-country contexts.

Effective coordination, collaboration, and partnerships among EPR stakeholders are consistently identified as critical drivers of success (Leclerc & Badami, 2024; Lodhia et al., 2017; Park et al., 2018). This is an indication that EPR programmes are typically embedded within multi-level environmental governance arrangements and, as such, cannot function effectively without structured coordination across actors and institutional levels. Gupta & Sahay (2015) found that when producers assume financial responsibility while outsourcing physical responsibility for collection and recycling, outcomes improve significantly in terms of collection, recycling, and recovery rates. This coordinated allocation of responsibility is therefore considered a key contributor to EPR effectiveness. Similarly, recycling sectors in developed countries have strengthened following the introduction of EPR, largely due to well-organised cooperation between producers and recyclers (Massarutto, 2014).

Furthermore, infrastructure has also been shown to play a central role in enabling EPR performance. In Portugal, adequate recycling infrastructure combined with strong organisational arrangements enabled full population coverage for waste collection and recovery (Niza et al., 2014). The study attributes the success of Portugal's EPR programme to the establishment of organised networks of operators responsible for collection, transport, and treatment of specific waste streams, which led to increased volumes of waste collected and recovered. Such infrastructural and organisational maturity distinguishes many developed-country EPR systems and underpins their downstream performance.

In addition, monitoring, incentives for compliance and penalties for non-compliance have been identified as important enablers of effective EPR implementation (Cai & Choi, 2021). Conversely, cases of weaker EPR performance have been reported in contexts where oversight and enforcement are limited. For example, in Brazil and Colombia, weak monitoring and ineffective sanctioning have constrained EPR outcomes (Park et al., 2018). Similar

performance limitations linked to insufficient incentives have also been observed in Canada (Portugaise et al., 2023). To address these gaps, scholars recommend cost-effective monitoring mechanisms, diversification of EPR governance structures, and shared oversight responsibilities between PROs and local authorities. The establishment of “*solid but feasible targets*,” coupled with flexibility in compliance pathways, has also been highlighted as essential for sustaining EPR performance (Park et al., 2018). At a broader level, this context contrasts with developing countries, underscoring the need for context-specific EPR evaluation frameworks that account for common but often overlooked criteria.

2.2.5 Barriers to Extended Producer Responsibility

Despite the performance improvements attributed to EPR, particularly in the downstream sector, scholars have identified several barriers that constrain the full realisation of EPR goals. One commonly cited limitation is the presence of recycling infrastructure gaps, especially within domestic downstream processing, which can hinder the achievement of EPR targets (Lodhia et al., 2017). Within this context, the availability of separate collection and recycling agencies has been shown to contribute significantly to EPR success (Gupt & Sahay, 2015). It can therefore be argued that developed countries, including EU Member States, have progressed further in EPR implementation partly due to their relatively advanced recycling infrastructure, an advantage that is often lacking in developing countries such as Nigeria.

Secondly, illegal and informal recycling activities have also been identified as barriers to EPR performance in developed-country contexts. In Japan, for example, “*illegal collection, dumping, and export*,” often associated with informal practices, have been observed to limit EPR effectiveness (Portugaise et al., 2023). This contrasts with evidence from developing nations, where formal recyclers continue to experience heavy competition from the informal sector (Gui, 2020; Woggsborg & Schröder, 2019), even though the latter remain central to WEEE management. As such, there is the need to recognise geographical and institutional differences in EPR performance, as factors that constrain EPR in one context may support it in another.

In addition, weaknesses in monitoring and oversight have been identified in the literature as further constraints on EPR effectiveness. In Canada, stakeholders have reported limitations in monitoring EPR performance due to insufficient data on import and export flows and inaccuracies in quantifying material movements (Portugaise et al., 2023). Less prominent but equally important barriers include limited transparency in EPR programme operations and a predominant focus on recycling rather than reuse, both of which may undermine broader circular economy objectives (Leclerc & Badami, 2024). Although these challenges are identified primarily in developed-country settings, they remain relevant to this study because they highlight structural and governance-related weaknesses that can affect EPR performance across contexts. Understanding these barriers is therefore essential for conducting a rigorous and context-sensitive evaluation of EPR effectiveness in Nigeria.

Taken together, the literature suggests that on the one hand, EPR programmes in developed countries have achieved significant improvements in downstream WEEE management; on the other hand, their effectiveness varies considerably depending on policy design, governance, and institutional capacity. The distinction between upstream and downstream impacts, the role of infrastructure, and the presence of effective monitoring and enforcement mechanisms are all critical determinants of performance. These insights provide important foundations for evaluating EPR implementation in other contexts, particularly in developing countries.

2.3 Extended Producer Responsibility in Developing-Country Context

This section discusses the state of EPR specifically in developing countries, including evaluation approaches and existing gaps, key performance drivers, and barriers affecting the effectiveness of EPR programmes

2.3.1 Challenges and Gaps in Extended Producer Responsibility Implementation in Developing Countries

Similar to developed countries, a considerable body of literature examined EPR in developing-country contexts. However, the conditions under which EPR operates and the challenges affecting its performance differ significantly. Existing evaluations of EPR in developing countries are fragmented, with more focus on selected aspects of the policy while neglecting others that are also critical to effectiveness. In their study, Pongajow et al. (2025) found that most EPR evaluations lay strong emphasis on government perspectives and policy design, while giving limited attention to the experiences and roles of other stakeholders involved in implementation. Similarly, Woggsborg & Schröder (2019) observed that EPR-related research in Nigeria was concentrated on financial and environmental dimensions, giving less consideration of social factors, particularly the role of the informal sector. This omission is likely to compromise the credibility of previous EPR evaluation given that informal actors play a central role in e-waste collection and recovery in many developing countries (Ezeudu, 2024; Odeyingbo et al., 2025; OECD, 2016). As a result, existing evaluations provide only a partial understanding of how EPR influences WEEE management outcomes. Effective EPR evaluation must therefore consider broader social, political, economic, cultural, and geographical factors that shape system performance (Ezeudu, 2024; Odeyingbo et al., 2025). Similar patterns have been observed in other countries including Kenya, South Africa, and China and Ghana, where informal systems coexist with, and in some cases undermine, formal EPR arrangements (Odeyingbo et al., 2025; Pongajow et al., 2025). It is clear that neglecting informal sector dynamics either in EPR design or its implementation mechanism can significantly result in unintended consequences for WEEE in general.

Beyond analytical gaps in the literature, regulatory and institutional gaps further limit EPR performance in developing countries. Cass Talbott (2022) highlights persistent non-coherence between EPR policy design and implementation practice as a key factor undermining effectiveness. This is evident in Nigeria, where Odeyingbo et al. (2025) identified technical and compliance gaps between the country's EEE regulatory framework and its EPR guidelines. For example, they stated that although importer registration is a formal requirement under Nigeria's EPR programme, registered importers account for only about 3.5% of total electronics imports entering the country in containers. Such discrepancies between regulatory provisions and actual practice weaken EPR enforcement and compromise policy outcomes.

Based on the above, a clear contrast emerges between EPR evaluation in developed and developing-country contexts. When compared, EPR effectiveness in developed countries is most commonly assessed through downstream indicators such as collection and recycling rates, supported by relatively strong regulatory frameworks, organised PRO systems, and available data. Even in this situation, however, questions have emerged whether EPR is the absolute cause of observed downstream outcomes (Ahlers et al., 2021; OECD, 2016; Walls, 2006). Overall, EPR performance in developing countries remains constrained by weak enforcement, poor regulatory compliance, dominant informal sectors, institutional and data limitations, and inadequate integration of broader socio-economic realities into EPR design and implementation.

2.3.2 Enablers of Extended Producer Responsibility in Developing Countries

Evidence suggests that the main enablers of EPR are broadly similar across developed and developing countries. These include producer responsibility, stakeholder coordination, financing mechanisms, incentives, and regulatory oversight. However, the way these drivers operate, and their relative importance, differs significantly in developing-country contexts.

Stakeholder collaboration is consistently identified as a critical driver of EPR performance in developing countries. Several studies emphasise that coordination among EPR stakeholders supports regulatory compliance and improves the functioning of e-waste management systems (Pongajow et al., 2025; Ezeudu, 2024; Odeyingbo et al., 2025). Such collaboration facilitates producer participation in EPR schemes (Ribeiro & Kruglianskas, 2020) and contributes to making systems both financially sustainable and environmentally responsible (Pongajow et al., 2025). In Nigeria, cooperation between producers and PROs has been particularly important in mobilising EPR financing (Ezeudu, 2024). Because PROs are privately managed and operated on a non-profit basis, they are able to attract funding from international development agencies and bilateral or multilateral donors. This external financial support is especially critical in developing countries, where limited economic capacity and underdeveloped waste management systems constrain the adoption of circular economy practices (Ezeudu, 2024).

Incentives also play a central role in stimulating EPR adoption and performance in developing-country contexts (Ardi & Purwojatmiko, 2019; Pongajow et al., 2025). Ardi & Purwojatmiko (2019) found that administrative incentives such as corporate environmental reputation influence producers' intentions to adopt EPR, while logistical incentives such as efficient collection and recycling facilities can shape positive behaviour towards EPR. Given persistent infrastructure and logistics challenges in developing countries, such incentives can significantly enhance EPR effectiveness. Financial incentives aimed at recycling innovation have also been identified as important drivers. In China, for example, such incentives contributed to a more than fivefold increase in WEEE recycling volumes, from 18.1 million units in 2009 to 97 million units in 2013 (Pongajow et al., 2025). Similarly, Faibil et al. (2023) discovered that operational instruments, such as advanced deposit-refund schemes, were more influential than strategic considerations in encouraging EPR adoption for E-waste in Ghana. These findings suggest that EPR performance not only depends on the presence of incentives, but also how and where they are applied.

Penalties are also widely recognised as an important enabler of EPR, particularly in developing-country contexts where regulatory compliance is often weak (Tran et al., 2021). Effective penalties can encourage producer compliance when designed to reflect company size, revenue, and the environmental consequences of non-compliance (Tran et al., 2021). However, there are concerns that widespread non-compliance and limited enforcement capacity may reduce the deterrent effect of penalties, as observed in Nigeria (Odeyingbo et al., 2017). This highlights the need to assess penalties not only in regulatory terms but also in relation to enforcement realities.

When compared across contexts, EPR programmes in both developed and developing countries are grounded in similar principles, including producer responsibility, coordination among stakeholders, financial mechanisms, incentives, and regulatory oversight (Gupt & Sahay, 2015; Mallick et al., 2024). However, their performance, implementation dynamics, and evaluation need diverge substantially. In developed countries, EPR effectiveness is largely enabled by strong institutional capacity, organised PRO systems, extensive infrastructure, and relatively low informal sector participation. This has allowed evaluations to focus primarily on

downstream outcomes such as collection and recycling rates, although concerns remain regarding material quality, causal attribution, and governance performance (Compagnoni, 2022; Niza et al., 2014; Ahlers et al., 2021; Dimitropoulos et al., 2021).

In contrast, as it will be discussed in the next sub-section, developing countries face additional structural constraints, including dominant informal sectors, limited enforcement capacity, infrastructure deficits, data scarcity, and misalignment between policy design and implementation practice, factors that fundamentally shape how EPR operates in reality (Woggsborg & Schröder, 2019; Cass Talbott, 2022; Odeyingbo et al., 2025). Consequently, EPR effectiveness in developing contexts is highly sensitive to governance quality, incentives, financing arrangements, stakeholder behaviour, and social inclusion, dimensions that are often insufficiently captured in conventional EPR evaluation approaches.

2.3.3 Barriers to Extended Producer Responsibility Performance in Developing Countries

The role of the informal sector is one of the most prominent and contested issues shaping EPR performance in developing countries. Empirical studies consistently recognise informal actors as central to WEEE collection and recovery, yet their role within EPR programmes remains highly ambiguous. While some studies argue that the informal sector can enable WEEE recovery, others contend that it acts as a major barrier to effective EPR implementation. Several scholars argue that informal waste activities prevent producers from achieving formal recycling targets, as WEEE is diverted away from EPR-recognised recycling channels (Gupt & Sahay, 2015; Pongajow et al., 2025). Similarly, Cai & Choi (2021) describe the relationship between EPR and informal recycling as a “*chicken-and-egg*” relationship, suggesting that once EPR become sufficiently established, illegal and informal recycling would gradually be eliminated. Their argument is based on the premise that illegal and informal recycling divert WEEE away from formal EPR channels, thereby reducing the volumes available to official recycling systems and limiting the ability of producers to meet formal recycling targets.

In comparison with developed-country contexts, the framing of the informal sector as problematic rather than complementary to EPR remains broadly consistent. However, a key contradiction emerges in literature for developing countries. While informal actors are often identified as a barrier to EPR performance, many studies simultaneously advocate for their inclusion and formalisation, recognising their critical role in WEEE recovery and livelihood provision (Woggsborg & Schröder, 2019; Ezeudu, 2024). This debate is considerably missing in developed countries, where informal sector participation in WEEE management is minimal and EPR programmes operate predominantly through formal institutional arrangements. Despite increasing interest in waste picker integration, evidence shows that the inclusion of informal actors within EPR policies remains limited and fragmented, particularly in developing contexts (Cass Talbott, 2022).

Based on the available literature, infrastructure inadequacy is another common barrier to EPR effectiveness in developing countries. Studies identify deficiencies across the WEEE value chain, including separation, collection, transportation, treatment, and disposal, as persistent constraints (Gaur et al., 2025; Niza et al., 2014; Pongajow et al., 2025; Thukral & Singh, 2023). The high capital cost of formal recycling infrastructure, combined with long payback periods, discourages private investment and limits system expansion (Pongajow et al., 2025). In Nigeria, these infrastructural gaps are particularly evident and have been documented across multiple stages of WEEE management (Ezeudu, 2024; Nnorom & Odeyingbo, 2020; Odeyingbo et al., 2025). Similar challenges have been observed in other developing countries,

including India and China, where insufficient recycling capacity continues to constrain EPR performance (Thukral & Singh, 2023; Zheng et al., 2017). More broadly, infrastructure-related barriers represent a shared constraint to EPR effectiveness across both developed and developing contexts, particularly with respect to downstream recycling capacity. In developed countries, although EPR has contributed to improved downstream outcomes, limitations in domestic recycling infrastructure persist, and the presence of well-organised separate collection and recycling agencies has been shown to significantly influence system success (Gupt & Sahay, 2015; Lodhia et al., 2017). In developing countries, however, these infrastructural limitations are more pronounced, systemic, and closely intertwined with financial constraints, informal sector dominance, and weak enforcement capacity (Thukral & Singh, 2023; Pongajow et al., 2025; Ezeudu, 2024; Odeyingbo et al., 2025). Consequently, evaluating EPR effectiveness without adequately accounting for these context-specific barriers risks producing biased and incomplete assessments, particularly in developing-country settings.

The literature reviewed above suggests that EPR performance is context-dependent and encompasses several dimensions. Together, the findings suggest that conventional evaluation approach based on just outcome indicators may be insufficient to capture the implementation dynamics through EPR operates in developing-country contexts. Consequently, a TBE, which is capable of examining the interactions between policy design, implementation context, and outcomes is particularly more suitable for evaluating Nigeria's EPR programme.

2.4 Rationale for Conceptual Framework

This section presents further details of the conceptual framework adopted for this study, including the evaluation criteria and the justification for their selection.

2.4.1 Theory-Based Evaluation (Intervention/Programme Theory)

A Theory-Based Evaluation (TBE) forms the core of the conceptual framework used in this study. Originally developed within the field of educational research (Fitz-Gibbon & Morris, 1996; Weiss, 1997), TBE has since been widely applied in the evaluation of complex policy programmes, including environmental policies and EPR systems (Manomaivibool, 2008; Mickwitz, 2003; Tojo, 2004). The approach is considered particularly suitable for evaluating programmes with long-term objectives whose outcomes may not be immediately measurable (Tojo, 2004; Weiss, 1997)(Tojo, 2004; Weiss, 1997). It is also useful in contexts where data gaps may constrain conventional outcome-based evaluation approaches (Richter & Koppejan, 2016). TBE enables the explicit formulation and reconstruction of a programme theory, which in this study corresponds to the design logic of Nigeria's EPR programme. Through this reconstruction, the approach seeks to explain not only whether a programme achieves its intended objectives, but also why it works or fails to work in practice. In simple terms, TBE evaluates programme effectiveness by comparing the intended outcomes predicted within the programme theory against the outcomes observed in practice or their empirical proxies. This approach has been considered more effective than conventional evaluation methods for assessing complex environmental policies because it enables a more systematic understanding of the interactions between policy context, implementation mechanisms, and outcomes (Mickwitz, 2003). Applying TBE to Nigeria's EPR programme therefore enables an examination not only of whether the programme achieves its stated objectives, but also how implementation mechanisms influence the achievement or limitation of those outcomes.

To understand the intended expectations of the EPR programme, TBE allows for the reconstruction of the sequence of activities and mechanisms expected to produce the desired outcomes (Vedung, 1997, cited in Manomaivibool, 2011). This reconstructed representation of the implementation process serves as a conceptual model against which actual implementation practices can be compared (Tojo, 2004). Subsequent studies further extended the application of TBE by incorporating a dual reconstruction approach involving both espoused theory and theory-in-use (Friedman, 2001; Hansen & Vedung, 2010). Espoused theory refers to the reconstruction of how the policy is formally expected to achieve its objectives based on policy and legal documents, while theory-in-use reconstructs how the programme is actually implemented according to the experiences and perspectives of stakeholders involved in practice. The reconstruction of intervention theory is structured around three key components: *situation theory*, which describes the problem being addressed; *causal theory*, which explains the assumed cause–effect relationships within the intervention; and *normative theory*, which outlines the envisioned outcomes (Hansen & Vedung, 2010). These components have also been described using related terms such as context, mechanisms, and outcomes (Manomaivibool, 2011). In addition, Hansen & Vedung (2010) proposed five steps for reconstructing intervention theory (Fig. 2-2). These elements collectively form the logic upon which TBE/intervention theory conducts policy evaluation and will serve as the guiding framework for constructing the conceptual framework of this study.

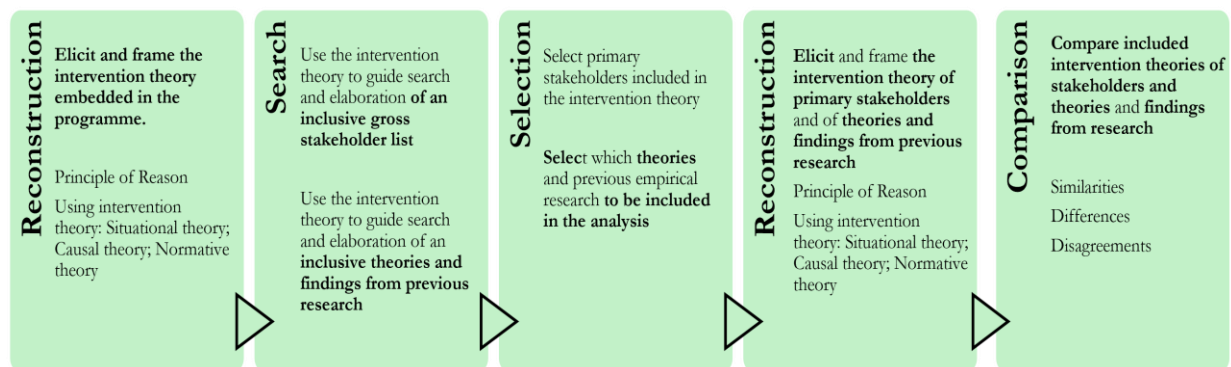


Figure 2-2 EPR reconstruction steps

Source: Author's illustration adapted from Hansen & Vedung, (2010)

2.4.2 Existing Frameworks Based on Theory-Based Evaluation (Intervention/ProgrammeTheory)

Several scholars have applied intervention theory in evaluating EPR using clearly defined analytical frameworks. There is broad consensus in the literature that an intervention theory framework should include key elements such as *actors*, *inputs*, *activities*, *outputs*, and *outcomes* (immediate, intermediate, and ultimate) (Manomaivibool, 2009; Tojo, 2004; Weiss, 1997; Mickwitz, 2003). This structure facilitates the identification of the broader *context*, *mechanisms*, and *expected outcomes*, which form the basis for evaluation within intervention theory.

In addition, studies have identified relatively consistent EPR goals, expected outcomes, and objectives that form the basis for evaluating EPR programmes (Fig. 2-3). An ultimate goal of an EPR widely recognized across literature is the “*life-cycle environmental improvement of product systems*” (Manomaivibool, 2009; Richter & Koppejan, 2016; Tojo, 2004). Based on existing studies, EPR outcomes are typically categorized as *immediate* and *intermediate*, representing key changes that must occur before the overall goal can be achieved. Three *immediate* outcomes

include *upstream changes, the development of downstream infrastructure, and the establishment of feedback mechanisms between upstream and downstream actors* (Manomaivibool, 2008; Richter & Koppejan, 2016; Tojo, 2004). The first immediate outcome focuses primarily on producers, who possess the capacity to influence product design, while the latter outcomes relate more explicitly to the EoL management of products (Manomaivibool, 2008). Furthermore, the literature identifies three key *intermediate outcomes* namely; *design for environment, closing material loops, and improved waste management practices* (Richter & Koppejan, 2016; Tojo, 2004). While these outcomes are generally considered consistent indicators for evaluating EPR through TBE, particularly within OECD countries, the context in non-OECD countries, including programme design and the distribution of responsibilities among stakeholders, may differ significantly (Tojo, 2004).

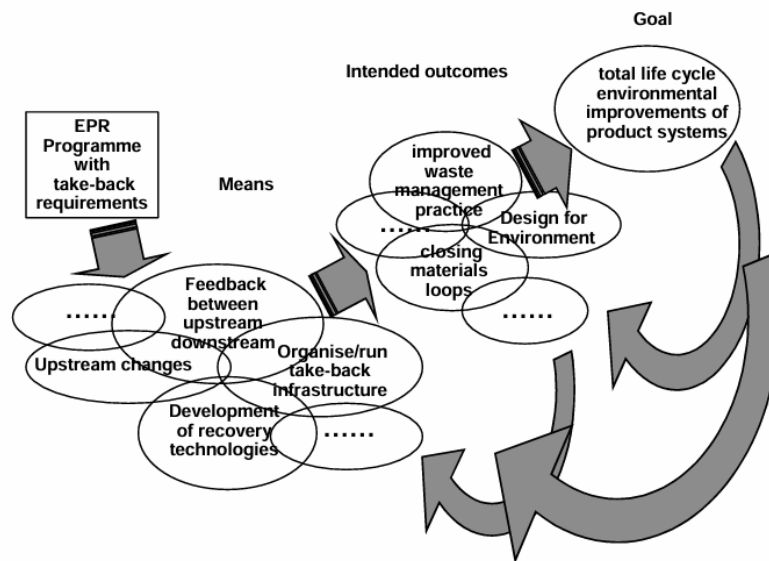


Figure 2-3 Empirical EPR Evaluation framework

Source: Tojo (2004)

These empirically derived objectives for EPR evaluation, together with the logical steps for developing an TBE framework, will be applied in the context of evaluating Nigeria's EPR programme for WEEE. In doing so, additional unintended outcomes will also be incorporated to ensure that the framework adequately reflects the Nigerian realities.

2.4.3 Defining Extended Producer Responsibility Evaluation Criterion (Effectiveness)

This section outlines how *effectiveness* is defined in this study and establishes the boundaries for its evaluation based on insights from empirical literature.

Several criteria for policy evaluation have been discussed in the literature. These include *relevance, effectiveness, efficiency, impact, persistence, and flexibility* (European Environment Agency, n.d.; Mickwitz, 2003). While all these criteria provide valuable and systematic insights into policy evaluation, it is important to clearly define the scope of evaluation in order to ensure analytical rigor and feasibility. Within the context of EPR, many studies have identified

effectiveness as the primary criterion for policy evaluation (Manomaivibool, 2008; Richter & Koppejan, 2016; Tojo, 2004). *Effectiveness* refers to the extent to which a policy achieves its anticipated outcomes in relation to its clearly defined objectives (European Environment Agency, n.d.; Mickwitz, 2003; Manomaivibool, 2008). Traditionally, effectiveness has been considered the most dominant criterion in evaluation practice (Vedung, 1997, cited in Tojo, 2004).

In EPR-specific policy evaluations, this criterion is often referred to as “*environmental effectiveness*” (Manomaivibool, 2008; Richter & Koppejan, 2016; Tojo, 2004). Manomaivibool (2008) defines effectiveness as the “*extent to which an actual programme addresses the causes of the environmental problem identified by the policy paradigm.*” This emphasis largely stems from the fact that the core goals and objectives of EPR policies are predominantly environmental in nature.

2.4.4 Empirical Application of Theory-Based Evaluation Framework Based on Effectiveness Criterion

This section reviews empirical studies that have applied the established intervention theory framework and effectiveness criterion in evaluating EPR systems and forms the empirical guideline for this study.

Richter & Koppejan (2016) evaluated EPR systems for lamps in Nordic countries using similar EPR goals and outcomes (both immediate and intermediate) established in the literature, as discussed in the previous section. Their evaluation involved reconstructing stakeholders’ perspectives (theory-in-use) following the methodological guidance proposed by Hansen & Vedung (2010). The justification of their findings was based on the extent to which actual practices aligned with the generally established EPR objectives and outcomes, particularly in terms of environmental effectiveness. Similarly, Manomaivibool (2008) evaluated EPR systems in the United Kingdom and Sweden using the same effectiveness criterion and reconstruction process within an intervention theory-derived framework. The study compared EPR policy design with implementation dynamics to identify areas of alignment and gaps. Although the analysis did not explicitly distinguish between *espoused theory* and *theory-in-use*, both dimensions were implicitly captured through the comparison between formal policy provisions and practical implementation outcomes. Together, these studies demonstrate the empirical applicability of intervention theory for evaluating EPR policies based on clearly defined frameworks and evaluation criterion. However, it is important to note that most of these empirical applications have been conducted primarily within OECD countries. Consequently, a gap remains in applying this framework and the established EPR goals and objectives in Nigeria, a non-OECD country.

Another important observation is that, while the evaluations in both studies were based on empirically defined EPR objectives in line with the applied framework, they do not fully account for side effects that may not have been captured in the policy design but nonetheless influence policy effectiveness. Mickwitz (2003) refers to such side effects as unintended or unanticipated effects. For instance, several studies highlight that informal sector practices can significantly influence EPR outcomes, yet these factors are often overlooked in previous evaluations, particularly in developing countries (Ezeudu, 2024; Manomaivibool, 2009; Odeyingbo et al., 2025; Woggsborg & Schröder, 2019). As noted by Tojo (2004), environmental policy evaluation should extend beyond simple goal-achievement models systematically account for both anticipated and unanticipated outcomes. Ignoring such effects may undermine the achievement of overall EPR policy objectives (Mickwitz, 2003; Tojo,

2004). Based on this argument, the present study integrates potential unanticipated effects into the established TBE framework to evaluate Nigeria's EPR programme for WEEE, using effectiveness as the primary evaluation criterion.

2.4.5 Description of the Conceptual Framework

This section describes the various components and interactions within the conceptual framework adopted for this study (Fig. 2-4).

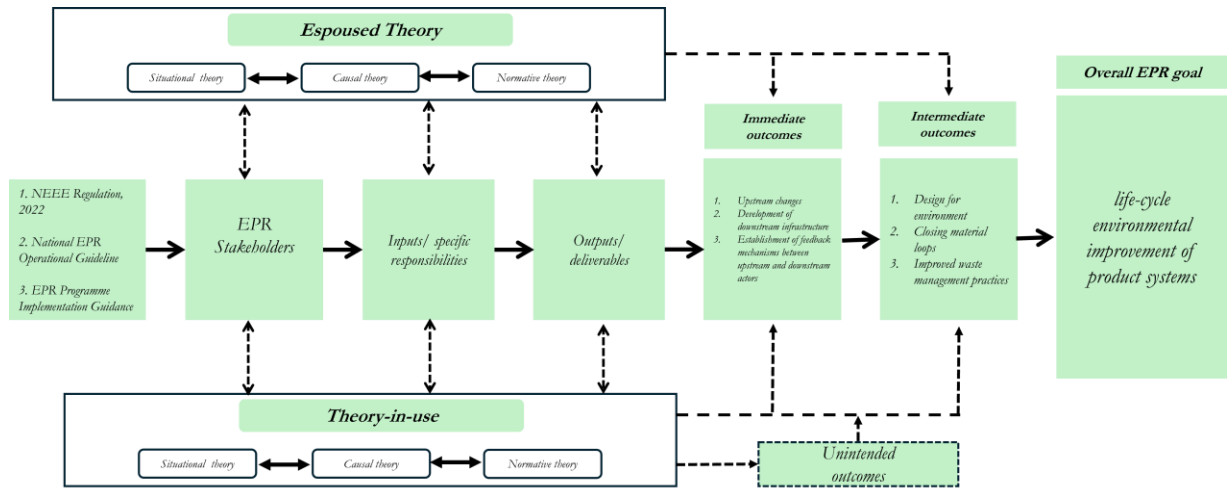


Figure 2-4 Conceptual framework

Source: Author's Illustration (2026) adapted from Tojo (2004), Richter & Koppejan (2016), Hansen & Vedung (2010), Manomaivibool (2009), and Friedman (2001).

Firstly, at the core of this framework is the TBE approach, which guides the overall evaluation of Nigeria's EPR programme for WEEE. The framework adopts evaluation criteria derived from existing empirical EPR studies to assess the interactions between context, implementation mechanisms, and outcomes. This directly addresses the overall research aim and the main research question (RQ1) regarding the effectiveness of Nigeria's EPR programme.

Secondly, the top layer represents the *espoused theory*, which addresses RQ1a. This layer focuses on reconstructing how Nigeria's EPR programme is formally designed and expected to operate based on policy and regulatory documents. It examines the contextual assumptions, implementation mechanisms, and intended outcomes embedded within the policy design.

Thirdly, the bottom layer represents the *theory-in-use*, which addresses RQ1b. This layer reconstructs how the EPR programme operates in practice. Unlike the espoused theory derived from policy documents, the theory-in-use is empirically reconstructed from the perspectives of stakeholders across the EPR value chain.

Finally, the *espoused theory* and *theory-in-use* are comparatively examined across the contextual, causal, and normative dimensions of the tripartite intervention theory framework proposed by Hansen & Vedung (2010). This interaction-based analysis enables the identification of areas of

alignment, divergence, and contradiction between the intended policy design and implementation realities, and how these shape immediate and intermediate outcomes toward the overall EPR goal of life-cycle environmental improvement of product systems.

Additionally, the framework also incorporates unintended outcomes, addressing RQ1c, to capture additional positive or negative effects emerging from implementation practices that were not originally anticipated within the policy design.

3 Methodology

This chapter describes the methods used for sampling, data collection and the data analysis procedures in this study.

3.1 Research Design

This study adopted a TBE approach, employing a qualitative design complemented by quantitative data to evaluate the implementation of Nigeria's EPR programme for WEEE as shown on Fig. 3-1. A qualitative approach is particularly appropriate for this study, as it enables in-depth, context-rich insights into complex policy and organisational processes that cannot be adequately captured through quantitative indicators alone (Creswell & Creswell, 2018; Patton, 2002). This is especially relevant in the Nigerian context, where EPR implementation involves multiple stakeholders and institutional arrangements, making strictly quantitative approaches insufficient for capturing the full complexity of the system (Corbin & Strauss, 2008; Yin, 1984). The evaluation was structured in three sequential stages. First, a directed qualitative content analysis of relevant policy documents establishing Nigeria's EPR programme was conducted to reconstruct the policy design logic (espoused theory) of the programme. This analysis was guided by three core evaluation lenses: policy context, implementation mechanisms, and expected outcomes, consistent with Hansen & Vedung (2010). Second, the reconstructed espoused theory informed the identification and selection of key EPR stakeholders, as well as the design of semi-structured interview questions used to examine the implementation logic of the EPR programme based on stakeholders' perspectives and experiences. This approach enabled a more nuanced understanding of how the EPR programme operates in practice across different stakeholder groups. Third, secondary quantitative data on WEEE collection and recycling were gathered from relevant sources. In addition, field observations were conducted at WEEE processing sites located in Lagos, Nigeria. Both the quantitative data and field observations were incorporated to triangulate stakeholder perspectives, thereby strengthening the credibility and robustness of the findings.

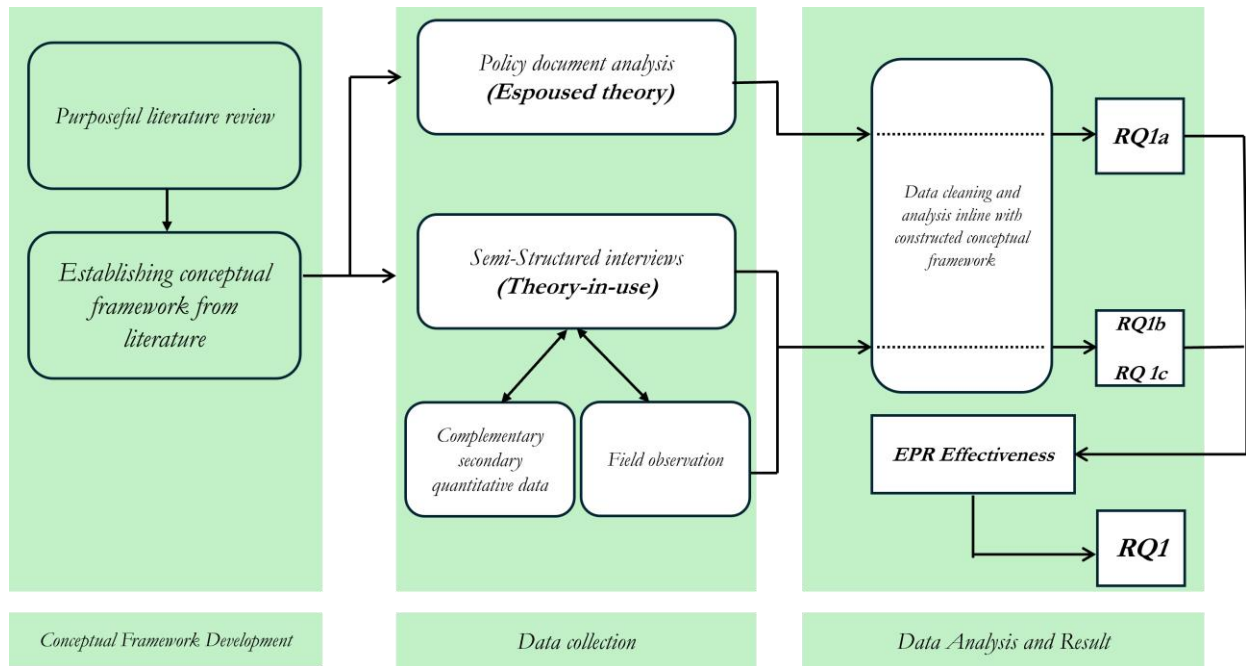


Figure 3-1 Visualization of the research design

Source: Author Illustration, (2026)

3.2 Method for Data Collection

3.2.1 Document Gathering

Three key policy documents that establish the EPR programme and outline its implementation framework were purposively selected and analysed for this evaluation study, including the NEEE Regulations 2022 (Government of Nigeria, 2022), the National EPR Operational Guideline (NESREA, 2014), and the Nigeria's EPR Guidance Document for the EEE Sector (NESREA, 2022). To ensure credibility, the documents were obtained from official government and institutional sources, including the Federal Ministry of Environment and the NESREA. The selection of these documents is consistent with qualitative research approaches that emphasise the use of primary, information-rich sources for policy analysis (Bowen, 2009). While document analysis is often used as a method for triangulation (Denzin, 2017), it was employed in this as a secondary data source to enable a systematic examination of the EPR policy design (espoused theory). The analytical approach used to examine the documents was based on guidelines proposed by Hansen & Vedung (2010) as shown earlier on Fig. 2-2.

3.2.2 Semi-Structured Interviews

This study adopted a *purposive sampling strategy* to include key stakeholder groups identified in the conceptual framework. This approach ensured the inclusion of participants with relevant knowledge and experience of EPR implementation, thereby providing rich, context-specific insights for the evaluation (Creswell, 2013; Creswell & Poth, 2018). All interviews were guided by the ethical guidelines of Lund University (see Appendix D).

A total of thirteen (13) participants, representing different stakeholder groups across Nigeria's EPR value chain, participated in the interviews either online or offline (see Appendix F). The

participants included representatives from Libra Circle (producer/importer), EPRON (PRO), E-Terra (formal recycler), Waste Pickers Association of Nigeria (WAPAN) representing civil society organisations (CSOs), an informal collector representing the informal sector, W3 Ecofriendly Ltd. (E-waste collector), a consumer representative, Lagos State Environmental Protection Agency (LASEPA), NESREA, and other government regulatory institutions including Standards Organisation of Nigeria (SON), Nigeria Customs Service (NCS), Federal Competition and Consumer Protection Commission (FCCPC), and the Federal Ministry of Environment. While the selection of one participant per stakeholder group may be considered a limitation when viewed against grounded theory approaches that emphasise multiple interviews to achieve data saturation (Charmaz, 2006, cited in Saunders et al., 2018), this is not the objective of the present study. Instead, the sampling strategy is intentionally designed to prioritise stakeholder representation and depth of experience of EPR implementation over statistical generalisation.

Semi-structured interviews served as the primary data collection method for this study, guided by an interview protocol as recommended by Creswell & Creswell (2018). This approach ensured consistency across interviews while allowing sufficient flexibility to explore participants' perspectives in depth. The interview protocol was structured into four components: (1) an introduction outlining the purpose of the study and obtaining informed consent, (2) an opening question to establish rapport, (3) core content questions aligned with the evaluation framework, and (4) a closing section to summarise and appreciate the participant's contribution (see Appendix E). Follow-up questions and probing techniques were also employed to explore to clarify key points (Creswell & Creswell, 2018; Li et al., 2017). A majority of the interviews lasted between 25 and 50 minutes, allowing sufficient depth of discussion (Li et al., 2017). With participants' consent, all interviews were *audio-recorded and transcribed verbatim*. Field notes were also taken during interviews as a precautionary measure in case of technical failure (Creswell & Creswell, 2018). To ensure confidentiality and encourage honest responses, all data were *anonymised and assigned coded identifiers*. Participants were also informed that there are no right or wrong answers, and that the purpose of the interview is to understand their experiences and perspectives regarding EPR implementation (Creswell & Creswell, 2018).

3.2.3 Quantitative Data Gathering

To complement the qualitative data obtained from stakeholder interviews, available secondary quantitative data on annual WEEE collection and recycling were also utilised in this study. This approach supported triangulation of the interview findings, thereby enhancing the credibility, validity, and robustness of the overall evaluation process (Creswell & Creswell, 2018). Annual data on WEEE collection and recycling for a period of 2023–2025 was obtained from E-Terra and EPRON. In order to ensure credibility and reliability, priority was given to official and verifiable sources, and the data were further validated with EPRON before being incorporated into the analysis.

3.2.4 Field Observation

Field observation was also employed as a complementary method to support data triangulation. Observations were conducted across four (4) locations in Lagos State, Nigeria, including the E-Terra recycling facility, W3 Ecofriendly Ltd E-waste collection hub, El-As Tech WEEE collection hub, and the Alaba informal WEEE dismantling site. These observations provided deeper visual and contextual understanding of actual implementation practices among both formal and informal stakeholders. However, field observations were not

used as a standalone data collection method, but rather to validate and enrich findings obtained from stakeholder interviews.

3.3 Method for Data Analysis

3.3.1 Document Analysis

Policy documents were analysed using a *direct qualitative content analysis*, guided by the conceptual framework established in this study. This approach is appropriate as it allows for the application of *predefined, theory-driven categories* to systematically examine policy content (Hsieh & Shannon, 2005). The analysis focused on three key components of the framework: context, implementation mechanisms, and expected outcomes. A *deductive coding framework* was developed based on these components, and relevant sections of the selected policy documents were systematically identified and categorised accordingly. This process enabled a structured examination of how Nigeria's EPR policy defines the problem, outlines implementation arrangements, and anticipates intended outcomes, as well as the causal assumptions underlying the policy design. Following the coding process, the data was synthesised to reconstruct the *espoused theory* of Nigeria's EPR programme (see Appendix C). This reconstructed theory subsequently served as a benchmark for comparison with the actual EPR implementation in practice (*theory-in-use*), as derived from stakeholder interviews, in order to identify alignments and gaps between policy design and implementation.

3.3.2 Interview Analysis

Interview data were analysed following qualitative analysis procedures outlined by Creswell & Creswell (2018) and in a manner consistent with similar EPR evaluation studies (Richter & Koppejan, 2016; Manomaivibool, 2008). The analysis began with the organisation and preparation of interview transcripts. Interviews conducted online via zoom were video-recorded. Others conducted physically were audio recorded. All interview recordings were downloaded and transcribed using TurboScribe software. All transcripts were subsequently manually reviewed, cleaned, and verified to ensure accuracy prior to analysis. Coding of interview transcripts was aided by NVivo software. The coding was conducted using a *multi-stage coding process* guided by the conceptual framework for this study (see Appendix G). In the first coding cycle, a *deductive coding approach* consistent with Hsieh & Shannon (2005) was used, with initial codes derived from the three core analytical components of the framework: *context, implementation mechanisms, and specific outcomes*. In the *second cycle of coding*, the coded data were further refined into subcodes. Both stages enabled the consolidation of data into more meaningful analytical groupings. This iterative process enhances the analytical depth and supports the identification of *system-level dynamics and inconsistencies* in EPR implementation. The results from the coding process formed the basis for the presentation of findings and interpreted in relation to the conceptual framework. This analytical process provided insight into how Nigeria's EPR programme is understood and experienced by stakeholders, thereby reconstructing the *theory-in-use*.

3.3.3 Quantitative Data Analysis

To strengthen the validity of the findings, available data for WEEE collected and recycled data obtained from E-Terra and EPRON was analysed into charts. This analysis identified the level of progress made by recycling companies and under the EPR programme annually in terms of WEEE recovery and processing. Additionally, the quantitative findings were *integrated with qualitative insights* from stakeholder interviews to corroborate, contextualise, or challenge observed patterns. This process enabled a triangulation of evidence, thereby enhancing the

credibility, validity, and robustness of the evaluation (Creswell & Creswell, 2018). Due to potential inconsistencies in data reporting across sources, emphasis was placed on identifying general trends and patterns rather than precise statistical estimation, ensuring that the analysis remains robust despite data limitations.

3.3.4 Data Triangulation

The final stage of the analysis involved the triangulation of data derived from policy document analysis (espoused theory), stakeholder interviews (theory-in-use), quantitative data on WEEE collected and recycled, and field observations. Comparative analytical reasoning was employed to systematically examine the degree of alignment between findings from stakeholder interviews and the policy design reflected in the analysed documents. Additionally, quantitative data and field observations further complemented and strengthened the credibility of the interview findings through triangulation. these two dimensions across the core components of the evaluation framework. This has been explicitly discussed in chapter four (4).

3.4 Reflexivity

I have over five years of experience working in the Nigeria's environmental sector, focusing on waste management and circular economy initiatives. While this provides valuable contextual understanding of its EPR programme useful for this study, it might have influenced my perspective to align with some aspects of the study. Hence, reflexive practices, including the use of analytical memos and continuous reflection, was applied to ensure that findings are absolutely based on the empirical evidence (Creswell & Creswell, 2018).

4 Results

This chapter presents findings derived from policy document analysis, stakeholder perspectives, quantitative data, and field observations. The results are discussed according to the sequence of the extended TBE framework adopted in this evaluation, namely: EPR programme context, implementation mechanisms, immediate outcomes, intermediate outcomes, and unintended outcomes. The reconstruction of the espoused theory, presented in Fig. 4-1 (see Appendix C for more details), was based on findings from the policy documents and describes the intended policy design of Nigeria's EPR programme. The chapter subsequently compares these policy expectations with stakeholder experiences in practice in order to answer the research questions. In addition, the charts presented in this chapter visualise interview responses based on the proportion of stakeholders who identified or referenced particular issues. All stakeholders are identified using the names of their respective organisations (see Appendix F).

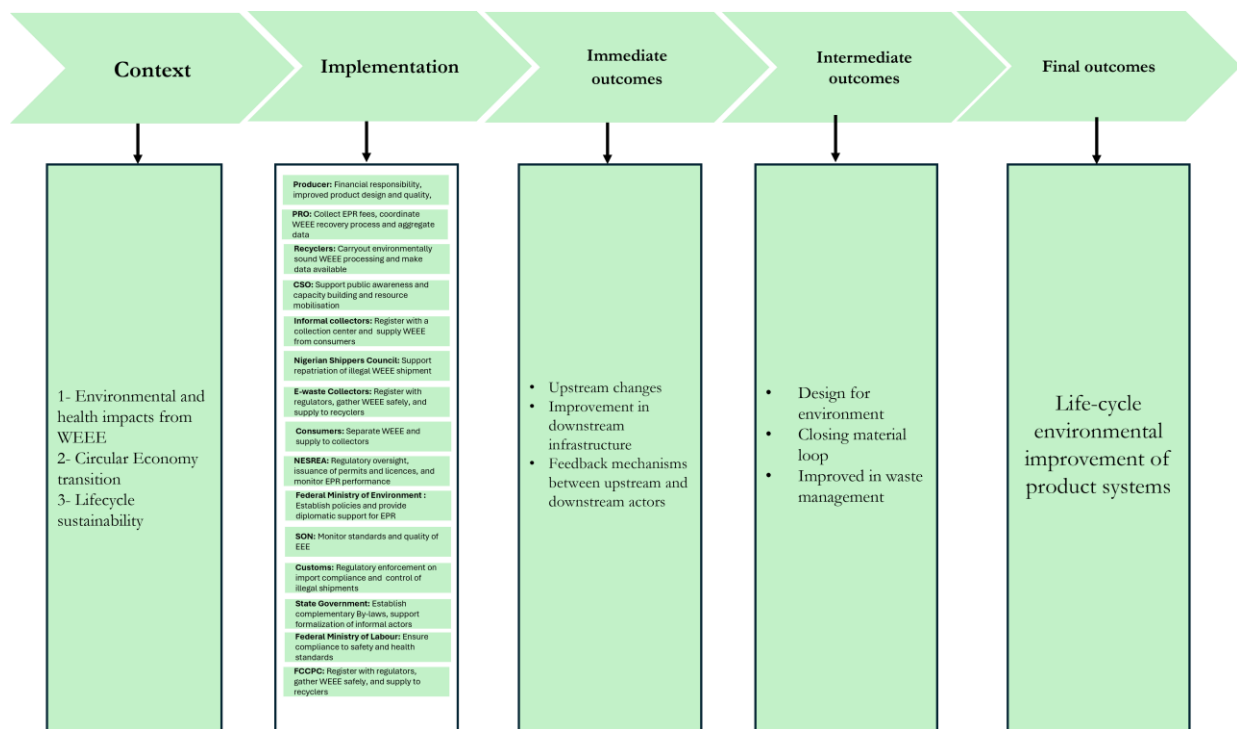


Figure 4-1 Simplified reconstructed EPR policy design

Source: Author's illustration based on NESREA (2022), NESREA (2014) and Government of Nigeria, (2022)

4.1 Context of Extended Producer Programme for WEEE in Nigeria

In the policy design, available evidence suggests that Nigeria's EPR programme was motivated by the recognition of the significant environmental and human health impacts associated with the production, use, and EoL management of EEE (Government of Nigeria, 2022; NESREA, 2014, 2022). For instance, NESREA (2014) states that *"proper waste management is important to protect human health and the environment as well as to preserve natural resources."* Additionally, the integration of circular economy principles within the electronics sector was identified as a policy priority (Government of Nigeria, 2022; NESREA, 2022). This was clearly reflected in

the policy's emphasis on *"a hierarchical, integrated approach and creating a closed loop involving reduction, reuse, recovery, repair and recycling"* (NESREA, 2014).

On the other hand, findings from stakeholders reveal a deeper and more context-specific understanding of the motivation behind EPR. Firstly, the majority of stakeholders identified the large-scale importation of EEE and UEEE as a key driver of WEEE generation, alongside unsafe and poor management practices prior to the introduction of EPR. These were highlighted as central reasons for its establishment (EPRON, WAPAN, NESREA, LASEPA, Nigerian Customs). WAPAN, a civil society organization, described Nigeria as *"more or less... a collection hub of used electronics,"* where low economic conditions drive consumer dependence on imported UEEE (WAPAN, 2nd April 2026). A similar perspective was expressed by Nigerian Customs, a government regulator, which noted that UEEE *"mostly, or about 99% of it, is imported"* (Nigerian Customs, 1st April 2026), while LASEPA, a state government representative, pointed to the affordability of *"Tokunbo (second-hand)"* electronics as a structural driver of increasing WEEE volumes (LASEPA, 1st April 2026).

Secondly, the recognition of producer responsibility for EoL product management emerged as a key motivation for EPR (Libra Circle, NESREA, EPRON). An importer organisation, Libra Circle, stated that *"once we finish producing... we still have a responsibility... to ensure that those products are adequately recycled"* (Libra Circle, 13th April 2026). Similarly, the primary Government regulator, NESREA, clarified that within the Nigerian context, *"whoever brings these products into the market should be responsible for the environmental management of those products"* (NESREA, 13th April 2026), explicitly extending this obligation to importers. This perspective was also emphasized by EPRON, the official EPR coordinating organisation, which stated that EPR is aimed at *"ensuring that producers are accountable and that financing... is funded by producers"* (EPRON, 10th April 2026).

Thirdly, stakeholders perceived EPR as a mechanism to improve informal sector practices through integration and formalisation (WAPAN, W3 Ecofriendly Ltd, LASEPA). W3 Ecofriendly Ltd, an E-waste collector, noted that *"when we integrate the informal handler... it will go a long way to help... the EPR to achieve their goals,"* while also emphasising the need to shift from environmentally harmful practices to more controlled systems (W3 Ecofriendly Ltd, 11th April 2026). Similarly, LASEPA stressed the importance of *"training... and integrating them into the system"* (LASEPA, 1st April 2026). This was further agreed by WAPAN;

"EPR is set up to ensure that the business of e-waste management is done properly and that the waste pickers, who are the foot soldiers, are properly encouraged and incentivised" (WAPAN, 2nd April 2026).

Additionally, government agencies and other stakeholders highlighted that EPR was introduced to address existing regulatory gaps in WEEE management (PRO, Civil Society, NESREA, Customs). The transition towards a circular economy also emerged casually amongst stakeholders (FMEnv, Informal collector). FMEnv, the government institution responsible for environmental policy development, noted that EPR should serve as a mechanism *"to ensure that we move... from the linear economy to the circular economy,"* with a focus on reducing landfill waste and extending product lifecycles (FMEnv, 31st March 2026).

Generally, a notable observation is that these contextual perceptions vary across stakeholders, as shown in Fig. 4-2, with the majority relating to unsafe and poor WEEE management, producer responsibility, and the heavy importation of WEEE. Conversely, livelihood creation and job opportunities were the least identified contextual motivations by stakeholders. Additionally, a few stakeholders, particularly the consumer representative, user of EEE and

UEEE, and FCCPC, the government agency responsible for consumer complaints and protection, reported having no knowledge of the broader EPR context.

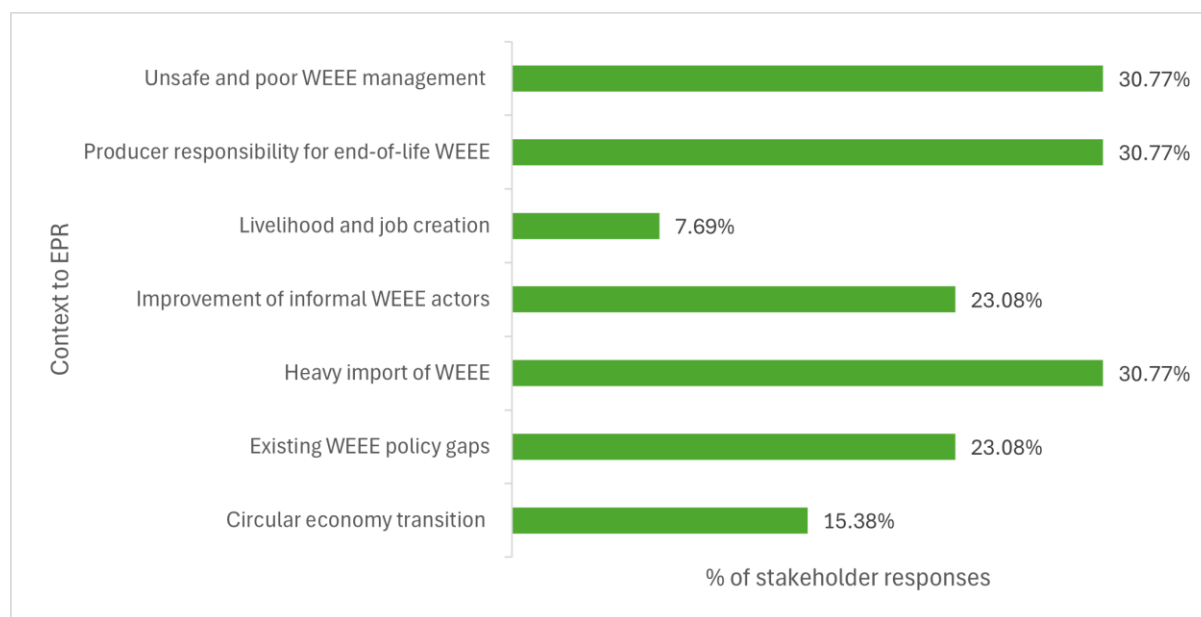


Figure 4-2 Specific EPR contexts in practice

Source: Authors Illustration (2026)

4.2 Implementation of Extended Producer Programme for WEEE in Nigeria

4.2.1 Collection, Recovery and Material Processing

In the policy design, collection, recovery, and material processing form the operational backbone of the EPR system. WEEE collectors and recyclers are expected to manage the physical flow of waste through organised collection, safe transportation, dismantling, and environmentally sound processing (Government of Nigeria, 2022; NESREA, 2022). Collectors and recyclers are required to register formally with regulatory bodies and obtain permit, maintain records, and ensure safe handling and storage (NESREA, 2022). Similarly, recyclers are expected to apply best management practices, treat hazardous fractions appropriately, and provide feedback to producers to improve product design (Government of Nigeria, 2022; NESREA, 2022). This is quoted in the regulation “A person who operates an e-waste collection centre.....e-waste recycling plant... shall register with the Agency and the PRO, and comply with the requirements provided” (Government of Nigeria, 2022. p. 3460). Additionally, informal collectors, who serve as last-mile WEEE recovery actors, are expected to be integrated into formal systems through registration, improved handling practices, and structured incentives (NESREA, 2022), while consumers are expected to separate WEEE at source and channel it through registered collection systems.

In practice, collection, recovery, and processing activities are highly decentralised and carried out by multiple stakeholders (Nigerian Customs, Libra Circle, E-Terra, WAPAN, W3 Ecofriendly Ltd). Both formal and informal actors undertake WEEE collection. Evidence for this multi-participatory collection is shown on Fig. 4.3. Informal collectors operate as key intermediaries, sourcing WEEE from importers, repairer shops, households, and dumpsites.

As the informal collector noted, *“we gather them and sell to e-waste collectors... within 2–4 weeks, they are sold to the larger companies”* (Informal collector, 11 April 2026). Formal collectors also source WEEE from the informal sector and compete directly with them by bidding for WEEE from companies who auction their old electronics. As described by a formal E-waste collectors, companies *“look on EPRON... and call... companies... to come for inspection... [and] the items are awarded to the highest bidder”* (W3 Ecofriendly Ltd, 11th April 2026). Moreso, E-waste collectors engage in basic repair and refurbishment, purchasing outdated electronics, fixing them, and reselling them into the market (W3 Ecofriendly Ltd, 11th April 2026).

Additionally, recyclers operate at a more advanced level, undertaking dismantling, sorting, and the export of hazardous E-waste fractions for further treatment under more controlled and environmentally sound conditions. As the recycler noted:

“For the hazardous waste... we have a partner that will take those hazardous waste from us... and we have to pass through the process of transboundary... before that.” (E-Terra, 9th April 2026).

Consumers also play a role in material recovery through reuse, sorting, and resale. For instance, consumers representative noted that faulty devices are retained for repair purposes, while non-repairable parts are sold to collectors. *“I sell the e-waste... to the nearby e-waste collectors... [and] this also fetches me some money”* (Consumer representative, 11 April 2026). Similarly, WAPAN and Nigerian Customs also support collection efforts. WAPAN stated its effort in establishing collection centres, while Nigerian Customs partners with international organisations to implement recovery initiatives for hazardous e-waste. As noted:

“We started a programme recently with the National Ozone Office in partnership with UNIDO and UNEP to see how we can be collecting old air conditioning systems, whereby households give us their old air conditions and they get a newer one, which is double inverter and one that use the better alternatives, non-ozone depleting substances” (Nigerian Customs, 1st 2026).

In addition, producers participate directly in recycling initiatives. Libra Circle noted that they operate private recycling systems to manage their own product waste streams.

4.2.2 Awareness, Education and Capacity Building

In the policy design, environmental awareness creation was assigned as a responsibility to government regulators, including the FCCPC, responsible for consumer complaints and protection, NESREA and CSOs (NESREA, 2022). For instance, NESREA is mandated to *“Enlighten and educate the public in campaigns funded by EPRON”* (NESREA, 2022. p13).

In practice, however, awareness creation and capacity-building activities are more pronounced with active implementation by multiple stakeholders (WAPAN, NESREA, FMEnv, LASEPA, EPRON). WAPAN highlighted its extensive sensitisation efforts on proper WEEE management across both formal and informal settings, utilising major local languages to reach a wider audience. It also noted the use of digital platforms, including WhatsApp, as tools for knowledge dissemination and coordination. As stated;

“We sensitise communities and business places on how to properly dispose of e-waste, because if it is wrongly disposed, it exposes the populace to very hazardous environments, affecting human health, as well as the soil and water” (WAPAN, 2nd April 2026).

Furthermore, regulatory bodies, particularly FMEnv and NESREA, also play a significant role in awareness creation and capacity building. NESREA described structured training programmes targeting both producers and E-waste handlers. As noted, *“if you're dealing with e-*

waste... [and] you don't handle them in an environmentally sound manner, you're going to expose yourself and... the environment" (NESREA, 13th April 2026). At the industry level, EPRON contributes to awareness primarily through stakeholder engagement. This includes fostering "buy-in" among industry actors and facilitating linkages across the value chain by introducing stakeholders to relevant partners.

4.2.3 Data Management, Monitoring and Reporting

In the policy design, the EPR programme mandates structured data management, monitoring, and reporting across stakeholders (Government of Nigeria, 2022; NESREA, 2014, 2022). Producers are required to provide periodic data on products placed on the market. As stated in the regulation *"A person who produces or imports EEE, shall keep records and furnish the Agency and the PRO in writing of the quantity of EEE imported into Nigeria"* (Government of Nigeria, 2022. p3460). The policy also assigns EPRON with responsibility for managing centralised data systems (Government of Nigeria, 2022; NESREA, 2022). Additionally, NESREA is expected to oversee monitoring and supervisory functions, while collectors and recyclers are expected to maintain records and report their activities to EPRON (Government of Nigeria, 2022; NESREA, 2022).

In practice, however, data management and reporting remain uneven and inefficient across stakeholders. EPRON has made efforts to establish a data management system, known as the *Black Box*, which has improved documentation within the system.

As noted, there has been *"progress in terms of developing... structure for the registrations,"* creating *"some form of documentation and opportunity for... regulators to know the stakeholders in the value chain"* (EPRON, 10th April 2026). Although reporting is undertaken by both WEEE collectors and recyclers, data is not consistently shared amongst stakeholders. W3 Ecofriendly Ltd noted that detailed inventories are maintained to track *"where what we collected goes, who collected what"* (W3 Ecofriendly Ltd, 11th April 2026). However, such data is not regularly reported to EPRON, as *"I share data on my e-waste collection with companies... [and] LASEPA"* (W3 Ecofriendly Ltd, 11th April 2026).

In contrast, E-Terra reported more structured and consistent data sharing practices across a broader range of stakeholders. *"On a quarterly basis, we send out reports of activities... the quantity of e-waste"* (E-Terra, 9th April 2026). Moreover, at the regulatory level, NESREA indicated that it receives reports from EPRON, stating that *"they are supposed to give us the quantity of e-waste collected, the quantity treated... [and] whatever activities that they carry out"* (NESREA, 13th April 2026).

4.2.4 Financing Mechanism and Economic Responsibility

In policy design, financing mechanisms are anchored on producer responsibility, where producers and importers are required to pay levies to EPRON, which are then used to fund collection, transportation, recycling, and environmentally sound disposal of WEEE generated from their products (Government of Nigeria, 2022; NESREA, 2014, 2022). This has been clearly quoted in the regulation *"A person who imports, manufactures, assembles, or distributes a new or used EEE without payment of recycling fees to the PRO for environmentally sound management (ESM) of e-waste. commits an offence"* (Government of Nigeria, 2022. p3466). This mechanism is expected to be managed by monitored by NESREA (NESREA, 2022).

In practice, producers are heavily non-compliant (EPRON). EPRON is taking other strategic measures to access external financial support. As clearly highlighted; *"EPRON has also helped the country to benefit from different funding opportunities... using, for instance, the GEF funded projects... it only happened because there was an EPRON system that was in place"* (EPRON, 10th April 2026).

Although the Black box, a financial system platform for producer compliance, is established by EPRON, they acknowledge the need for a more functional and sustainable financing mechanism. *“It is upon us to be able to get a financing mechanism that works for the system.”* (EPRON, 10th April 2026). Generally, the results reveal a less active level of financial responsibility among both producers and other stakeholders, as shown in Fig. 4.3.

4.2.5 Import Control and Transboundary WEEE Flows

In the policy design, the control of imports and transboundary flows of EEE and WEEE is assigned to multiple regulatory agencies (Government of Nigeria, 2022; NESREA, 2022). NESREA is responsible for registration and the issuance of clearance permits, SON, ensures product quality and safety compliance, and the Nigerian Customs oversees inspection, monitoring, and interception of illegal shipments. Additionally, the FMEnv is tasked with overseeing compliance with multilateral environmental agreements, particularly regarding the transboundary movement of hazardous waste.

In practice, regulatory actions on WEEE imports are ongoing across these agencies (NESREA, SON, Nigerian Customs, FMEnv). The Nigerian Customs reported the use of specialised units and technologies for scanning and monitoring imported goods. As stated, *“examination is done through scanning... [to] detect... what is being declared... and what is seen on the image”* (Nigerian Customs, 1st April 2026), enabling the identification of discrepancies in shipments. Similarly, SON ensures that imported products meet required standards before entering the market. Products are *“certified... before such products come into the country... to ensure that... it is fit for the purpose”* (SON, 13th April 2026).

In addition, coordinated enforcement actions, such as seizure and repatriation, are periodically undertaken to prevent the illegal importation of WEEE (SON, NESREA, Nigerian Customs, E-Terra). As stated in the policy document *“We had some importations... which we stopped... and the one from Germany was repatriated back at the cost of the shipper.”* (Nigerian Customs, 1st April 2026).

4.2.6 Informal Sector Integration and Support

In the policy design, the informal sector is recognised as a key actor within the EPR system and is expected to be progressively integrated into formal structures (Government of Nigeria, 2022; NESREA, 2022). This integration is expected to occur through the registration, licensing, incentivisation, and capacity building of informal actors. For instance, the regulation mandates the establishment of *“a registration system for informal collectors”* (Government of Nigeria, 2022. p350).

In practice, stakeholders demonstrate ongoing efforts toward informal sector formalisation and integration (WAPAN, LASEPA, NESREA). WAPAN highlighted support for obtaining permits and licences required for e-waste activities, noting that *“there are certain permits and licences that our members must... obtain before we can... handle e-waste”* (WAPAN, 2nd April 2026).

Capacity-building initiatives also extend to safety training and provision of protective equipment. E-terra, a formal E-waste recycling company, reported providing support to informal actors, stating that *“we... give them training and sometimes... the PPE to use”* (E-Terra, 9th April 2026). Similarly, regulatory actors described previous interventions, where *“they were given equipment... ID cards... so they could be recognised officially and not harassed”* (NESREA, 13 April 2026). These formalisation efforts are ongoing at both national and sub-national levels. LASEPA noted that it provides *“capacity building for the informal sector to integrate them into the system”* (LASEPA, 1st April 2026). In the same vein, the FMEnv asserted that *“there’s a lot of capacity building ongoing at the informal sector level.”* (FMEnv. 31st March 2026).

4.2.7 Product Standards, Quality Control and Social Compliance

In the policy design, product standards, quality control, and social compliance function as upstream regulatory safeguards within the EPR system (Government of Nigeria, 2022; NESREA, 2014, 2022). These responsibilities are distributed across multiple actors: SON develops and enforces design standards, conducts assessments, and issues certifications; producers are expected to comply with testing, certification, and verification requirements. As quoted, they are to “ensure product quality and standards” (NESREA, 2014. p18). Additionally, NESREA “issue appropriate permits and enforce compliance” (NESREA, 2022. p13). Moreso, FCCPC addresses consumer complaints and ensures standards compliance; while downstream actors are expected to adhere to environmental and safety requirements.

In practice, product standards, quality control, and enforcement are actively implemented by several stakeholders (SON, NESREA, FCCPC). SON mandates that new EEE products undergo conformity assessment through testing and certification prior to importation. As noted, products are “certified... before such products come into the country... to ensure that... it is fit for the purpose” (SON, 13 April 2026). This process includes schemes such as SONCAP, where “independent firms... carry out the conformity assessments... inspect, test, and certify” products in line with national standards (SON, 13 April 2026).

Again, enforcement measures are applied where non-compliance is identified. As stated, “if it is something that... is not fit for the purpose... you will be charged accordingly... and you will pay for the destruction” (SON, 13 April 2026). However, these standard checks primarily apply to newly imported EEE items. Similarly, the Nigerian Customs supports this process through inspection and verification mechanisms, including laboratory analysis where necessary. As noted, “lab analysis... [is used] to identify... so that you will not have contemplations before you do what you're supposed to do” (Customs, 1st April 2026). Producers also reported increased compliance with quality and standard control measures. As stated, “you cannot even process your import documents without an importation document from NESREA,” and products must also satisfy SON requirements prior to market entry (Libra Circle, 13 April 2026).

In addition, post-market enforcement occurs through consumer complaint mechanisms. As quoted;

“When we get information... [that] individuals are bringing substandard electronic devices... we go on surveillance first... where violations are identified, enforcement actions include investigation, mediation, and legal proceedings... we mobilise our staff... get a court order... shut down the place... and if it cannot be resolved, we file the case.”

(FCCPC, 2nd April 2026)

4.2.8 Regulatory Enforcement and Compliance

In the policy design, regulatory enforcement and compliance are anchored within a multi-level governance structure involving national regulators, standards agencies, and sub-national authorities (Government of Nigeria, 2022; NESREA, 2022). NESREA holds primary responsibility for enforcement oversight (NESREA, 2022). Other regulators include the FMEEnv for overall policy coordination, SON for market surveillance and enforcement of product standards, FCCPC for consumer protection and quality enforcement, and the Nigerian Customs for controlling illegal imports through strict monitoring. As quoted in the policy document, they are expected to “collaborate with NESREA to inspect and control the illegal shipment of ewaste into Nigeria” (NESREA, 2022. p14). Additionally, State governments are expected to support these efforts through the alignment of environmental By-laws with EPR regulations (NESREA, 2022).

In practice, regulatory enforcement is jointly implemented across these actors, with evidence of inspections, surveillance, seizure operations, and enforcement actions at different levels of the system (Nigerian Customs, NESREA, FCCPC, SON, LASEPA). This indicates an active level of regulatory functionality in practice, as reflected in the stakeholder responses visualised in Fig. 4-3. The Nigerian Customs reported carrying out seizure operations and controlling illegal shipments. Similarly, other regulators undertake enforcement activities within their respective mandates. As noted earlier by NESREA, non-compliant EEE shipments have been repatriated, and importers are required to take responsibility for the environmentally sound destruction of such items. FCCPC also operates specialised units responsible for investigation, surveillance, and enforcement of consumer protection regulations.

At the sub-national level, social, safety, and environmental compliance appears more pronounced. LASEPA reported conducting environmental assessments, including testing of air, water, and soil quality, to evaluate compliance with environmental standards. As plainly stated; *“Government is... collecting water samples... soil samples... and if... they are not complying, then we close down [the facility].”* (LASEPA, 1st April 2026).

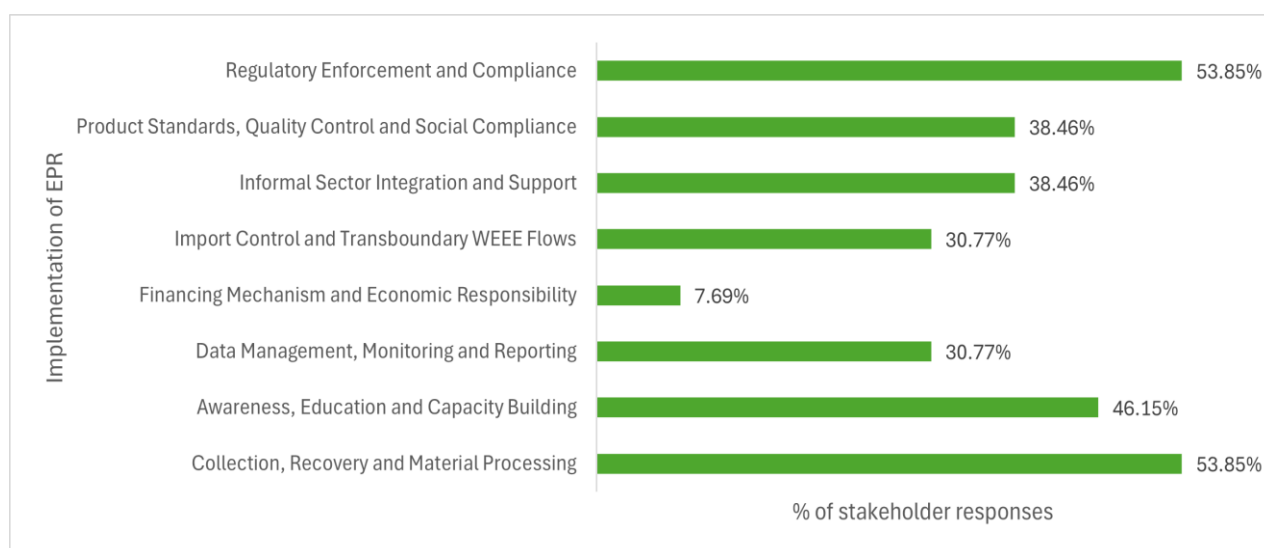


Figure 4-3 Specific stakeholder EPR roles in practice

Source: Authors Illustration (2026)

4.3 Immediate Outcomes of Nigeria's Extended Producer Programme for WEEE

4.3.1 Upstream Changes

In the policy design, major expected upstream changes under the EPR programme include increased control over the importation of WEEE and non-functional EEE products (Government of Nigeria, 2022; NESREA, 2022). For instance, the regulation states that *“non-functional end-of-life EEE and cathode ray tubes (CRT) shall not be imported into Nigeria”* (Government of Nigeria, 2022). Regulators are therefore expected to ensure that only verified, functional, and standards-compliant EEE products are imported and distributed, while producers and

importers are expected to comply with these requirements (Government of Nigeria, 2022; NESREA, 2022).

In practice, evidence suggests that upstream regulatory compliance has improved, particularly in relation to import regulation, product quality, and producer behaviour (Nigerian Customs, NESREA, WAPAN, EPRON, FCCPC, Libra Circle, SON). Stakeholders reported collaborative enforcement actions, including the interception and repatriation of non-compliant EEE shipments.

As noted by the Nigerian Customs:

“I can remember we had some importations from Germany and from China with this waste electronics and electrical equipment’s and some medical wastes that came into the country, which we stopped them from being cleared. And the one from Germany was repatriated back at the cost of the shipper. Hence, there’s a drastic reduction in terms of importations, consumption of these WEEE” (Nigerian Customs, 1st April 2026).

These enforcement actions have influenced import behaviour and improved compliance. As noted by Libra Circle, *“Two to three years ago, you could basically ship any electronic product and NESREA would not have anything to do with you, but now it is impossible”* (Libra Circle, 13th April 2026) indicating increased compliance among importers. These improvements are linked to enforcement mechanisms such as sanctions, including deregistration and revocation of import licences (NESREA, WAPAN). There are also emerging efforts to raise producer awareness regarding the control of persistent organic pollutants (POPs) in imported products, particularly due to their challenges in recycling (E-Terra). However, despite these observed immediate upstream outcomes, it remains insufficient. As noted by FMEnv, *“we’re achieving at the point of entry, maybe not as much as we desire, but at least there’s a lot of improvement needed.”*

Furthermore, persistent gaps have been attributed to governance and enforcement challenges. Prominent issues identified across multiple stakeholders include poor stakeholder coordination, limited regulatory presence at borders (FMEnv, SON, Libra Circle), and border porosity (Customs, FMEnv, SON). Stakeholders also reported difficulties in obtaining timely information from other regulatory agencies, which constrains the effective performance of their enforcement responsibilities. In addition, smugglers were reported to exploit alternative routes to bypass regulatory controls (SON, Nigerian Customs). Producers further highlighted the high cost of compliance as a significant barrier to full adherence to regulatory requirements.

4.3.2 Improvement in Downstream Infrastructure

In the policy design, immediate downstream outcomes are expected to include the establishment of functional infrastructure and structured operational systems for the safe and environmentally sound collection, transportation, handling, treatment, and processing of WEEE within a well-coordinated system (Government of Nigeria, 2022; NESREA, 2014, 2022). This is expected to be achieved mainly through the producer fees in coordination with EPRON (Government of Nigeria, 2022; NESREA, 2022).

In practice, while some efforts have been made, improvements in downstream infrastructural outcomes remain limited due to low investments, poor consistency and informal sector dominance and price advantages. Multiple stakeholders contribute to infrastructure development, although largely in fragmented and uncoordinated ways (WAPAN, LASEPA, NESREA, E-Terra). There is evidence of government-led and donor-supported initiatives. Under the Global Environment Facility (GEF) project, NESREA and LASEPA reported efforts to establish and upgrade collection centres in Lagos State, alongside initiatives for informal sector formalisation. Similar efforts were noted by WAPAN, who stated that *“we*

create a collection center where they can bring those e-waste materials and then they are paid for,” while waste pickers are also “stationed around the metropolis... [where] e-waste can be disposed in exchange for token” (WAPAN, 2nd April 2026).

Additionally, there is also evidence of targeted infrastructural support to collectors with limited capacity. As noted by W3 Ecofriendly Ltd: *“Government has already given us one acre of land that can allow us to process up to 100 tonnes of e-waste”* (W3 Ecofriendly Ltd, 11th April 2026). They further highlighted receiving prior support: *“I did an e-waste recovery and processing for items from PZ. I did not have a site. Hence, I used the Government site owned by LAWMA”* (W3 Ecofriendly Ltd, 11th April 2026). Similarly, downstream stakeholder support was also acknowledged by EPRON, noting that *“we’ve been able to introduce them (companies) to a lot of recyclers”* (EPRON, 10th April 2026).

However, despite these observed improvements, overall infrastructural capacity remains constrained (EPRON, Nigerian Customs). As observed, *“I’ve not seen them increase the capacity... the same machines... are still the same ones”* (EPRON, 10th April 2026). Several challenges continue to limit downstream infrastructural development. Informal sector dominance remains a key constraint (E-Terra, W3 Ecofriendly Limited). As noted, *“a lot of materials is still playing in the informal place”* (NESREA, 13 April 2026), largely driven by higher prices offered in the informal markets compared to formal systems (LASEPA, FMEnv). This creates uncertainty in feedstock supply and discourages investment in recycling infrastructure due to concerns over low returns (E-Terra). Programme inconsistency was also identified as a barrier by EPRON, noting that previous efforts to formalize the informal sector were not sustained. According to the findings, earlier interventions reverted to the status quo once funding was exhausted, with little evidence of continued follow-up or long-term institutional support. As quoted by, *“people continued their act of selling the e-waste at very exorbitant prices”* in informal markets (EPRON, 10th April 2026). Although the EPR programme formally recognises informal workers, stakeholders noted that integration remains challenging due to the inability of formal systems to match informal market prices.

Similarly, stakeholders attributed ongoing environmental and health pollution associated with some downstream recycling activities due to the use of inadequate facilities (FMEnv; EPRON). According to the FMEnv, some recycling centers are *“using technologies that are not appropriate,”* thereby further exacerbating environmental risks (FMEnv, 31st April 2026). FMEnv further explained that inadequate dismantling processes, resulting from poor recycling infrastructure and environmentally unsafe treatment methods, contribute significantly to environmental contamination and human health risks. As stated, *“if it’s not handled in an environmentally sound manner... there’s exposure into the air... and water bodies,”* while *“heavy metals also enter into the food chain... leading to exposure of humans... and the agricultural environment”* (FMEnv, 31st April 2026). Consequently, the impacts of such environmentally unsafe dismantling practices disproportionately affect vulnerable groups, particularly women and children (EPRON). This health exposure was vividly observed during field observations, as shown in Fig. 4-4, thereby supporting stakeholders’ perceptions regarding the environmental and health risks associated with WEEE management sites lacking adequate infrastructure.



Figure 4-4 E-waste exposure at collection facility

Source: Author's fieldwork/photo

4.3.3 Feedback Mechanisms Between Upstream and Downstream Actors

In policy design, feedback mechanisms are expected to function as a central system for information exchange, data sharing, and learning between upstream and downstream actors (Government of Nigeria, 2022; NESREA, 2022). This is to be facilitated through a centralised data management system (the *Black Box*), coordinated by the PRO and overseen by regulatory bodies such as NESREA (NESREA, 2022). Additionally, stakeholders are assigned mandate to ensure data exchange.

In practice, there are considerable evidence of emerging feedback mechanisms, primarily through data reporting systems and, to a lesser extent, through stakeholder interactions (Nigerian Customs, EPRON, NESREA, SON, Libra Circle, FCCPC). The national single-window platform, recently introduced in Nigeria but not yet fully operational, is expected to facilitate more seamless data sharing across stakeholders. As described, the platform enables “different stakeholders... to log in... see what is happening... and [enable] information sharing and data sharing” (Nigerian Customs, 1st April 2026). Similarly, EPRON highlighted the role of such systems in improving data accuracy and benchmarking, noting that access to more reliable information “means that we are able to get accurate information... to benchmark information that producers

are giving us” (EPRON, 10 April 2026). In addition, the *Black Box* system has been developed to consolidate product and WEEE data, with producers describing it as a mechanism to “create a harmonised system for... generating e-waste report” (Libra Circle, 13 April 2026).

However, feedback mechanism between stakeholders remains partial and uneven. While some downstream actors report data into the system, only recyclers indicated providing feedback to manufacturers and importers, particularly regarding hazardous components and product design. As noted, “we... let the manufacturer know they need to come up with a friendly plastic... free from POP” (E-Terra, 9th April 2026). Beyond formal systems, feedback also occurs through institutional and relational interactions, including joint inspections and collaborations between PROs, regulators, and state agencies. Despite these efforts, significant limitations persist. EPRON emphasised asymmetry in data exchange, stating that “we do a lot of sharing... we cannot say we receive the same... it’s not been easy getting data” (EPRON, 10th April).

Several factors contribute to these data exchange limitations. The centralisation of EPR at the federal level constrains state-level participation and responsiveness to local WEEE challenges (LASEPA). In addition, price dynamics in the informal sector undermine the use of formal data systems, with stakeholders noting that the *Black Box* design is “impractical to the system reality in the country,” as “e-waste will be sold... at the highest possible amount” (EPRON, 10th April). This reflects a system largely driven by market incentives rather than reporting requirements. Furthermore, fear of taxation contributes to data withholding and information hoarding among stakeholders (Libra Circle, EPRON, W3 Ecofriendly Limited, LASEPA). As stated, “if you tell an importer... this is how much you are supposed to bring in... after being calculated on the black box, they tell you that is too much” (EPRON, 10th April).

4.4 Intermediate Outcomes of Nigeria’s Extended Producer Programme for WEEE

4.4.1 Design for Environment

In policy design, producers and importers are expected to integrate eco-design features that reduce hazardous content, enhance product durability, and improve recyclability. For instance, the policy mandates producers “to manufacture environmentally friendly products by incorporating waste prevention, reuse and recycling considerations into product design” (NESREA, 2014, p.8). Similarly, producers are expected to “design products to reduce lifecycle environmental impacts” (NESREA, 2014, p.18). In addition, all EEE products are required to comply with established quality and technical standards. Products are also expected to include information that supports design-for-recycling and proper product labelling.

In practice, product design in the electronics sector has partially improved over time, particularly in terms of size, efficiency, and material composition (E-Terra, SON, EPRON, P02). However, results from stakeholders note that these developments are largely driven by global technological advancements rather than EPR-specific EPR interventions. As noted by consumer representative, technological evolution has progressed from “diskette... to compact disk... [to] flash drives” (Consumer representative, 11th April 2026). Similarly, W3 Ecofriendly Ltd observed that “panels are now smaller in size compared to the past” reflecting changes in product configuration and material use (W3 Ecofriendly Ltd, 11 April 2026). Despite these improvements, there is limited evidence of progress in reducing hazardous content in EEE, although some efforts are being made through producer awareness initiatives (E-Terra). In addition, products are subject to testing and certification processes prior to market entry (Libra Circle). SON further noted a reduction in substandard products entering through

formal channels due to regulatory enforcement, stating that *“if that product doesn't meet the requirement... don't even bring it in”* (SON, 13th April 2026). Stakeholders consistently attributed these improvements to global standards and technological innovation rather than EPR implementation (EPRON, W3 Ecofriendly Ltd). As noted by EPRON, *“all those design changes... [are] driven by... international standards... it can't be us”* (EPRON, 10th April 2026). Similarly, W3 Ecofriendly Ltd emphasised that improvements in product size and structure are *“not... because of EPR... just technological advancement”* (W3 Ecofriendly Ltd, 11th April 2026).

Nonetheless, significant challenges continue to limit the influence of EPR on product design. These include the illegal importation of substandard EEE through porous borders (FMEnv, Nigerian Customs) and the limited presence of standards enforcement agencies at ports (NESREA, SON). Furthermore, Nigeria's reliance on imports, coupled with limited domestic EEE production capacity (NESREA), constrains its ability to directly influence product design at the source. As such, regulatory influence is largely confined to controlling what enters the national market.

4.4.2 Closing Material Loop

In the policy design, closing material loops is not explicitly articulated as a primary objective of the EPR framework but is implicitly embedded as a secondary outcome (Government of Nigeria, 2022; NESREA, 2014, 2022). The system assumes that improved collection, tracking, and treatment of WEEE will enable the recovery of materials and their eventual supply to producers for new production cycle (NESREA, 2014, 2022). In achieving this, it is expected that formal recyclers will be the key drivers while receiving technical support from EPRON to *“identify markets for recycled products”* (NESREA, 2014. p20).

In practice, however, there is limited evidence of effective material recovery and reuse. While some efforts are being made to recover secondary raw materials from WEEE, these activities are largely dominated by the informal sector (NESREA, W3 Ecofriendly Ltd) and do not consistently flow through formalised channels as expected. As noted, *“less than 60% of the materials flow in that direction”* back to producers (EPRON, 10th April 2026). There is some evidence of partial progress toward material loop closure among downstream actors (E-Terra, W3 Ecofriendly Limited). W3 Ecofriendly Ltd indicated that certain recovered materials from dismantled EEE are redirected for secondary uses, including energy generation by other companies. Similarly, E-Terra processes WEEE to a certain stage before exporting it for further recycling, due to limited local capacity to complete the full recycling process.

Despite these efforts, stakeholders consider progress toward material loop closure to be insufficient and inefficient. As noted by EPRON, *“there's definitely improvement in trying to close material loops... [but] the efficiency of it, I'm not very sure”* (EPRON, 10th April 2026). Several challenges continue to constrain effective loop closure. Limited access to WEEE feedstock by formal recyclers, driven by their inability to purchase WEEE at prices comparable to those offered by the informal market, remains a key challenge (E-Terra, W3 Ecofriendly Ltd, Informal collector). In addition, insufficient WEEE recycling capacity among downstream actors restricts their ability to carry out full closed loop material recovery (E-Terra, LASEPA).

4.4.3 Improved Waste Management

In policy design, improved, efficient, documented, environmentally sound, and regulated WEEE management is a centrally expected outcome of the EPR programme (Government of Nigeria, 2022; NESREA, 2014, 2022). This includes adherence to safe handling and transportation procedures by downstream actors, efficient incentive-based recovery systems, controlled movement of WEEE within and beyond national borders, and effective repatriation of illegal or substandard EEE imports. As clearly stated in the regulation *“e-waste*

imported into Nigeria shall be sent back to the port of origin....any vessel used to import used EEE mixed with e-waste shall be forfeited to Nigeria" (Government of Nigeria, 2022. p3479). Additionally, it establishes WEEE collection and recycling targets, including the *"annual collection of 6,000 metric tonnes of e-waste and a progressive collection rate starting from 1% of EEE placed on the market, increasing to 3% from 2023 and 5% from 2025,"* (NESREA, 2022) with EPRON and relevant stakeholders responsible for achieving these targets. These targets are expected to be achieved through a structured recovery pathway.

In practice, however, improvements remain marginal, with limited structural transformation of WEEE management systems. Notable progress has been observed in the reduction of WEEE imports from transboundary sources, often disguised as used EEE (NESREA, Nigerian Customs, E-Terra). Illegally imported and substandard EEE including WEEE are increasingly intercepted, dismantled, and treated within Nigerian recycling facilities. As noted by E-Terra, *"there's a lot of imported electronics... being seized and brought here... those things were being destroyed in our facility,"* a process reportedly undertaken repeatedly, contributing to a reduction in illegal imports (E-Terra, 9th April 2026). This has increased the risk associated with non-compliant imports, as *"anybody that is importing will take a risk... the possibility of losing the container is 80 percent"* (E-Terra, 9th April 2026). However, these gains are largely limited to imports passing through formal border controls, as *"it's really difficult to track some of those things that don't come through the port of entry."* (Nigerian Customs, 1st April 2026).

In addition to this, available data on WEEE collection and recycling indicates a gradual annual increase in collection and recycling activities, although performance remains significantly below the targets established in policy design and insufficient to address the growing volume of WEEE generation. Data from EPRON shows that 329.071 tonnes and 349.662 tonnes of WEEE were officially collected and recycled in 2022 and 2023, respectively. In addition, data from E-Terra Technologies Limited indicates an upward trend in recycling activities at its facility between 2023 and 2025 (Fig. 4-5).

Moreover, despite being formally recognised within the policy framework, the informal sector remains inadequately integrated into the EPR programme and continues to represent a major barrier to achieving improved waste management outcomes. This undermines environmentally sound waste management efforts, as informal actors dominate access to WEEE materials while often relying on environmentally harmful dismantling practices (W3 Ecofriendly Ltd, FMEnv, EPRON). As noted by FMEnv, *"the huge amount of electronic waste... being poorly managed, especially in the informal sector... there's a huge gap"* (FMEnv, 31st March 2026). Crude dismantling practices within the informal sector create a competitive disadvantage for formal collectors and recyclers, who incur additional costs in adhering to environmentally sound waste management practices as mandated under the EPR (W3 Ecofriendly Ltd, E-Terra). This additional cost makes it difficult for the formal actors to pay similar price for WEEE. EPRON quoted *"they cannot buy the e-waste because they pay so much to manage it properly"* (EPRON, 10th April 2026). Informal actors consider the incentive in the formal EPR structure to be less attractive compared to what they make in the informal market. As noted by FMEnv, *"it is not attractive to the informal sector"* (FMEnv, 31st March 2026).

Similarly, companies often sell WEEE to mostly informal actors who offer higher prices during auctioning. As noted, *"companies prefer to sell to them... because they pay more"* (W3 Ecofriendly Ltd). Consequently, even unregistered informal actors can compete and win bids for WEEE directly from companies (W3 Ecofriendly Ltd, LASEPA). Although EPR fees from producers are intended to offset these cost disparities between the formal and informal market, it is unattained due to limited producer compliance (EPRON). This is partly attributed to the voluntary nature of registration within the *Black Box* system (FMEnv) and the high cost

of producer fee which could be a reason for producer hesitance. As noted, *“the fees are also high because... people do not give [e-waste] up for free... you have to buy back”* (FMEnv, 10th April 2026).

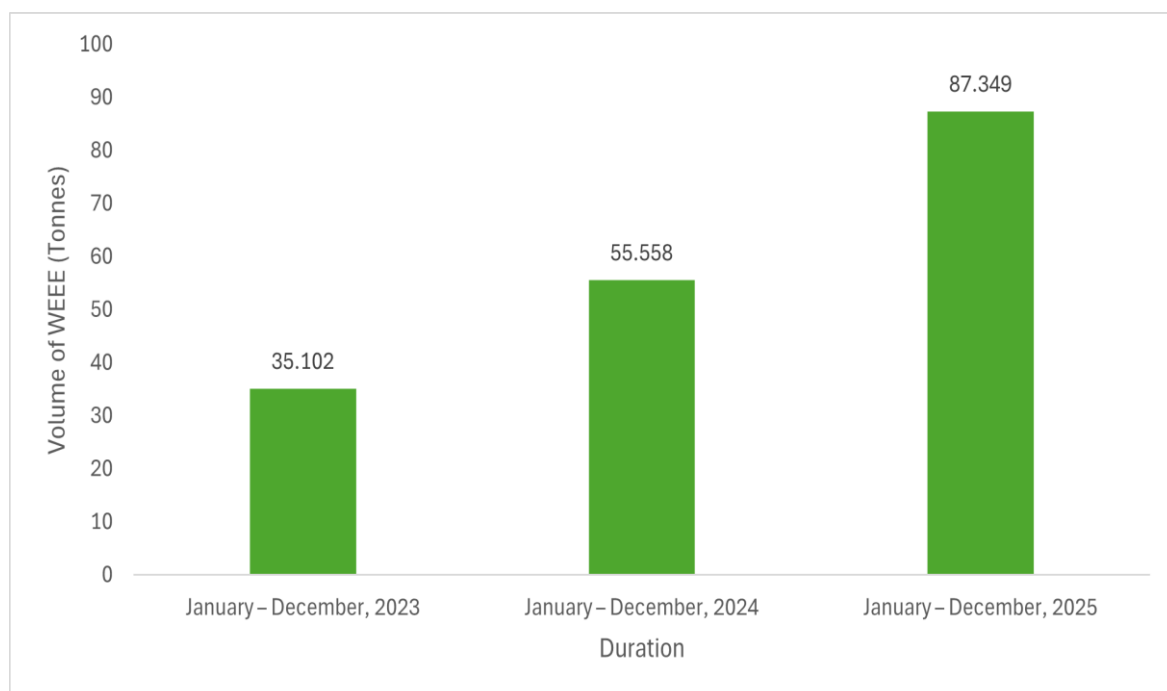


Figure 4-5 WEEE collection and recycling data

Source: E-Terra Technologies (2026)

4.5 Unintended Outcomes of Nigeria’s Extended Producer Programme for WEEE

One unintended outcome observed is jobs and livelihood displacement. A dominant view among stakeholders was that EPR has contributed to the establishment of more WEEE recycling and collection centres, thereby supporting job creation and social protection measures (W3 Ecofriendly Ltd, FMEnv, Libra Circle). For instance, W3 Ecofriendly Ltd stated that *“we registered everybody... under Social Insurance... even in periods that we did not make any profit”* (W3 Ecofriendly Ltd, 11th April 2026). Similar views were shared by the informal collector. However, although EPR may have contributed to the creation of better-quality formal jobs, an unintended consequence appears to be the displacement of livelihoods within the informal sector. Stakeholders noted that the formal employment opportunities created under the EPR remain limited in number and may come at the expense of larger livelihood losses among informal actors. As highlighted by Libra Circle, *“once you put them out of jobs... it’s going to create another problem”* (Libra Circle, 13th April 2026).

Secondly, environmental and health risks emerged as another unintended outcome of the EPR programme, largely due to intensified informal recycling activities associated with the increasing economic value of WEEE. As stated by an informal collector, *“EPR has made waste very valuable”* (Informal collector, 11th April 2026). Although EPR efforts to formalise the informal sector have incentivised WEEE collection, stakeholders noted that some actors falsely present themselves as formal collectors while continuing to channel WEEE into environmentally harmful informal recycling processes. EPRON noted that some actors claim

to be “*formal collectors*” but still take WEEE “*back into the informal process*” (EPRON, 10th April 2026). This has contributed to continued unsafe handling of WEEE and exposure to hazardous substances due to poor safety practices. Similar concerns were raised by Nigerian Customs, which noted that many informal actors “*don’t have the safety gears*,” exposing them to risks such as “*lead poisoning*” and harmful “*inhalations*.”

4.6 Reflections of Findings to the Study Approaches Used

This study has advanced the understanding of Nigeria’s EPR programme for WEEE by systematically evaluating its design, implementation mechanisms, and outcomes through the TBE framework, including an additional unintended outcomes component. In doing so, the study addressed the key gap identified in the problem statement regarding the limited empirical understanding of how Nigeria’s EPR programme functions in practice. With respect to the methods and framework used in this study, the established research questions have been answered.

First, the findings indicate that Nigeria’s EPR programme demonstrates partial effectiveness, thereby answering the main research question (RQ1). Although the programme’s design is broadly consistent with EPR principles and international best practices identified in the literature, significant gaps exist between policy intentions and implementation realities. Consequently, the effectiveness of the programme in practice remains limited despite the strength of its design. While some progress is observable, particularly in the control of transboundary WEEE from legal import routes, regulatory awareness, stakeholder reporting systems, and downstream recycling activities, a large proportion of the core anticipated outcomes, including design-for-environment, efficient material loop closure, environmentally sound waste management, and downstream infrastructure, remain insufficiently achieved. Collectively, the findings suggest that the limitations of the programme are not primarily due to the absence of policy structures, but rather the weak functionality of implementation mechanisms within the broader socio-economic and institutional realities in which the programme operates.

Regarding RQ1a, the Nigeria’s EPR policy design aligns considerably with broader empirical EPR theory, particularly in its anticipated outcomes and assigned stakeholder responsibilities. However, the policy design insufficiently accounts for contextual realities such as informal sector dominance, weak regulatory coordination, import dependency, and the economic dynamics shaping WEEE flows within Nigeria.

As for RQ1b, a substantial gap between policy design and implementation practice. Although implementation mechanisms exist institutionally, their practical effectiveness remains constrained by weak financial compliance, fragmented governance arrangements, informal market dominance, weak traceability systems, and limited enforcement capacity. Consequently, implementation outcomes demonstrate weaker alignment with broader empirical EPR expectations than the policy design itself. This indicates that strong policy intentions alone are insufficient to achieve effective EPR outcomes without implementation systems capable of adapting to contextual realities.

Additionally, jobs and livelihood displacement, as well as environmental and health risks, emerged as unintended outcomes associated with the implementation practices of the EPR programme. These outcomes were not explicitly anticipated within either the original EPR policy design or the existing TBE framework. This finding therefore addresses RQ1c of the study.

5 Discussion

This chapter critically reflects on the study's findings. Section 5.1 discusses the findings in relation to existing literature and evaluates the overall effectiveness of the EPR programme. Section 5.2 provides a reflection on the conceptual framework and methodology used in this study including their limitations.

5.1 Understanding Nigeria's EPR in the Context of Previous Studies

The findings suggest that Nigeria's EPR programme has achieved comparatively stronger performance in upstream regulatory control compared to the downstream domestic WEEE management. In practice, the considerable improvements have occurred in the reduction and environmentally harmful WEEE imports, increased monitoring of substandard EEE inflows, and the environmentally sound treatment of confiscated electronic shipments. This pattern appears closely linked to the original regulatory emphasis underpinning one of the key motivations behind the establishment of the EPR programme. When compared with intended policy expectations, implementation practices in this area appear relatively aligned with the programme's intended objectives. This is consistent with previous assertions by (GEF, 2023; Odeyingbo et al., 2025) and contradicts with (Apoorva & Arpit, 2023; Sadiq, 2025). A possible explanation for this contrasting argument is that, although the EPR programme seems to have positively influenced a reduction WEEE importation, such progress may remain largely limited to formal border control systems. Meanwhile, illegal importations through informal and poorly monitored routes are likely to persist, thereby undermining the overall effectiveness of upstream WEEE control measures.

The findings further suggests that the EPR has underformed in addressing domestic WEEE management within Nigeria. This finding is consistent with (Ezeudu, 2024; Odeyingbo et al., 2025). Specifically, the collection and recycling targets established within the policy framework remain substantially higher than the actual volumes recovered under the EPR programme. This observation is also consistent with Park et al., (2018) who emphasised that for EPR outcomes to be achieved, targets that are feasible must be established. A major explanation for this implementation gap appears to be the weak downstream infrastructural capacity within Nigeria's EPR programme. Although the development of effective collection, transportation, recycling, and environmentally sound treatment systems was anticipated as a key outcome of the EPR design, insufficient progress has been made in establishing these systems in practice. This challenge appears to be driven primarily by low producer compliance with financial responsibilities under the EPR programme, alongside weak enforcement mechanisms, inadequate investment in formal recycling infrastructure, and the continued dominance of informal recovery networks operating outside environmentally sound standards. Consequently, financial resources available for strengthening downstream infrastructure for the recovery and management of WEEE remain insufficient relative to the growing scale of WEEE generation in the country. This observation aligns with Gupta & Sahay (2015) and Mallick et al. (2024), who argue that effective producer responsibility is central to successful EPR implementation.

Similar infrastructural limitations have been widely observed in other developing-country contexts, including Ghana, India, Indonesia, and South Africa (Ardi & Purwojatmiko, 2019; Gaur et al., 2025; Niza et al., 2014; Pongajow et al., 2025; Thukral & Singh, 2023). Contrary to developing countries, more advanced WEEE management infrastructures in OECD countries have been shown to contribute significantly to EPR success (Gupt & Sahay, 2015; Niza et al., 2014). This suggests that the infrastructural challenges observed are not unique to Nigeria but reflect a broader structural pattern across many developing-country EPR programmes. As

such, without stronger producer financial compliance by producers, Nigeria's EPR programme, and by extension those of other developing countries, risk functioning primarily as import-control mechanisms rather than fully operational systems for environmentally sound and circular WEEE management.

Additionally, producer financial non-compliance in practice appears to be strongly misaligned with the expectations and intended obligations established within the EPR policy framework. A possible explanation for continued producer fee evasion, despite the existence of payment mechanisms through EPRON, may be linked to limited enforcement and the largely voluntary nature of compliance in practice, even though the policy formally criminalises non-payment. Again, alternative infrastructural investments from private sector have also remained limited due to uncertainties within the WEEE recovery market. In general, these findings are consistent with previous studies which argue that infrastructural limitations in developing-country EPR programmes are often interconnected with financial constraints, informal sector dominance, and weak regulatory enforcement (Ezeudu, 2024; Odeyingbo et al., 2025; Pongajow et al., 2025; Thukral & Singh, 2023). Overall, the findings from this study, together with existing literature, suggest that WEEE infrastructural challenges in Nigeria are not isolated technical problems, but rather interconnected systemic challenges shaped by financial, institutional, market, and informal sector dynamics. More broadly, the findings suggest that the current dependence on producer fees as the primary financing mechanism for EPR programmes may not be sufficiently viable.

Another notable finding from this study is that the prevention of environmental and health impacts associated with WEEE management remains a major challenge, despite being one of the primary motivations underpinning the establishment of Nigeria's EPR programme. This challenge is linked both indirectly and, to some extent, directly to the functionality of the EPR programme itself. One major indirect factor is the environmentally harmful dismantling practices predominantly associated with informal sector operations. Informal actors mainly focus on recovering economically valuable components from WEEE while discarding non-valuable parts directly into the environment, practices which stakeholders perceived to be harmful to both human health and the natural ecosystem. Similar environmental and health concerns linked to informal WEEE dismantling have been widely reported in existing studies (Grant et al., 2013; Odeyingbo et al., 2025; Song & Li, 2014). Given that the informal actors often pay higher prices compared to formal E-waste collectors, they have a strong market advantage and dominate WEEE recovery.

In contrast, formal EPR actors are required to comply with environmental and occupational safety standards, which increase their operational costs and reduce their ability to compete financially with informal actors who largely bypass such standards. In principle, this price disparity is expected to be offset through producer fees under the EPR system. However, producer non-compliance, as mentioned earlier, continue to position formal EPR actors at a competitive disadvantage. Although penalties have been identified as effective tools for encouraging producer compliance (Tran et al., 2021), Nigeria's EPR programme has not implemented sufficiently strict sanctions on producers likely as a result of weak enforcement mechanisms. This aligns with Odeyingbo et al. (2017), who found that widespread non-compliance and weak enforcement capacity reduce the deterrent effect of penalties. Similar weak monitoring and ineffective sanctioning have also been found to constrain EPR performance in other developing countries, including Brazil and Colombia (Park et al., 2018). These suggest that sanctions alone may not be sufficient to ensure compliance within developing-country EPR programmes unless supported by strong enforcement structures and strong institutional capacity. Consequently, producer fee evasion indirectly strengthens the market dominance of informal actors and contributes to increasing environmental and health

pollution associated with crude WEEE dismantling practices. These findings reinforce the argument that robust economic instruments and effective enforcement mechanisms are critical to EPR effectiveness in Nigeria and, by extension, other developing-country contexts. This observation aligns with Ezeudu (2024) and Odeyingbo et al. (2025), who similarly argue that economic factors strongly influence EPR performance and overall effectiveness.

Furthermore, the increasing pollution associated with informal WEEE dismantling is likely linked to a policy design gap in which the complexity of informal sector operations was significantly underestimated. Within the policy design, informal actors were primarily positioned as last-mile collectors expected to channel WEEE from households to formal E-waste collectors. However, findings from practice reveal a much more complex system in which informal actors participate directly in WEEE collection, dismantling, trading, and export of recovered secondary materials to international markets. This suggests that the informal sector was not adequately accounted for within the EPR design. Similar concerns were raised by Woggsborg & Schröder (2019), who argued that informal sector realities are often insufficiently integrated into EPR systems in developing countries. Moreso, Portugaise et al. (2023) identified similar informal complexity in Japan and highlighted their implications for overall EPR effectiveness. In essence, the inadequate consideration of informal sector dynamics within the Nigerian EPR design is arguably a key barrier to achieving EPR effectiveness. This observation aligns with earlier studies which argue that weak integration of informal sector realities can undermine EPR performance and generate unintended outcomes (Ezeudu, 2024; OECD, 2016; Odeyingbo et al., 2025).

Additionally, findings suggest that Nigeria's EPR programme may itself be contributing indirectly to environmental and health externalities through the increased economic value attached to WEEE recovery. The growing value of WEEE has encouraged increased participation of both informal and formal actors within the recovery market. However, this increased participation, particularly by informal actors, has also intensified environmentally harmful dismantling practices and associated pollution. Even among formal actors, the establishment of recycling and processing facilities under the EPR programme has in some cases generated environmental and health concerns for surrounding communities. These consequences further compromise the achievement of overall EPR effectiveness. The persistence of these environmental and health externalities appears strongly linked to weak regulatory enforcement. Although the EPR policy requires environmental impact assessments and compliance with environmental safety standards before the establishment of WEEE recycling facilities, findings suggest that these requirements are not consistently enforced in practice.

A possible explanation for this regulatory weakness may be linked to the multi-level governance structure and overlapping institutional responsibilities within Nigeria's EPR system. These overlaps create opportunities for some actors to bypass regulatory requirements, thereby contributing to the environmental challenges observed. While Portugaise et al. (2023) argue that shared oversight responsibilities between PROs and local authorities can strengthen EPR implementation, this study suggest that such arrangements may function differently in contexts where regulatory capacity, transparency, and institutional accountability remain weak. In developing-country contexts such as Nigeria, overlapping responsibilities without strong coordination mechanisms may instead increase fragmentation, reduce accountability, and weaken enforcement effectiveness. Overall, although the Nigerian EPR programme established environmental and safety expectations within its policy design, it did not sufficiently anticipate the broader consequences of incentivising WEEE recovery without equally strengthening regulatory oversight, enforcement capacity, and mechanisms for managing informal sector participation.

This study also found product design to be an unattained outcome of the Nigerian EPR programme. Achieving this outcome requires direct influence on producers alongside effective feedback mechanisms capable of transmitting downstream information into product development processes. However, Nigeria's strong dependence on imported EEE and UEEE significantly limits the EPR programme's influence over the actors responsible for actual product design decisions. Although product design improvement is explicitly stated within the EPR policy, no tangible implementation mechanism currently exists to drive such change in practice. This absence of practical enforcement and incentive mechanisms considerably constrains the achievement of upstream product design outcomes. This observation aligns with Tojo (2004), who argues that enforcement mechanisms are necessary to support manufacturers' strategies towards improved upstream environmental performance, including product design improvements. Similarly, Compagnoni (2022), Ardi & Purwojatmiko (2019), and Gupta & Sahay (2015) contend that incentives are critical in encouraging producers to improve product design under EPR programme. Since most producers are not domiciled within Nigeria, they are also less likely to perceive direct benefits from improving products in response to Nigerian EPR requirements, thereby reducing motivation for upstream changes. This limitation reflects a wider challenge across many import-dependent EPR program.

In contrast to the Nigerian context, stronger product design outcomes observed in European contexts have largely been supported through complementary policy instruments beyond EPR itself, particularly the EU Ecodesign Directive, which promotes more sustainable product design (Pastor et al., 2014). This supports the argument by Mallick et al. (2024) that EPR effectiveness is often shaped by broader supporting policy frameworks rather than EPR mechanisms alone. As such, the Nigerian EPR currently lacks both the regulatory leverage and incentive structures necessary to meaningfully influence producer-driven product design improvements.

Another major issue that emerged from this study is the potential disruption of informal sector livelihoods by the EPR programme. Since economic and livelihood considerations were not strongly prioritised within the original motivations and design of Nigeria's EPR, implementation efforts aimed at achieving more environmentally sound WEEE management practices have simultaneously threatened the low-quality but important livelihood sources of many informal actors who depend on WEEE recovery for survival. Nonetheless, the EPR programme has also contributed to the creation of healthier and more environmentally sound jobs, particularly within formal E-waste collection and recycling activities. However, stakeholders perceived these emerging formal jobs to be far fewer than the much larger informal workforce potentially affected by the transition process. This creates a difficult trade-off within the EPR programme. While the programme promotes safer and more environmentally sound WEEE management, it also risks reducing the livelihoods of the informal sector. It has been found previously that the informal actors involvement in WEEE recovery is primarily driven by livelihood and survival needs rather than environmental protection motivations (SWTCH-Asia, 2025). Although previous studies argue that there is insufficient data to clearly determine the extent of job losses and job gains between formal and informal actors under EPR programmes (Henzler et al., 2018; Scheinberg et al., 2016), the issue remains a significant concern within the Nigerian context. Accordingly, this largely unanticipated trade-off is considered to be an unintended outcome of the EPR. This observation aligns with Woggsborg & Schröder, (2019), who argue that Nigerian EPR neglected social and livelihood considerations. Similarly, earlier studies argued that inadequate consideration of informal sector dynamics can undermine EPR performance and generate unintended consequences (Ezeudu, 2024; OECD, 2016; Odeyingbo et al., 2025).

In a nutshell, Nigeria's EPR was not sufficiently designed as an inclusive transition system capable of addressing the socio-economic realities of informal actors during both policy design and implementation. Consequently, this gap has contributed to a formalisation resistance by the informal actors. This finding aligns with previous studies which contend that weak integration of informal actors within EPR systems can lead to displacement, marginalisation, and livelihood threats for waste workers (Anantakrishnan, 2021; Cass Talbott, 2022; Portugaise et al., 2023; Woggsborg & Schröder, 2019).

Furthermore, Nigeria's EPR programme states an intention to promote circular economy principles in both design and implementation, however the mechanisms required to translate this intention into concrete outcomes remains insufficient. In practice, the most visible progress has been in reducing the importation of substandard EEE and WEEE. However, even products that meet import standards will eventually become EoL after use. This means that the circular economy objective of preventing WEEE generation has not been sufficiently demonstrated in practice, especially in relation to reducing unnecessary EEE consumption, extending product lifespan, and promoting reuse-oriented strategies. This finding is consistent with Leclerc & Badami. (2024), who also identified limited integration of circular economy objectives within EPR programmes. This limited progress is considerably linked to the narrow and outdated "5R" strategy reflected in Nigeria's EPR policy. While the policy explicitly states some circularity strategies, it does not sufficiently integrate others such as *refuse, rethink, refurbish, remanufacture, and repurpose*, as identified by Kirchherr et al. (2017). The absence of these strategies suggests a vague conceptualisation of circular economy within the EPR design. This is important because these strategies are necessary for achieving other anticipated EPR outcomes, including improved product design, and effective material loop closure. For instance, remanufacturing EEE from recovered WEEE requires a functional closed-loop system where materials recovered by recyclers are returned to producers for new production cycle. However, this system is largely absent in Nigeria's EPR.

Due to limited advanced recycling infrastructure, partially processed WEEE materials are often exported abroad for final recycling and possible reintegration into new products. This aligns with Forti et al. (2020), who observed similar patterns in many developing countries where limited domestic recycling capacity leads to the export of pre-processed WEEE fractions for further treatment internationally. However, dependence on external markets means that material loop closure is not fully controlled by Nigeria's EPR programme. It depends on external factors such as market conditions, technological capacity, regulatory systems, material value, and international demand for secondary materials. This finding is consistent with Richter and Koppejan (2016), who argued that increased collection and recycling do not automatically guarantee effective closed-loop circularity because material reintegration depends on broader market and value-chain conditions. Similarly, Ahlers et al. (2021) argue that EPR programmes often prioritise collection and recycling quantities while giving limited attention to recyclate quality and actual reintegration into new production systems. In addition, the study observed large-scale export of valuable secondary WEEE materials by informal actors, which remains largely unaccounted for under the EPR programme. Although these activities may contribute to some form of material recovery, they also raise environmental concerns because of the crude dismantling practices that often occur before export. This observation aligns with Gupta & Sahay (2015) and Pongajow et al. (2025), who argue that informal market dominance and weak formal recovery systems constrain circular material flows within developing-country EPR contexts. Overall, material loop closure under Nigeria's EPR remains considerably weak due to limited integration of circular economy principles, dependence on external markets for full recovery, and the continued dominance of informal material flows outside formal EPR accountability. This suggests that Nigeria's EPR has not yet moved beyond collection and recycling towards a more complete

circular economy model capable of preventing WEEE generation, extending product lifespans, and ensuring environmentally sound reintegration of recovered materials.

5.2 Reflections of Findings to the Study Approaches Used

The application of the TBE framework provided a structured and rigorous basis for evaluating Nigeria's EPR programme by enabling a systematic comparison between policy design (espoused theory) and actual implementation (theory-in-use). This was particularly useful in unpacking the interactions between context, mechanisms, and outcomes, thereby moving beyond a simple goal-attainment assessment to critically examine why certain outcomes were achieved or not achieved. In this regard, the framework proved useful in identifying misalignments between policy design assumptions and implementation realities. However, some aspects of EPR evaluation using the framework could be further strengthened. While the framework was effective in reconstructing the policy design logic and assessing implementation outcomes, it was less effective in examining the dynamic interactions and organizational relationships among multiple stakeholders involved in EPR implementation. Future studies could therefore integrate additional theoretical perspectives into the TBE framework to better examine inter-organizational interactions, coordination dynamics, and governance relationships between EPR actors, particularly in understanding implementation gaps across stakeholder groups.

Regarding the methodology, 13 stakeholder interviews conducted across 15 identified stakeholder groups provided rich insights into how the EPR programme operate in practice. Although interviewing one representative per stakeholder group was sufficient to address the study's objectives as it prioritised stakeholder representation over statistical generalisation. Nonetheless, additional perspectives may have emerged from including multiple participants within each group. Future research could improve on this limitation by engaging multiple representatives from each stakeholder group to provide a more comprehensive understanding of stakeholder perspectives. Additionally, quantitative data on annual WEEE collection and recycling supported triangulation of the interview findings. However, the data were limited to one recycling company and the PRO. In future studies, access to more aggregated national quantitative data on WEEE activities, or data from multiple recycling companies in cases where national data remain fragmented, would be useful in providing more insightful trends on WEEE collection recovery trajectories in Nigeria. Furthermore, the document analysis focused primarily on the three main policy documents upon which Nigeria's EPR programme was established. Although these documents were sufficient for the purpose of this study, future research could include additional related policies to provide deeper insights into the broader policy design logic underpinning the EPR framework. Lastly, field observations were useful in providing visual context and deeper understanding of EPR implementation realities. However, the observations were limited to only Lagos State. Future studies could explore other parts of the country to provide a more comparative understanding of geographical variations in EPR implementation.

6 Conclusion

This thesis set out to evaluate the effectiveness of Nigeria's EPR programme for WEEE, not only through its outcomes, but also by examining its underlying motivations, implementation mechanisms, and actual implementation practices in relation to the original policy design. This approach enabled the study to identify whether observed gaps emerged from weaknesses in policy design, implementation realities, or both. The study found Nigeria's EPR programme for WEEE to be partially effective. Although the programme demonstrates considerable theoretical coherence in policy design and some operational progress in implementation, significant gaps persist between intended policy expectations and actual implementation realities. Specifically, the study found observable improvements in upstream regulatory outcomes, particularly in the control of illegal WEEE and substandard EEE imports at formal entry points. There has also been some progress in stakeholder reporting systems and information-sharing mechanisms between actors.

However, other fundamental anticipated outcomes, including downstream infrastructure, environmentally sound waste management, effective material loop closure, and design-for-environment, have not been achieved. A central finding of this study is that implementation realities are strongly influenced by contextual factors insufficiently accounted for within the EPR design itself. Informal sector dominance, import dependency, fragmented regulatory coordination, weak financial compliance, market-driven WEEE material flows, the absence of strategic implementation mechanisms for achieving anticipated WEEE collection targets, and limited local capacity and markets for closed loop material recovery and recycling from downstream actors to producers, among other factors, continue to constrain the effectiveness of the Nigeria's EPR programme. Consequently, while the EPR programme is functionally operational to some extent, its implementation mechanisms remain insufficient to substantially achieve its intended outcomes.

In addition, unintended socio-economic and environmental health externalities emerged from implementation practices, further revealing important gaps between policy intentions and actual outcomes. These findings collectively respond to RQ1a, RQ1b, and RQ1c, and ultimately answer the main research question (RQ1) regarding the extent to which Nigeria's EPR programme is effective based on policy design and implementation practice. Overall, this study concludes that the effectiveness of an EPR programme, whether newly established or mature, cannot be understood solely through policy intentions or regulatory structures. Rather, effectiveness depends on the interaction between context, implementation mechanisms, and actual outcomes in practice.

6.1 Practical Implications and Recommendations for Non-Academic Audiences

The study found that producers fees, central to the success of Nigeria's EPR programme, are currently not effective in strengthening WEEE collection and recovery, supporting downstream recycling infrastructure, and reducing the competitive advantage of environmentally harmful informal WEEE management practices. While improving producer fee compliance remains fundamental to improving EPR effectiveness, this study further suggests that leveraging currently "missing" EPR fees associated with UEEE imported into Nigeria, whose producers are located abroad, may provide a more viable complementary financing mechanism to bridge the existing EPR financing deficit towards achieving improved effectiveness for the programme. Apoorva & Arpit (2023) estimated that between €340–€380

million in EPR fees linked to exported UEEE to Africa remain unremitted annually, despite the original purpose of such fees being to support environmentally sound EoL product management. This recommendation aligns with the global EPR approach referred to as Ultimate Producer Responsibility (UPR), proposed by Thapa et al. (2023). which emphasises extending producer responsibility across transboundary material flows. In practice, such a mechanism could involve negotiated bilateral or multilateral agreements that enable exporting-country PROs to transfer a proportion of EPR fees to Nigeria's designated PRO, EPRON, based on the estimated volume of UEEE exported into Nigeria (Sadiq, 2025). Moreso, operationalising such a mechanism would require strong accountability systems, harmonised reporting frameworks, transparent monitoring procedures, and diplomatic cooperation between exporting and importing countries to avoid governance conflicts, double counting of obligations, or financial mismanagement. This recommendation is particularly relevant for the Federal Ministry of Environment, NESREA, and EPRON, which play critical roles in enabling diplomatic engagement, ensuring regulatory compliance, strengthening data management systems, and operationalising the EPR programme in Nigeria.

Additionally, considering the persistent resistance by many informal actors to formally participate in Nigeria's EPR programme, as well as their non-compliance to environmental and health safety standards, this study recommends piloting a community-based monitoring initiative that strategically engages selected informal actors themselves to support the strengthening of environmental compliance within informal operational sites. Actors will be trained, remunerated and directly work under the supervision of NESREA. The rationale for this recommendation draws from existing literature recognising that informal actors possess deep knowledge of local recovery networks and material flows, which may provide valuable insights for strengthening environmental monitoring and regulatory oversight in contexts characterised by weak formal enforcement capacity (Bhaskar et al., 2024; Davis & Garb, 2015). The pilot initiative should, however, be implemented with clearly defined accountability structures, transparent oversight mechanisms, periodic monitoring, and safeguards against abuse of authority. Furthermore, the programme should be designed as a complementary inclusion mechanism rather than a purely punitive enforcement strategy, recognising that socioeconomic vulnerabilities and livelihood dependence significantly shape informal sector participation in WEEE management. Financing the initiative could be supported through blended mechanisms involving producer fees, government funding, environmental fines, and international development support. This approach aligns with SWITCH-Asia, (2025), who recommended strict environmental enforcement combined with inclusive transition measures as an important pathway for improving informal sector integration, as well as ongoing advocacy by the Global Alliance of Waste Pickers, (2021) for greater recognition of informal workers as critical stakeholders within EPR programmes.

Furthermore, the study found that mechanisms for advancing circular economy objectives remain insufficiently embedded within both the design and implementation of Nigeria's EPR programme. As such, this study recommends a strategic review of the EPR programme to more comprehensively integrate contemporary circular economy principles capable of reducing dependence on new and used EEE consumption, extending product lifespan, improving resource efficiency, and ultimately minimising WEEE generation.

6.2 Implications and recommendations for academic audiences

This study contributes to the existing body of knowledge empirically, methodologically, and theoretically. Empirically, it provides the first comprehensive evaluations of Nigeria's EPR programme effectiveness for WEEE by examining the policy design and implementation in practice. The findings contribute to a data-driven understanding of the EPR logic and

underlying enablers and challenges that determine potential effectiveness for Nigeria, and by extension, other developing countries with similar contexts.

Methodologically, the study demonstrates the applicability of a multi-method approach involving document analysis, stakeholder interviews, secondary quantitative data, and field observations for evaluating EPR programmes in Nigeria. In addition, the inclusion of multiple stakeholder groups across the EPR value chain provided deeper insights and opportunities to comparatively evaluate the internal implementation mechanisms upon which EPR outcomes and overall effectiveness depend. This further demonstrates the relevance and validity of such this study approach for evaluating EPR programmes in other developing-country contexts with similar conditions to Nigeria.

Theoretically, the study extends the practical application of the TBE framework by incorporating *unintended outcomes*. This additional component captures outcomes that emerged during implementation and influences expected programme outcomes either positively or negatively. Furthermore, the study contributes to ongoing scholarly discussions on the applicability of EPR expectations across OECD and developing-country contexts. A strong alignment between Nigeria's EPR policy design and theoretical expectations commonly reflected in OECD-oriented EPR literature. However, this alignment does not necessarily translate into effective implementation or realization of intended outcomes when contextual realities are insufficiently considered. The study therefore highlights the importance of contextualizing EPR programmes based on the unique socio-economic, institutional, and market conditions in places where they operate.

Future research could strengthen the findings from this study by examining whether similar unintended outcomes emerge across other developing countries with comparable EPR structures. Additionally, further studies should explore mechanisms for influencing environmentally conscious product design within import-dependent economies where direct producer engagement remains limited. Finally, there is a need for deeper social and anthropological analyses of informal sector operations in order to inform more realistic, socially responsive, and cohesive integration strategies within EPR programme.

6.3 Personal Closing Reflection

As this thesis comes to an end, it leaves behind a deeper reflection on the future of our environment and human health in a world increasing dependence on electronic devices. The consequences of poorly managed associated electronic waste raise some important questions: What kind of environmental future are we creating through current systems of production, consumption, and disposal? What legacy do we wish to leave behind for our children, siblings, and future generations, pollution or prosperity? Answering these questions depends not only on the existence of effective policies, but also on the willingness of societies, institutions, and industries to prioritise long-term environmental sustainability and human well-being over short-term economic gains.

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Appendix A Overview of Data Collection

Data Collection Method	Date of Data Collection	Main RQ it helps to answer
Document Analysis (3 Policy Documents)	1 st March -30 th March 2026	RQ 1a & RQ 1
Semi-Structured Interviews (13 stakeholder group)	1 st April -23 rd April 2026	RQ 1b & RQ 1
Field observation (4 location visited)	11 th April 2026	RQ 1b & RQ 1
Quantitative Data Gathering (E-waste recycling rates for recycling companies)	13 th April -17 th April 2026	RQ 1b & RQ 1

Appendix B: Literature Review Mapping Table

Domain	Sources from the Literature
Principles and design of EPR	(Lindhqvist, 2000); (OECD, 2016); (Mallick et al. 2024);(Compagnoni 2022); (Massarutto 2014); (Gupt and Sahay 2015); (Walls 2006); (Gupt and Sahay 2015); (Wang et al., 2017); (Huisman et al., 2008); (Kaffine & O'Reilly, 2013); (OECD, 2024); (Deutsche Gesellschaft für Internationale Zusammenarbeit, 2022); (NESREA, 2022)
Existing practices of EPR globally	(Mallick et al., 2024); (Compagnoni, 2022); (Massarutto 2014); (Gupt and Sahay 2015); (Cai and Choi, 2021); (Niza et al. 2014); (Park et al. 2018); (Portugaise et al., 2023); (Lindhqvist, 2000); (OECD 2016); (Sienkiewicz et al. 2012); (Kalimo et al. 2015); (Leclerc and Badami 2024); (Micheaux and Aggeri 2021); (Ahlers et al. 2021); (Dimitropoulos et al. 2021); (Börner and Hegger, 2018); (Manomaivibool 2008); (Richter and Koppejan 2016); (Tojo 2004); (Lodhia et al. 2017); (Atasu 2019); (Gui 2020)
Existing practices of EPR in developing countries	(Ezeudu 2024); (OECD 2016); (Odeyingbo et al. 2025); (Pongajow et al., 2025); (Cass Talbott, 2022); (Woggsborg and Schröder, 2019); (Ribeiro and Kruglianskas, 2020); (Ardi and Purwojatmiko, 2019); (Faibil et al., 2023); (Tran et al., 2021); (Odeyingbo et al., 2017); (Gupt & Sahay, 2015); (Mallick et al., 2024); (Compagnoni, 2022); Niza et al., 2014); (Ahlers et al., 2021); (Dimitropoulos et al., 2021); (Cai and Choi, 2021); (Thukral and Singh 2023); (Gaur et al. 2025); (Nnorom & Odeyingbo, 2020); (Zheng et al. 2017)
Conceptual framework development	(Manomaivibool, 2009); (Tojo, 2004); (Mickwitz, 2003); (Manomaivibool, 2011); gaps (Richter and Koppejan, 2016); (Friedman 2001); (Hansen and Vedung 2010); (Weiss, 1997); (Coryn et al., 2011); (EEA, 2016); (Manomaivibool; 2008)

Appendix C: Reconstructed EPR Design Logic

	Context	Implementation			Outcomes						
S/N	Problem	Stakeholders	Responsibility	Outputs	Upstream changes	Development of downstream infrastructure	Establishment of feedback mechanisms between upstream and downstream actors	Design for environment	Closing material loops	Improved waste management practices	Uncategorized objective
1	The generation of harmful pollution from the production of EEE, as well as e-waste across its lifecycle to end-of-life, poses significant risks to both the environment and human health.	Producers	-Register with EPRON, renewal, and pay annual levies to EPRON for WEEE management -Comply to regulations and laws -Provide quarterly information on EEE products e.g market share via black box -Provide finances and establish approved WEEE collection, handling, transportation and treatment facilities (individual or collective) - Design products to reduce lifecycle environmental impacts - Ensure product quality and standards -Provide shipping details of EEE products including hazardous component, damage, etc. -Importers: obtain SONCAP/MA NCAP, environmental import clearance documents - Importers: Functionality	-Increased finances for WEEE management - Fulfilment of EPR regulatory requirements - Availability of reliable and up-to-date data on EEE placed on the market -Operational and adequately financed WEEE management infrastructure established - Adoption of eco-design features in EEE products - EEE products are in compliance with established quality and technical standards -Availability of detailed and accurate information on EEE shipments and product composition - Verified compliance of imported EEE with national quality and environmental standards -Verification of functionality of imported used EEE prior to market entry -Availability of accurate and up-to-date records on EPR compliance for transparency	-Increased finances for WEEE management - Fulfilment of EPR regulatory requirements - Availability of reliable and up-to-date data on EEE placed on the market -Availability of detailed and accurate information on EEE shipments and product composition - Verified compliance of imported EEE with national quality and environmental standards -Verification of functionality of imported used EEE prior to market entry -Availability of accurate and up-to-date records on EPR compliance for transparency			-Adoption of eco-design features in EEE product -EEE products are in compliance with established quality and technical standards			

			test of imported UEEE -Maintain records and report	-Verification of functionality of imported used EEE prior to market entry -Availability of accurate and up-to-date records on EPR compliance for transparency							
2		Producer Responsibility Organisation s - EPRON	-Register stakeholders -Collect fees/levies based on agreed methodology by stakeholders from producers -Setup, manage data base (black box), and develop operational manual -Periodic auditing of all actors -Pay collectors and recyclers -Fundraising to support R&D and awareness -Submit quarterly and annual report to NESREA -Provide advisory services to stakeholders -Gender mainstreaming	-Established registry of stakeholders participating in the EPR system -Established funding mechanism with contributions from obligated producers -Timely submission of periodic reports to NESREA - Increased access to technical and regulatory guidance for stakeholders -Established and operational data management system (black box) and standardised operational guidelines -Documented audit reports on stakeholder performance and compliance status -Incentive-based payments for e-waste collection and treatment activities - Secured funding to support innovation and public awareness initiatives -Timely submission of periodic reports to NESREA - Increased access to	-Established registry of stakeholders participating in the EPR system -Established funding mechanism with contributions from obligated producers -Timely submission of periodic reports to NESREA - Increased access to technical and regulatory guidance for stakeholders	-Incentive-based payments for e-waste collection and treatment activities -Established funding mechanism with contributions from obligated producers -Incentive-based payments for e-waste collection and treatment activities	-Established and operational data management system (black box) and standardised operational guidelines -Established and operational data management system (black box) and standardised operational guidelines -Documented audit reports on stakeholder performance and compliance status	- Secured funding to support innovation and public awareness initiatives	- Increased access to technical and regulatory guidance for stakeholders - Secured funding to support innovation and public awareness initiatives	-Incentive-based payments for e-waste collection and treatment activities - Secured funding to support innovation and public awareness initiatives	- Integration of gender considerations into EPR policies, programmes, and activities

				technical and regulatory guidance for stakeholders - Integration of gender considerations into EPR policies, programmes, and activities							
3		Recyclers	-Conduct EIA for recycling facilities -Submit environmental audit report every 3 years -Maintain health standards -Keep records of WEEE received and recycled -Use of best management practices for handling EEE -Partner with collectors - Provide information to Producers that can be used to design or label products to enhance recovery	- Increased environmental compliance clearance for recycling facilities based on EIA findings -Availability of triennial environmental audit reports for regulatory review -Availability of safe working conditions in across WEEE operations. - Documented tracking of WEEE collection and recycling volumes - Approved handling and management procedures for EEE - Formalised collaboration agreements with e-waste collectors -Availability of information to support design-for-recycling and product labelling		- Increased environmental compliance clearance for recycling facilities based on EIA findings -Availability of safe working conditions in across WEEE operations. - Approved handling and management procedures for EEE	-Documented tracking of WEEE collection and recycling volumes -Availability of information to support design-for-recycling and product labelling	-Availability of information to support design-for-recycling and product labelling	-Availability of information to support design-for-recycling and product labelling - Documented tracking of WEEE collection and recycling volumes - Approved handling and management procedures for EEE	-Availability of triennial environmental audit reports for regulatory review -Availability of safe working conditions in across WEEE operations. - Approved handling and management procedures for EEE - Formalised collaboration agreements with e-waste collectors	
4		Civil Society Organizations (CSO)	-Public awareness	-Increased dissemination of information on e-waste and EPR to the public	-Enhanced knowledge of community-specific challenges among EPR actors					-Increased dissemination of information on e-waste and EPR to the public -Organised	

			-Sensitize policy makers and PRO on local needs and priorities -Capacity building -Resource mobilization to support EPR policy and plans	-Enhanced knowledge of community-specific challenges among EPR actors -Organised capacity development initiatives for effective EPR participation -Mobilised financial and material resources to support EPR implementation					- capacity development initiatives for effective EPR participation -Mobilised financial and material resources to support EPR implementation	
5		Informal collectors	-Register with a collection center - Use of appropriate PPE/transport system -Receive payment from collectors and pay consumers for e-waste	- Documented details of informal collectors with collection centres -Improved adherence to safe handling and transport procedures -Active incentive payment for e-waste collection		-Documented details of informal collectors with collection centres -Improved adherence to safe handling and transport procedures			-Improved adherence to safe handling and transport procedures -Active incentive payment for e-waste collection	
6		E-waste collectors	-Register officially -Organize and provide incentives for informal collector's formalization -Provide information to consumers on collection facilities -Keep records of e-waste collected -Ensure safe transport of e-	-Formally registered according to EPR -Organised initiatives promoting formal participation of informal collectors -Increased availability of information on collection points and services for consumers -Availability of accurate records on quantities of e-waste collected -Controlled movement		-Formally registered according to EPR -Organised initiatives promoting formal participation of informal collectors -Increased availability of information on collection points and services for consumers -Controlled movement and storage of e-waste within authorised facilities	-Availability of accurate records on quantities of e-waste collected -Increased availability of information on collection points and services for consumers	Provide information to producers useful for design to facilitate collection and recovery	-Organised initiatives promoting formal participation of informal collectors -Controlled movement and storage of e-waste within authorised facilities	

			waste and storage in approved facility -Provide information to producers useful for design to facilitate collection and recovery	and storage of e-waste within authorised facilities -Availability of feedback data from downstream actors to inform product design							
7		Consumers	-Separate E-waste and subscribe to pick up services -Report poor quality to FCCPC and improper disposal -Release of E-waste to registered collectors	-Availability of sorted e-waste collected regularly. - Documented feedback of poor quality EEE -Availability of e-waste handed over to authorised collection channels	-Documented feedback of poor quality EEE	-Availability of sorted e-waste collected regularly. -Availability of e-waste handed over to authorised collection channels				-Availability of sorted e-waste collected regularly. -Availability of sorted e-waste collected regularly.	
8		National Environmental Standards and Regulations Enforcement Agency (NESREA),	-Annual inspection programme of enforcement bodies and targeted inspection -Issuance of permits -Issue guidelines on EPR -Monitoring and performance evaluation of stakeholders including EPRON -Public education on EPR, health impacts, etc -Create platform for data reporting on performance and report of e-waste disposal violation -Screen, approve and annually audit 3rd party to manage black box system -Publish impact data on quarterly	-Updated record of stakeholder compliance. -Increased number of stakeholders with permits. -Published procedures and guiding for EPR implementation - Documented performance assessment of EPRON and other stakeholders' activities -Increased availability of educational materials on health and environmental risks of e-waste -Centralised platform for monitoring stakeholder performance	-Increased number of stakeholders with permits. -Published procedures and guiding for EPR implementation	-Updated record of stakeholder compliance.	-Documented performance assessment of EPRON and other stakeholders' activities -Centralised platform for monitoring stakeholder performance and reporting non-compliance -Vetted and authorised third-party management of the data (black box) system -Accessible public reporting of EPR performance and impacts			-Updated record of stakeholder compliance. -Documented performance assessment of EPRON and other stakeholders' activities -Increased availability of educational materials on health and environmental risks of e-waste	

			NESREA news and website	and reporting non-compliance							
				-Vetted and authorised third-party management of the data (black box) system							
				-Accessible public reporting of EPR performance and impacts							
9		Federal Ministry of Environment	Establish policies and provide political and diplomatic backings to guide regulatory and enforcements functions	-Formal policy instruments and political mandate guiding regulatory activities	Establish policies and provide political and diplomatic backing to guide regulatory and enforcement functions					Establish policies and provide political and diplomatic backing to guide regulatory and enforcement functions	
10		Standards Organisation of Nigeria (SON)	-Ensure eco-design measures for EEE that eliminate hazardous materials and facilitate re-use and treatment of e-waste -Quality standard compliance -Data sharing on market information, and compliance	-More EEE products with reduced hazardous content and improved product design -Availability of high quality EEE in the market -Accessible information on EEE market information and compliance	-Availability of high quality EEE in the market -Accessible information on EEE market information and compliance		-Accessible information on EEE market information and compliance	-More EEE products with reduced hazardous content and improved product design			
11		Nigeria Customs Service (NCS)	-Inform importers on EEE obligations -Ensure registration compliance and share EEE importers list to EPRON and NESREA -Data sharing on inflow and outflows of EEE -Inspect, control, and report illegal	-Awareness of importers regarding EEE compliance requirements - Documented compliance of importers and transmission of data to EPRON and NESREA Availability of data on inflows and outflows of EEE shared among relevant stakeholders -Reduction and sanctioning of illegally shipment of	-Awareness of importers regarding EEE compliance requirements -Documented compliance of importers and transmission of data to EPRON and NESREA		Availability of data on inflows and outflows of EEE shared among relevant stakeholders -Reduction and sanctioning of illegally shipment of WEEE				

			shipment	WEEE							
12		Nigeria Shippers Council (NSC)	-Provide enabling environment for repatriation of illegal shipment -Data sharing	-Established mechanisms and support systems for the repatriation of illegal shipments -Available data on illegal shipment and repatriation shared among relevant stakeholders						-Established mechanisms and support systems for the repatriation of illegal shipments -Available data on illegal shipment and repatriation shared among relevant stakeholders	
13		State Governments	-E-waste sorting initiatives -By-laws alignment with National E-waste regulations -Establish and register e-waste collection and treatment facilities -Formalization of informal collectors	-Availability of organised e-waste sorting activities. -Harmonised state-level regulations consistent with national EPR policies -Availability of approved collection and treatment facilities -Documented enrolment and inclusion of informal collectors	-Harmonised state-level regulations consistent with national EPR policies	-Availability of approved collection and treatment facilities -Availability of organised e-waste sorting activities. -Documented enrolment and inclusion of informal collectors				-Availability of organised e-waste sorting activities -Documented enrolment and inclusion of informal collectors -Availability of approved collection and treatment facilities	
14		Federal Ministry of Labour and Employment	-Ensure compliance to occupational safety and health standards -Enforce laws on child labour and other labour related regulations. -Ensure gender equality in e-waste sector.	-Availability of workplaces operating in line with OSH requirements -Workplaces adopt all labour laws and regulations during in e-waste operations -Availability of gender-inclusive frameworks within the e-waste sector		-Availability of workplaces operating in line with OSH requirements				-Availability of workplaces operating in line with OSH requirements	-Workplaces adopt all labour laws and regulations during in e-waste operations -Availability of gender-inclusive frameworks within the e-waste sector
15		Federal Competition and Consumer Protection Commission (FCCPC)	-Extend complains -Awareness on take-back	- Availability of accessible consumer complaint and redress mechanisms -Increased availability of	- Availability of accessible consumer complaint and redress mechanisms		- Availability of accessible consumer complaint and redress mechanisms			-Increased availability of information on consumer take-back options	

				information on consumer take-back options							
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Source: (Government of Nigeria, 2022; NESREA, 2014; NESREA, 2022)

Appendix D: Interview Consent Form

Aliyu Sadiq | Extended Producer Responsibility for WEEE in Nigeria: A Theory-Based Evaluation

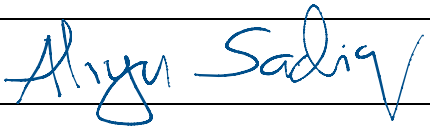
CONSENT FORM

This form is to ensure that you have been given information about the Extended Producer Responsibility for WEEE in Nigeria and to give you an opportunity to confirm that you are willing to take part in this research. I invite you to first refer to the Information Sheet (pages 2-3) to familiarise yourself with the details of the project. Once you have done this, please indicate which of the following statements apply to you (a checked box indicates consent):

☐	As a research participant, I am aware of my right to withdraw participation at any time
☐	I give my consent that the interview can be recorded in writing , translated and analysed
☐	I give my consent that the interview can be audio- or video-recorded , transcribed using a third party speech-to-text transcription application, translated (if necessary) and analysed
☐	I give my consent to be identified by my organization
☐	I understand that the results of the research will be presented so that no information can be traced to me personally / I have been informed that pseudonymity of participants will be ensured
☐	I give my consent that a record of my interview can be safely stored for future reference
☐	I have been informed who will benefit from the participation
☐	I have been informed how data will be either destroyed or reused at the end of the research
☐	I have been informed of the secondary use of data

Note: Your participation is voluntary. As an interviewee, you do not have to answer all the questions that are asked; you reserve the right to refuse or cease participation in the interview process without stating your reason and may request to keep certain materials confidential. In addition, you have the right to review any summary or synthesis of the interview at any time up until the data is actually published. There will be no monetary payment for participating in the research, but you will have contributed to a research project that generally aims to evaluate EPR for EEE in Nigeria. Please, sign below to confirm your consent – digital signatures are possible:

	Participant(s)	Researcher(s)
Name(s)		Aliyu Umar Sadiq
Organization		Lund University

Signature		
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INFORMATION SHEET

Description of the Research Programme

This thesis research is part of the completion requirements for Erasmus Mundus Joint Masters in Environmental Sciences, Policy and Management (MESPOM) at Lund University's International Institute for Industrial Environmental Economics (IIIIEE). The research is conducted independently and focuses on evaluating the effectiveness of Nigeria's Extended Producer Responsibility (EPR) programme for Waste Electrical and Electronic Equipment (WEEE).

WEEE has become one of the fastest-growing waste streams globally, posing significant environmental and public health concerns. Nigeria established an EPR programme to tackle this challenge yet the extend of progress remains unknown. This study seeks to evaluate the effectiveness of Nigeria's EPR programme and contribute to improved understanding of EPR implementation challenges in Nigeria, while also providing practical recommendations for strengthening environmentally sound WEEE management. In relation to your expertise and experience within the EPR and WEEE management, your participation and insights will provide valuable contributions to this research.

Data Management

Information about GDPR implementation at Lund University can be found at: lunduniversity.lu.se/gdpr. All data collected during this research will be treated confidentially and securely stored on password-protected devices used solely for research purposes. Interview responses will be anonymised, and unique identifiers will be assigned to participants to ensure confidentiality and privacy. Participation in this research is entirely voluntary, and participants may withdraw from the study at any stage without any consequences. The collected data will only be retained for the duration necessary to complete the thesis research and related academic requirements. Participants also retain the right to request access to their data, request corrections, restrict processing, or request deletion of their information where applicable. Please note that the final thesis will be publicly accessible through the university repository as part of standard academic dissemination and transparency practices.

For any enquiries regarding this research, please contact:

Aliyu Sadiq

Researcher,

The International Institute for Industrial Environmental Economics, Lund University

Email: aliyu.sadiq@mespom.eu

Appendix E: Interview Protocol

Purpose

- To understand stakeholder's perceptions regarding the EPR programme for WEEE implementation in Nigeria

Introduction

- Greetings and consent
- Briefly introduce my research and how their experiences will be useful in the study

Key Questions:

Context (Problem Situation)

1. How would you describe the current situation of electronic waste management in Nigeria?
2. In your understanding, what are the key problems related to electronic products that the EPR programme is focussed on addressing?
3. Based on your experience, are there other important issues related to electronics and E-waste that you believe are not adequately addressed within the current EPR programme?

Implementation (Mechanisms / Cause–Effect Processes)

4. What role does your organisation or group play within the EPR programme?
5. How is your organisation fulfilling its responsibilities in addressing electronic waste under the EPR programme?
6. Does your organisation have the necessary resources and capacity required to fulfil its mandate? If not, what are the main limitations?
7. Have there been any notable progress or achievements regarding the execution of your assigned responsibilities? If yes, please describe them.
8. What are the **main challenges** your organisation faces in implementing its responsibilities within the EPR programme?

Outcomes (Immediate Outcomes)

9. In general, what is the situation of the electronic waste management since the introduction of the EPR programme? (Open ended)
10. Has the EPR programme influenced electronics producers or importers to adopt measures that minimise end-of-life waste from their products? If yes, please explain how. (*Upstream changes*)
11. Has there been any improvement in infrastructure for the collection, transportation, or recycling of electronic waste influenced by the EPR programme? If yes, please explain. (*Downstream infrastructure*)
12. Have you observed any improvements in e-waste collection and recycling practices since the introduction of the EPR programme? (*Downstream infrastructure*)
13. Is there any communication or feedback mechanism between your organisation and other EPR stakeholders regarding improvements in product design upstream and waste management downstream? Please describe. (*Feedback mechanisms*)

14. Are there any challenges that limit effective communication or collaboration between EPR stakeholders?

Intermediate Outcomes

15. Has the EPR programme in Nigeria influenced producers to consider environmental aspects in the design of electronic products, such as durability, repairability, or recyclability? If yes, please explain how. (*Design for Environment*)
16. Are there currently any processes or initiatives for environmentally sound recovery of materials from electronic waste under the EPR programme? (*Closing material loops*)
17. What challenges exist that limit effective recovery and reuse of materials from electronic waste? (*Closing material loops*)
18. Have you observed improvements in electronic waste collection and recycling systems that can be linked to the EPR programme? (*Improved waste management practices*)
19. From your perspective, does the EPR programme sufficiently address electronic waste from imported used electronics? What challenges exist in managing this issue? (*Improved waste management practices*)

Unintended Outcomes

20. Have you observed any unintended effects of the EPR programme, either positive or negative? Please explain.

Appendix F: Participants and Interviews Information

Code	Name of Organization	Stakeholder Group	Date	Interview format	Duration	Relevance
NESREA	National Environmental Standards and Regulatory Enforcement Agency	Government Regulator	13 th April 2026	Physical	35 minutes	The participant is a senior-ranking officer involved in the coordination of the EPR programme within the organisation.
FMEEnv	Federal Ministry of Environment	Government	31 st March 2026	Online	48 minutes	The participant is a senior-ranking officer involved in EPR programme policy coordination within the Ministry
SON	Standards Organization of Nigeria	Government Regulator	13 th April 2026	Physical	24 minutes	The participant is a senior-ranking officer involved in EPR related activities programme within the organisation.
FCCPC	Federal Competition and Consumer Protection Commission	Government Regulator	2 nd April 2026	Online	33 minutes	The participant is an officer with experience working in the organization
Nigerian Customs	Nigerian Customs Service	Other Government	1 st April 2026	Online	49 minutes	The participant is a senior-ranking officer involved in the implementation and coordination of the EPR programme within the organisation.
LASEPA	Lagos State Environmental Protection Agency	State Government regulator	1 st April 2026	Online	41 minutes	The participant is a senior-ranking officer involved in the implementation and coordination of the EPR programme

						at the State level
EPRON	E-waste Producer Responsibility Organization of Nigeria	Producer Responsibility Organization (PRO)	10 th April 2026	Online	45 minutes	The participant is a senior-ranking officer involved in the implementation and coordination of the EPR programme
Libra Circle	Libra Circle	Producer/Importer	13 th April 26	Online	30 minutes	The participant is a staff involved in ensuring compliance with the EPR programme in the organization.
E-Terra	E-Terra Technologies	Formal recycler	9 th April 2026	Physical	35 minutes	The participant is a senior staff involved in the technical aspects of E-waste recycling and compliance with the EPR in the organization
W3 Ecofriendly Ltd	W3 Ecofriendly Limited	E-waste Collector	11 th April 2026	Physical	72 minutes	The participant is a senior staff involved in the E-waste collection and compliance with the EPR programme in the organization
Informal Collector	Informal Collectors	Informal Collectors	11 th April 2026	Physical	31 minutes	The participant is a long-time informal collector of WEEE
WAPAN	Waste Pickers Association of Nigeria	Civil Society Organization (CSO)	2 nd April 2026	Online	52 minutes	The participant is a senior-ranking officer involved in the implementation and coordination of the EPR programme within the organization
Consumer	Consumers	Consumers	11 th April 2026	Physical	17 minutes	The participant is a consumer of EEE

Appendix G: NVivo Code Book

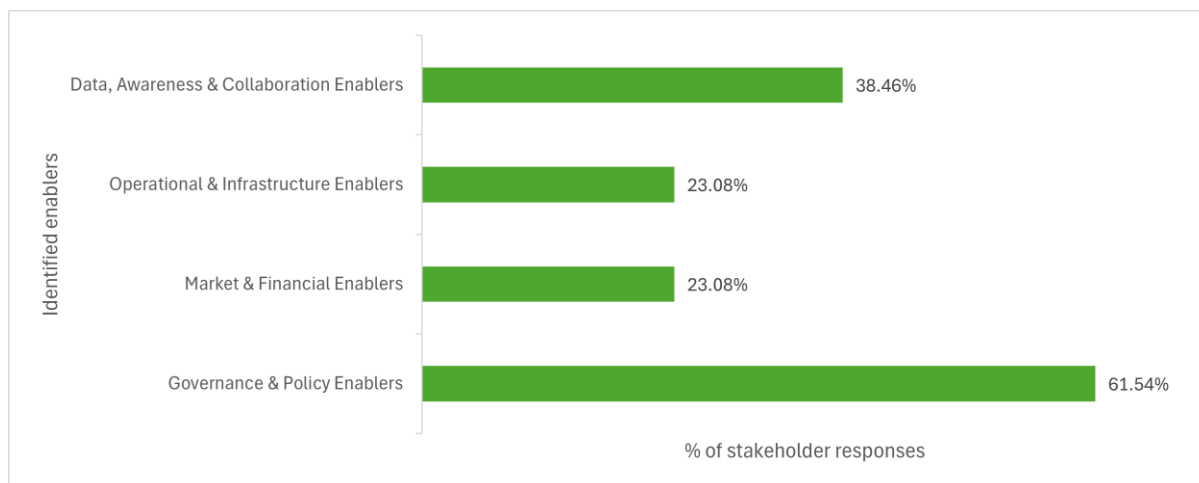
First Cycle Coding	Second Cycle Coding	Descriptors (Example)	Files	References
Context			12	48
	Circular economy transition	<i>"To ensure that we move... from the linear economy to the circular economy,"</i>	2	4
	Existing WEEE policy gaps	<i>"I think this is intended to also help the policymakers and the government to create an enforcement, more or less, on the activities and the managements of e-waste in Nigeria"</i>	3	4
	Heavy import of WEEE	<i>"e-waste mostly, or about 99% of it, is imported"</i>	4	8
	Improvement of informal WEEE actors	<i>"EPR is set up to ensure that the business of e-waste management is done properly and that the waste pickers, who are the foot soldiers, are properly encouraged and incentivised"</i>	3	4
	Livelihood and job creation	<i>"E waste can create job opportunities for people who are jobless especially in the aspect of recycling of the e-waste"</i>	1	2
	Producer responsibility for end-of-life WEEE	<i>"Whoever brings these products into the market should be responsible for the environmental management of those products"</i>	4	7
	Unsafe and poor WEEE management	<i>"EPR is set up to ensure that the business of e-waste management is done properly and that the waste pickers, who are the foot soldiers, are properly encouraged and incentivised"</i>	4	6
Implementation			13	112
	Collection, Recovery and Material Processing	<i>"We gather them and sell to e-waste collectors... within 2–4 weeks, they are sold to the larger companies"</i>	7	18
	Awareness, Education and	<i>"We sensitise communities and business places on how to properly dispose of e-waste, because if it is</i>	6	16

	Capacity Building	<i>wrongly disposed, it exposes the populace to very hazardous environments, affecting human health, as well as the soil and water”</i>		
	Data Management, Monitoring and Reporting	<i>“Progress in terms of developing... structure for the registrations,”</i>	4	10
	Financing Mechanism and Economic Responsibility	<i>“EPRON has also helped the country to benefit from different funding opportunities... using, for instance, the GEF funded projects... it only happened because there was an EPRON system that was in place”</i>	1	2
	Import Control and Transboundary WEEE Flows	<i>“We had some importations... which we stopped... and the one from Germany was repatriated back at the cost of the shipper.”</i>	4	9
	Informal Sector Integration and Support	<i>“They were given equipment... ID cards... so they could be recognised officially and not harassed”</i>	5	6
	Product Standards, Quality Control and Social Compliance	<i>“... Certified... before such products come into the country... to ensure that... it is fit for the purpose”</i>	5	17
	Regulatory Enforcement and Compliance	<i>“Government is... collecting water samples... soil samples... and if... they are not complying, then we close down [the facility].”</i>	7	19
	Enablers	<i>“It only happened because there was an EPRON system that was in place”</i>	12	39
	Barriers	<i>“Misclassification is part of it”</i>	13	185
Immediate Outcomes				
Upstream changes		<i>“We're achieving at the point of entry, maybe not as much as we desire, but at least there's a lot of improvement needed.”</i>	10	16
Feedback mechanism amongst actors		<i>“Create a harmonised system for... generating e-waste report”</i>	6	14

Improvement in downstream infrastructure		<i>"I've not seen them increase the capacity... the same machines... are still the same ones"</i>	8	23
Intermediate Outcomes				
Design for Environment		<i>"All those design changes... [are] driven by... international standards... it can't be us"</i>	11	20
Closing material loop		<i>"there's definitely improvement in trying to close material loops... [but] the efficiency of it, I'm not very sure"</i>	2	4
Improved waste management		<i>"there's a lot of imported electronics... being seized and brought here... those things were being destroyed in our facility,"</i>	6	20
Unintended Outcomes			11	32
	Environmental and health externalities	<i>"Heavy metal is also entering into the food chain... leading to exposure of humans... and the agricultural environment"</i>	5	10
	Socio-economic impacts	<i>"We registered everybody... under Social Insurance... even in periods that we did not make any profit... even contract staff enjoy these benefits"</i>	5	8

Appendix H: Visualization of Interview Results: Barriers and Enablers to Nigeria's EPR

Percentage of interviewed stakeholders (n=13) who responded to specific enablers under the EPR



Percentage of interviewed stakeholders (n=13) who responded to specific barriers under the EPR

