

Meeting E-Waste Targets in Italy

An evaluation of the national WEEE management system

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Abstract

As volumes of e-waste (WEEE) are increasing worldwide, the environmental and health impacts caused by this waste stream are leading to rising concern over how it is managed and disposed of. In the European Union this has been addressed by the WEEE Directive, a policy requiring all Member States to have a system for managing e-waste. The revised policy (Directive 2012/19/EU) sets increasingly ambitious targets for countries to achieve. Within this context, this thesis evaluates the Italian WEEE management system with particular focus on how the policy is transposed, how it is received by the stakeholders and whether or not the intended outcomes are actually being reached. The WEEE Directive is transposed differently across all Member States and this leaves questions about how national systems perform and where their weaknesses lie. Using a set of complementary analytical methods, this research evaluates the performance of the Italian system with the use of intervention theory combined with three performance criteria: effectiveness, legitimacy and transparency. The findings of this thesis highlight the areas in which Italian WEEE management is facing challenges and where it is succeeding. On the basis of the findings, recommendations are provided to enhance the system performance in light of the increasingly stringent EU targets.

Keywords: Extended Producer Responsibility, E-waste, WEEE Directive, Italy, WEEE management system, policy evaluation, intervention theory

Executive Summary

As electrical and electronic waste (e-waste) is rising in quantities worldwide, it is also rising within the agendas of policymakers. The increase in generation of this waste stream can be linked to rising consumption and rapidly changing technologies. E-waste is very different compared to traditional municipal solid waste (MSW) streams as the products contain hazardous substances harmful to human health and the environment, contain valuable raw materials, come in all sizes, and are not disposed of regularly due to their relatively long life-span. These characteristics make the management of WEEE very interesting but also very complex and challenging.

In 2002, the WEEE Directive (Directive 2002/96/EC) was introduced by the European Union (EU), implementing the extended producer responsibility (EPR) principle whereby producers are given the responsibility for managing the waste resulting from their products. The Directive has been updated and new targets have been set under the recast Directive introduced in 2012 (Directive 2012/19/EU). This study focuses on the implementation of the WEEE Directive in Italy. The national transposition and the waste management system for WEEE are assessed in detail.

In general, Italy's MSW management has been showing overall positive trends in separate collection and infrastructure development over the last decades. In terms of e-waste, currently Italy is well-placed amongst other Member States in terms of collection rates. However, the question is how the policy is transposed, how it is received by the stakeholders and whether or not the intended outcomes are actually being reached. The challenge now is to take the next big step and achieve the higher collection targets set under the WEEE Directive recast by enhancing the performance of the system.

Background and problem definition

The **aim** of this thesis is to highlight the areas in which the Italian national WEEE management system is facing challenges and where it is succeeding, and to suggest areas of potential improvement. Although the WEEE Directive has three main objectives (improved waste management, increased eco-design and closing material loops), this study focuses solely on assessing the operational aspects of the WEEE management system in Italy, hence the improved waste management practices. The **research questions** that are developed to guide this study are the following:

RQ1: What are the roles and responsibilities of the stakeholders involved in the national WEEE management system?

RQ2: How is the national system operating with respect to the legislative requirements?

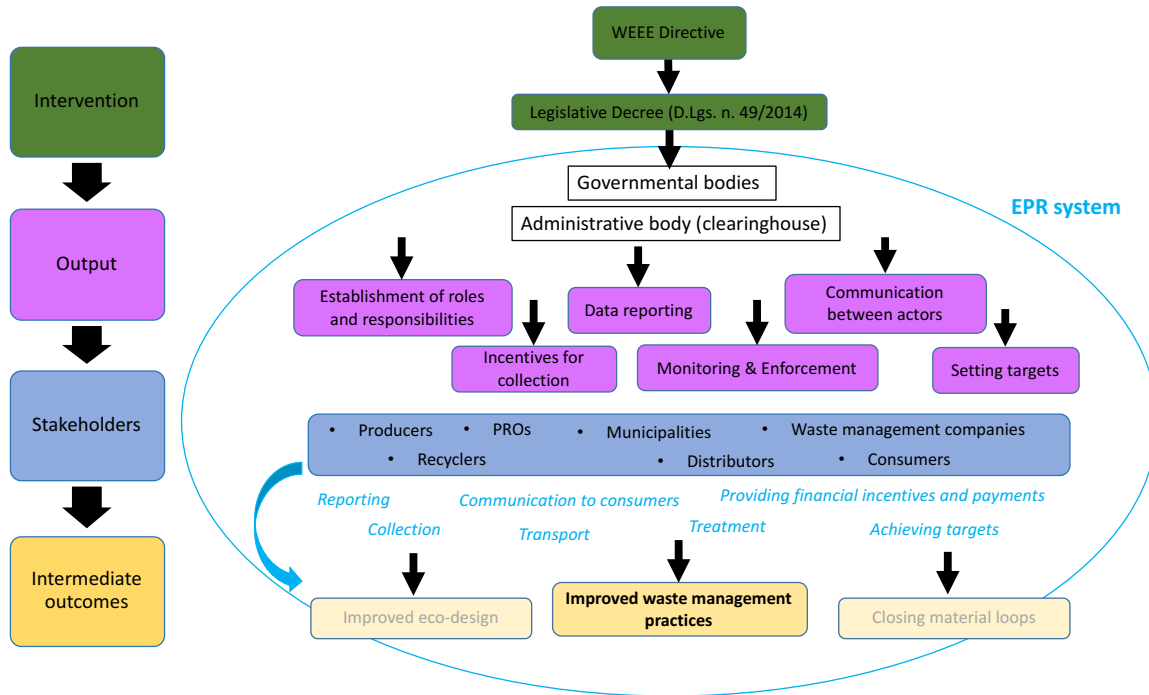
RQ3: How can the performance of the national WEEE management system be enhanced in order to achieve EU targets?

This paper is also supported by a case study done at the local/municipal level. The municipality of Parma is used in order to assess whether the findings identified at the national level are reflected at the local level as well.

Research design

This thesis takes the form of a policy evaluation, in which the policy under consideration (WEEE Directive and Italian transposition) is being assessed. Vedung's (1997) intervention theory is used in order to undertake this evaluation, whereby the intervention (policy/program) is reconstructed according to how it is projected to run in theory. This is then used as a basis

for evaluation, where the actual outcomes of the policy are assessed in accordance to what is predicted in theory. Three evaluation criteria are used to evaluate the system's performance: effectiveness, legitimacy and transparency. The following figure is developed in order to lay out the policy intervention in detail for the Italian WEEE legislation. Intervention theory (left side column in the figure) together with the three criteria for evaluation represent the main components of the analytical framework.



Various methods are used for the research and analysis. These include literature review, quantitative data collection, observation and stakeholder interviews. The data collected is then assessed against the three criteria to evaluate the performance of the EPR system. As a result, various areas of the policy are identified as challenges within the system.

Key findings

Through the analysis undertaken with the gathered data and using the analytical framework, several findings are brought to light. The following list presents the main findings:

- Lack of proper monitoring and enforcement on behalf of governmental bodies, negatively influencing system performance in terms of effectiveness (goal-achievement).
- Improper reporting of data on behalf of governmental bodies, implying inadequate target calculation and low levels of transparency.
- Concerns about the system structure on behalf of stakeholders, compromising legitimacy.
- Insufficient communication amongst stakeholders, resulting in lack of transparency and therefore lack of trust amongst them and towards the system.
- Distributors are not sufficiently fulfilling their responsibility of collecting WEEE from consumers at their retail points, influencing both effectiveness and legitimacy.
- Communication towards consumers to increase awareness levels is essential in contributing to increased collection rates.
- The existing financial incentive mechanisms to boost collection rates are not entirely accepted and it is questionable whether they are the right means to increase system

effectiveness. Concerns as to who is actually financing the system is also a problem, tied to transparency.

- Achieving increasingly stringent EU targets has been identified as a significant challenge, putting system effectiveness at risk.

Furthermore, the case study reveals an interesting finding with regards to the differences in system effectiveness between northern and southern regions of Italy. Although Parma is in the northern region of Emilia-Romagna and has a high quality of life and developed waste management practices, WEEE collection data is well below the national average (although following a parallel trend). This is an important finding as it suggests that the differences between regions (north vs. south) are more complex than predicted and it is not simply higher GDP leading to better system performance.

Conclusions and recommendations

A set of recommendations are developed on the basis of the findings and analysis. These recommendations, if addressed properly, will allow the system to enhance its performance in light of the increasingly stringent EU targets. The recommendations include putting more efforts into the final establishment and continuous operations of the Vigilance and Control Committee, responsible for monitoring and implementing legislative requirements. The work of this body shall be transparent in ensuring all actors are fulfilling their requirements and that targets are being met. Furthermore, establishing a uniform reporting system that replaces the existing incomplete SISTRI reporting tool will allow for effective monitoring of the entire system (in all its activities and all its actors). This research also suggests setting up a mechanism that allows dialogue between stakeholders, ensuring there is transparent and easy communication throughout the entire system. Distributors are highlighted as a major challenge in that they seem to not be fulfilling their responsibility in providing WEEE collection at their retail points. Focusing on distributors for collection is important as they are in direct contact with consumers and have the potential to positively influence collection rates. Administrative bodies are recommended to concentrate on this actor to increase the collection of household waste. In addition, communication to consumers is also identified as highly significant. The level of consumer education is of great influence on the overall system performance as it strongly affects the amount of e-waste that is disposed of properly and hence enters the system. Awareness campaigns and activities should be targeted to a wider audience to have a stronger impact. Lastly, the introduction of new methods of collection is recommended, allowing consumers to have greater convenience in disposing of their products (e.g. containers placed in shopping centres). If this is done at the national level a larger-scale impact on collection rates is more likely.

Along with these recommendations, this paper contributes to outlining the current status of the Italian WEEE management system and draws attention to the areas in which improvements are needed in terms of operational management of e-waste. The findings are valuable as they have an internal viewpoint in combining stakeholder perspectives and concerns within the system. System actors can use this thesis to expand their knowledge of Italian WEEE management and the challenges that exist throughout.

Table of Contents

ACKNOWLEDGEMENTS	I
ABSTRACT	II
EXECUTIVE SUMMARY	III
LIST OF FIGURES	VIII
LIST OF TABLES	VIII
ABBREVIATIONS	IX
KEY DEFINITIONS	X
1 INTRODUCTION	1
1.1 PROBLEM DEFINITION	2
1.2 AIM AND RESEARCH QUESTIONS	3
1.3 STUDY SCOPE AND LIMITATIONS	4
1.4 ETHICAL CONSIDERATIONS	5
1.5 AUDIENCE	5
1.6 DISPOSITION	6
2 LITERATURE REVIEW	7
2.1 WASTE HIERARCHY	7
2.2 WASTE MANAGEMENT IN ITALY	7
2.2.1 <i>Background to case study: municipality of Parma</i>	8
2.3 WHAT IS EPR?	9
2.4 E-WASTE	12
2.4.1 <i>WEEE Directive</i>	13
2.4.2 <i>WEEE Directive 2002/96/EC</i>	13
2.4.3 <i>WEEE Directive Recast 2012/19/EU</i>	13
2.5 E-WASTE IN ITALY	16
2.5.1 <i>Transposition of WEEE Directive</i>	16
2.5.2 <i>Program Agreements</i>	18
2.5.3 <i>Putting Italy's WEEE performance into context</i>	18
2.5.4 <i>Mapping out the system</i>	20
2.5.5 <i>Stakeholders</i>	22
2.6 THEORY AND FRAMEWORK	25
2.6.1 <i>Theoretical background</i>	25
2.6.2 <i>Intervention theory</i>	26
2.6.3 <i>Performance criteria</i>	26
2.6.4 <i>Analytical framework</i>	28
3 METHODOLOGY	30
3.1 DATA COLLECTION	31
3.2 COLLABORATION/PARTNERS	32
4 FINDINGS	33
4.1 OUTPUTS	34
4.1.1 <i>Monitoring and enforcement</i>	34
4.1.2 <i>Reporting</i>	35
4.1.3 <i>Structural problems</i>	36
4.1.4 <i>Communication between actors</i>	37
4.2 INTERMEDIATE OUTCOMES	38
4.2.1 <i>Distributors</i>	38
4.2.2 <i>Communication towards consumers</i>	39

4.2.3	<i>Financial incentives & payments</i>	40
4.2.4	<i>Target achievement</i>	41
5	ANALYSIS AND DISCUSSION	43
5.1	EFFECTIVENESS	44
5.1.1	<i>Are the results in accordance with the goal?</i>	44
5.1.2	<i>Are the results produced according to the programme?</i>	46
5.2	LEGITIMACY	47
5.3	TRANSPARENCY	49
5.4	DISCUSSION OF RESEARCH QUESTIONS	51
6	REFLECTIONS AND CONCLUSION	57
6.1	REVIEW OF METHODOLOGICAL AND ANALYTICAL CHOICES.....	57
6.1.1	<i>Methodology</i>	57
6.1.2	<i>Analytical framework</i>	58
6.1.3	<i>Study legitimacy</i>	59
6.1.4	<i>Generalisability</i>	59
6.2	FURTHER RESEARCH.....	59
6.3	SUMMARY AND FINAL THOUGHTS.....	60
	BIBLIOGRAPHY	62
	APPENDIX I. WEEE GROUPINGS	67
	APPENDIX II. PERSONAL COMMUNICATIONS	69
	APPENDIX III. SAMPLE INTERVIEW GUIDE	70

List of Figures

Figure 2-1 EU waste hierarchy.....	7
Figure 2-2 Map of Italy	9
Figure 2-3 The Circular Economy	10
Figure 2-5 Timeline of WEEE legislation in EU and Italy.	16
Figure 2-6 Total waste collected (kg/capita) in EU Member Countries, 2013.	19
Figure 2-7 Total waste collected (collection/average PoM of 3 previous years) in EU Member Countries, 2013	20
Figure 2-8 Mapping of material flows.....	21
Figure 2-9 Mapping of responsibilities in WEEE management.....	22
Figure 2-10 Mapping of a general intervention theory	26
Figure 2-10 Framework for analysis.....	29
Figure 3-1 The 4-step approach to Policy Evaluation	30
Figure 4-1 Implementation chain for WEEE system in Italy.....	33
Figure 4-2 Collection rates in Parma vs. Italy.....	42
Figure 5-1 Challenges identified within the implementation chain.....	43

List of Tables

Table 2-1 WEEE Directive categories and targets until 2018	14
Table 2-2 WEEE Directive categories and targets from 2018	14
Table 2-3 Context – demographic information	16
Table 2-4 WEEE product groupings in the Italian system	18
Table 2-5 Performance criteria for policy evaluation	27
Table 2-6 Research question 2 and sub questions	28
Table 3-1 Research questions and methods for data collection	30
Table 4-1 Conversion from five Italian product groupings to ten Directive categories..	35
Table 4-2 Comparing data for products put on the market (PoM)	35
Table 4-3 Comparing data for waste collected from households.....	35
Table 5-1 Categorisation of findings according to the analytical framework	44

Abbreviations

B2B – Business-to-Business

B2C – Business-to-Consumer

E-waste – electrical and electronic waste

EEE - electrical and electronic equipment

EPR – extended producer responsibility

EU- European Union

IPR – individual producer responsibility

ISPRA – Istituto Superiore per la Protezione e la Ricerca Ambientale (Italian National Institute for Environmental Protection and Research)

MSW – municipal solid waste

PoM – Put on Market

PRO – Producer Responsibility Organisation

SISTRI – Sistema di controllo della tracciabilità dei rifiuti (Control system for traceability of waste)

WEEE – Waste electrical and electronic equipment

Key definitions

Collection – the gathering of waste, including the preliminary sorting and preliminary storage of waste for the purposes of transport to a waste treatment facility (Directive 2008/98/EC).

Disposal - any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy (Directive 2008/98/EC).

EEE – equipment which is dependent on electric currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such currents and fields and designed for use with a voltage rating not exceeding 1000 volts for alternating current and 1500 volts for direct current (Directive 2012/19/EU).

Historical waste – WEEE from products placed on the market on or before 13 August 2005 (Directive 2012/19/EU).

Orphan waste – WEEE from products whose producers no longer exist (Savage, 2006).

Preparing for re-use – checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing (Directive 2008/98/EC).

Recovery – any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy (Directive 2008/98/EC).

Recycling – any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes (Directive 2008/98/EC).

Re-use – any operation by which products or components that are not waste are used again for the same purpose for which they were conceived (Directive 2008/98/EC).

Treatment – recovery or disposal operations, including preparation prior to recovery or disposal (Directive 2008/98/EC).

Waste – any substance or object which the holder discards or intends or is required to discard (Directive 2008/98/EC).

WEEE – electrical or electronic equipment which is waste, including all components, sub-assemblies and consumables which are part of the product at the time of discarding (Directive 2012/19/EU).

1 Introduction

The production and usage of electronic devices is growing exponentially around the world and resulting in increasing volumes of its respective waste stream (Widmer et al., 2005). The disposal of these products is given growing attention in policymaking owing to the rising concerns over how it is managed, how it can be prevented and what the health and environmental impacts are (Ongondo et al., 2011).

Over the past few decades, several efforts have been made at the international level to address the issues around and related to electrical and electronic waste, i.e. e-waste or WEEE¹. The 1992 Basel Convention seeks to reduce the transboundary movement of hazardous wastes, including e-waste, from developed countries to developing countries (Widmer et al., 2005). At the EU level, the WEEE Directive (Directive on waste electrical and electronic equipment) was introduced in 2002, requiring all Member States to have a system for managing e-waste. The Directive requires producers to acquire the responsibility to take back the products at their end-of-life and ensure they are adequately treated and disposed of. This principle underlying the WEEE Directive is called Extended Producer Responsibility (EPR) and suggests that producers of products should be given the responsibilities for waste management, which otherwise may default to consumers and authorities or not taken responsibility for at all (Lindhqvist, 2000). The purpose of the Directive is to promote sustainable production and consumption, primarily by preventing production of WEEE (through eco-design), reducing the final disposal of waste (through improved waste management), and closing the loop to retrieve valuable secondary raw resources (2012/19/EU). Each EU Member State is required to transpose the Directive into national law and fulfil the requirements and functions set out by the EU legislation. In 2012, the WEEE Directive (2002/96/EC) was updated with major changes in targets for collection rates to be met by Member States from 2016 and 2019.

Italy transposed the WEEE Directive in 2005 under the Legislative Decree n. 151/2005 and subsequently introduced a national WEEE management system in 2007. As appointed by the Directive, the responsibility of e-waste management is given to producers. This has led to many changes within the system, including the introduction of new actors, responsibilities, activities and requirements. Furthermore, Italy has reached the 4kg target previously set by the WEEE Directive but achieving the new targets set under the recast Directive will be very challenging due to their stringency and require important steps to be taken by all stakeholders involved. The new targets draw into question the country's ability to achieve them with the current management system that is in place. The system for e-waste management is highly complex and involves many different stakeholders, flows and responsibilities. These aspects need to be integrated to operate together and create a balanced, coordinated and well-performing system.

It is interesting to study how these factors are characterised and function within the Italian national context as it is anticipated that it will be difficult to achieve the new targets particularly because the previous ones were only just met and collection rates haven't gone up much since. In terms of collection rates, Italy lies approximately in the middle of the EU countries. It is thus interesting to study the system and seek to understand both which factors are allowing it to reach this rank and which factors are dragging it back.

¹ The terms e-waste and waste electrical and electronic equipment (WEEE) are used interchangeably in this thesis.

1.1 Problem definition

Global amounts of electrical and electronic equipment (EEE) put on the market (PoM) are increasing and are predicted to continue increasing in the next years (Remedia, 2015). In Europe, WEEE is currently estimated to be the fastest growing waste stream (Favot, 2014). Concurrently, the overarching legislation (WEEE Directive) has been reviewed and new targets have been set for the near future (Directive 2012/19/EU). Reaching these targets requires current systems to adapt. In Italy, as in many other EU countries, if the system is sustained at its current level and rates, the targets will not be met (Remedia, 2015).

Van Rossem *et al.* (2006) study the transposition of the WEEE Directive in Member States and find that the legislation is transposed in various ways that are not fully reflecting the intents of the EU Directive. A study conducted by Huisman *et al.* (2006) on the implementation of the WEEE Directive across Europe finds: that the legislation lacks clarity; roles and responsibilities are not well defined; and stakeholders are often not provided adequate incentives for improvement. In Italy, a national system is in place and the WEEE Directive recast is transposed into national law. However, the question is how it is transposed, how it is received by the stakeholders and whether or not the intended outcomes are actually being reached. These questions are important to assess as these factors contribute to the overall effectiveness of the system. Understanding how and why the system is effective or not is necessary to understand where improvements can be made to meet targets and better address the growing e-waste problem.

This research paper contributes to the limited body of literature currently existing in this field. Perez-Belis *et al.* (2015), undertakes an extensive literature review of the current e-waste trends globally. The areas identified as the most researched are general WEEE management, WEEE generation, social aspects of WEEE and design aspects. Out of the 307 articles reviewed by the authors, only four are conducted in Italy, all studying the physical and chemical characteristics of EEE (Palmieri *et al.*, 2014; Delfini *et al.*, 2011; Taurino *et al.*, 2010; Tuncuk *et al.*, 2012). This goes to show that there is currently lack of research on the operational system management, economic and business perspectives of WEEE in Italy (Favot, 2014). More specifically, the role of the different stakeholders in the system and their efforts in trying to reach the new EU targets is an area of research that is highly relevant to analyse. Furthermore, it is currently unknown how the incentive mechanisms impact the efficiency of these systems and what challenges currently exist for all stakeholders.

To summarise, some of the research gaps identified are:

- In depth stakeholder analysis
- Analysis of incentive mechanisms (how they work, their impact, who is affected, etc.)
- Challenges faced by stakeholders (practical challenges, relational challenges, etc.)
- Case study on a municipality in Italy
- Highlighting best practices in Italy to serve as examples for other EU countries

There are many further gaps in research within the context of WEEE management. These include assessing eco-design incentives and evaluating the degree to which material loops are actually being closed. However, while addressing these gaps is also important, this thesis will not be concentrating on these aspects of WEEE management. In Italy, the literature on WEEE management at the national level is minimal and only focuses on certain areas. There exist certain studies, mostly by PROs (Remedia, 2015; UNU-ISP, n.d.; Favot and Grassetti, 2016), that lay out the system and describe its operations. However, to the knowledge of the author, there is no study assessing the system's operational management performance through a

multifaceted approach taking into account stakeholder views. This is what this paper aims to contribute to the existing literature. The author's intent is to contribute to research at the national level, but also to WEEE literature more globally. Studies on specific countries will allow for greater knowledge spillovers, capacity transfer, sharing of best practices and benchmarking. This is especially true in the context of the WEEE Directive which covers all EU Member States and their diverse WEEE management systems.

It is worthwhile to undertake this research because the results are useful for all stakeholders along the value chain to understand where the system successes and failures lie. This contributes to increasing awareness amongst actors in the hope that further action will be taken in order to enhance the system's performance.

1.2 Aim and research questions

This research paper examines the Italian national WEEE system, with particular focus on the role of the involved stakeholders in contributing to the management of this waste stream. Moreover, as existing literature focuses on technical characteristics of WEEE (technicalities of product manufacturing and treatment), this paper instead focuses on the system from a policy evaluation perspective. This covers organisational characteristics of the system, including aspects such as roles and responsibilities of actors, relations between actors and mechanisms to incentivise collection. The criteria for evaluation are introduced in further detail in Section 2.6.3.

Subsequently, this thesis attempts to suggest potential improvements to the current practices in Italian WEEE management on the basis of the findings from the evaluation. This is done through an in-depth analysis of the stakeholders according to the established criteria determining the performance of the system.

Based on the objective of this paper, three research questions are formulated:

RQ1: What are the roles and responsibilities of the stakeholders involved in the national WEEE management system?

- How do these stakeholders interact?
- What are the materials flows in the system?

RQ2: How is the national system operating with respect to the legislative requirements?

- Are the targets being met?
- How do the different stakeholders receive the policy?
- How transparent is the program?
- Is the performance at the local/municipal level consistent with the national level?

RQ3: How can the performance of the national WEEE management system be enhanced in order to achieve EU targets?

The approach this paper takes is a policy evaluation, adopted using intervention theory as well as three performance criteria for analysis. In order to answer the research questions, several steps are followed. Firstly, the policy is reconstructed with the help of intervention theory, used to layout the intervention (policy) according to how it is supposed to perform in theory. The actual outcomes of the policy are evaluated against what is predicted by the theory. This is done with the use of three performance criteria: effectiveness, legitimacy and transparency.

These criteria determine to what extent the policy is achieving its intended outcomes. The results gathered from the literature review, quantitative data analysis and stakeholder interviews are then analysed and discussed. The methodology is addressed in more detail in Section 3 (methodology).

1.3 Study scope and limitations

The focus of this report is the Italian national WEEE management system. More precisely, this paper assesses the operational aspects of the Italian system, meaning the system structure and the waste management. As previously mentioned, the three main objectives of the WEEE Directive are: improved eco-design, improved waste management practices, and closing material loops. As Huisman (2013) suggests, operational improvements are more urgent to address than prevention (eco-design) aspects because reaching the ultimate objective of minimising environmental impacts of e-waste is more readily and practically reached through increased collection and improved treatment (operational waste management improvements). Hence, this paper focuses on analysing the second objective, the operational aspects of waste management in Italy. Eco-design and closing material loops are out of the scope of this study. In order to achieve operational improvements, all stakeholders (not only producers) need to be allocated clear responsibilities in order to contribute to the overall system (Huisman, 2013). This gives ground for the choice of including stakeholder concerns in this research.

The analysis is done on the national legislation (transposed from EU law), the stakeholders involved along the value chain and the activities undertaken. The time scope of the research is from 2002, when the WEEE Directive (2002/96/EC) was introduced, to 2016. Usually, systems are assessed for their environmental effectiveness and economic efficiency (Fredholm *et al.*, 2007). Here, only the material flows are analysed and mapped out to determine effectiveness. No emphasis is made on the economic flows within the system. The reasoning behind this choice is that it is difficult to obtain cost information due to confidentiality and competitive reasons (Monier *et al.*, 2014).

To recall, the aim of this study is to assess the performance of the national WEEE system and identify key challenges through an analysis of system stakeholders. Italy's system has been introduced facing several complications but at the same time is able to achieve certain degrees of operational complexity and effectiveness, proving to be an interesting case amongst the EU Member States. The implementation of EU policies at the national level is contingent on the context and the administration of the Member State. This makes it interesting to undertake a study focusing on the policy evaluation in one country. Few studies have been done on Italy's operational WEEE management, especially with the inclusion of stakeholder perceptions and concerns. The existing literature that studies WEEE in Italy mainly focuses on eco-design improvements and consumer disposal behaviour (UNU-ISP, n.d.; Capurso, 2014; Mussetta, 2013; Cutaia *et al.*, 2013). Certain studies exist outlining how the national system operates and is set up, however these studies are undertaken either by the clearinghouse (annual reports) or by PROs, actors within the system. This could lead to a potential bias or overlooking of certain aspects whereas an academic study, as this thesis, has an external overlook and does not take the point of view of any system actor. This type of research is likely to bring to surface issues that have not been addressed in existing studies. Hence, the author is aiming to fill in a gap at the national level but also at the EU-level in providing a study that can be used for means of comparison or for sharing of practices amongst countries. Lastly, Italy is the author's country of origin, which also explains the choice and the determination to study this Member State amongst others.

This research includes a case study in order to assess whether the findings resulting at the national level are reflected also at the local/municipal level. The case study focuses on the municipality of Parma. There are several reasons for this choice. Emilia-Romagna, the region where Parma resides, is amongst the most progressive in terms of general waste management at the national level. It is a quite wealthy region, centre of many industrial and economic activities. For these reasons the city of Parma proves to be an interesting case to analyse as it is foreseeable for it to show interesting results to be shared with other cities. Furthermore, the city is also chosen for convenience of the researcher as the municipality provides the opportunity and the resources to allow this in-depth case study.

The limitations of this paper are worthy of note. Most importantly, it is important to take into consideration that the findings and conclusions are of subjective nature and do not attempt to make universal judgements. This paper is based on a policy evaluation of the implementation of the WEEE Directive in Italy. Policy evaluations on a specific country context are not always readily generalised, however they provide useful insights especially when they draw from various information sources and data methods (triangulation). The findings are to be taken and interpreted considering the scope and context in which the research is undertaken. Further limitations on the research process itself can be found in the reflections and conclusion section (Section 6). These include generalisability of findings due to scoping and lack of contact with all stakeholders in the system.

1.4 Ethical considerations

This thesis seeks to respect all interviewees' responses and has kept the findings anonymous when requested. During interviews, the author clarified that the answers will be used as part of the research findings and will be the basis for analysis of this research. All interviewees were asked for their consent to record the interviews and most importantly were asked if they could be directly quoted or referenced. A copy of the draft thesis was sent to all interviewees in order to get further approval of the references content. The interviewees are all referred to by name, often coupled with their company/association within the text for more clarity to the reader.

Furthermore, the author closely communicated with one stakeholder during the research. ERP Italy provided their time and profound knowledge and experience to help the author with the research. Despite the close interaction with this stakeholder, the author maintained objectiveness as much as possible in analysing stakeholder concerns and views, seeking to show an unbiased evaluation.

Lastly, the research proposal for this thesis has been reviewed against the set criteria of the ethics review board at Lund University and has been found to not need a statement from the ethics committee.

1.5 Audience

Most of the stakeholders contacted and interviewed for this thesis have asked to receive a copy of the final paper. Hence, the intended audience of this thesis are all the stakeholders along the value chain for WEEE management in Italy, but also stakeholders and experts in other countries. This includes policy-making bodies and highly influential actors in determining the design of the system (for example active producer responsibility organisations), which can use the information provided to estimate the effectiveness of policies and identify where change is needed. Academics, research centres and NGOs focusing on this topic can also benefit from this paper as it is filling a research gap and providing additional knowledge on the system and its characteristics.

1.6 Disposition

Section 1 introduces the study and defines the problem and research objectives. The research questions, scope and audience are also presented.

Section 2 provides the literature review. This includes an introduction to the concept of EPR and the waste hierarchy. The paper then gives an overview of the WEEE Directive to later go into the specifics of Italian WEEE management. The last part of this section introduces the analytical framework used throughout this paper.

Section 3 presents an overview of the methodology used for this thesis. This includes an overview of the research questions, the research design and thesis collaboration partners.

Section 4 presents the relevant findings resulting from the quantitative data collection and stakeholder interviews.

Section 5 provides an analysis and discussion of the findings from the previous chapter. This is done following the structure provided by the analytical framework. The research questions are also directly addressed. This includes recommendations for enhancing system performance.

Section 6 provides reflections and conclusions. The methodology is reviewed and reflections are made upon the context, scope, framework, legitimacy and generalisability of the study. Furthermore, areas for future research are identified. A final summary and concluding remarks follow.

2 Literature review

This section reviews the existing literature and provides an overview of the policy under evaluation. This includes a general introduction to waste management in the EU, in Italy and at the municipal level (case study: municipality of Parma). Subsequently, a background on e-waste is presented followed by an introduction to the WEEE Directive and the transposition in Italy. The Italian system is mapped out and the main stakeholders are described. Lastly, the conceptual theory and analytical framework are presented.

2.1 Waste hierarchy

The seventh EU Environmental Action Plan, entered into force in 2014, states that by 2020 waste shall be managed in a way that prevents damage to both human health and the environment, including the management of hazardous waste (EC, 2010). Waste specific legislation exists in Europe since 1975 when the Waste Framework Directive (75/442/EC) was first introduced. Currently, the 2008 recast is in place (2008/98/EC). This Directive serves as the cornerstone of EU waste policy and its main focus is to provide a general framework with requirements for managing waste and laying down the main definitions and concepts (EC, 2013). Most importantly, the legislation introduces the waste hierarchy, which shall be applied by all EU waste legislation and Member State policies. The waste hierarchy presents the order in which waste management and prevention should be prioritised (Directive 2008/96/EC). Figure 2-1 shows the pyramid, from the most preferred option to the least preferred.

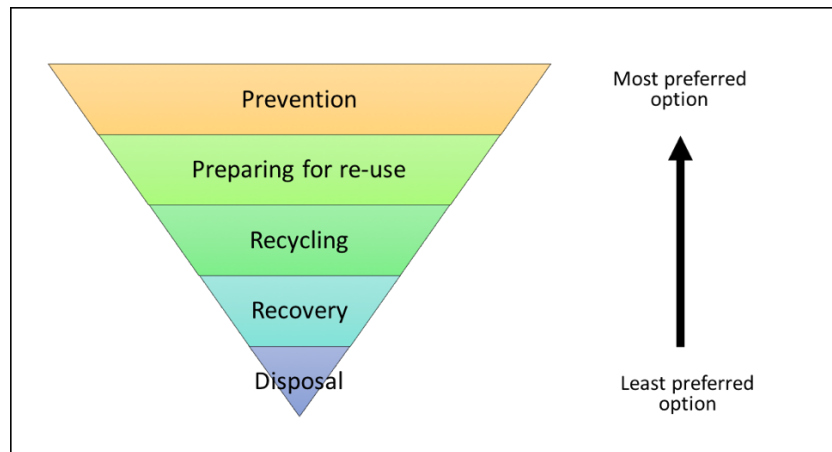


Figure 2-1 EU waste hierarchy

Source: own

Article 8 of the Waste Framework Directive also introduces the extended producer responsibility (EPR) principle. This concept is then brought through to the underpinning Directives, the WEEE Directive being one of these along with Directives for packaging, end-of-life vehicles (ELV) and others.

2.2 Waste management in Italy

Waste is often in the news headlines in Italy due to problems with mismanagement and lack of clear responsibility allocation between the state and the regions (OECD, 2011). As at the EU level, Italy has a national environmental policy, known as the “codice dell’ambiente”, i.e. Environmental Code (D. Lgs. n. 152/2006), which was initially introduced in 1997. The national environmental policy has underlying decrees for the waste management streams (La Forgia, 2015). In the past decade, Italy has shown increases in separate collection of all streams

of municipal solid waste (MSW) (Ferraris and Paleari, 2013). Despite overall positive trends, there are very big differences across the 20 regions (Ferraris and Paleari, 2013). For example, only half of the regions have met the national recycling target for biodegradable waste in 2010. Hence, at the national level, this disparity between regions can lead to problems in achieving targets as a whole (Ferraris and Paleari, 2013). The northern regions are those with more advanced waste management infrastructure and system design, whereas the south and the island regions are usually failing to achieve targets due to their underdeveloped waste management systems (Massarutto, 2010). A study conducted by Favot and Grassetto (2016) found that the highest performing region (in terms of collection rates) between 2008 and 2015 is Tuscany.

The illegal sector plays an important role in the waste management scene in Italy. Organised crime is growing within this industry, with hazardous waste being one of the main targets and becoming one of the most profitable fields for criminal activities (Germani *et al.*, 2015). Criminal organisations are often in control of landfills, especially in the southern regions (Buclet, 2002). According to a report by the Italian Financial Police, the main factor that leads to illegal disposal of waste is economic profit (Germani *et al.*, 2015). The e-waste sector is thus often a target area for illegal trafficking due to its high economic and resource value. It was only in 2006 that illegal trafficking of waste became part of the Environmental Code, finally introducing penal sanctions for this type of environmental crime (Vagliasindi *et al.*, 2015).

Data availability and transparency seem to be prevailing issues for most MSW streams in Italy (Ferraris and Paleari, 2013). The study undertaken for the European Environment Agency (EEA) on waste management in Italy shows lack of data availability in several areas and in many cases data from different sources has to be combined to be able to achieve more widespread figures (Ferraris and Paleari, 2013). Awareness levels are found to be relatively low in the country due to lack of data and transparency, negatively influencing awareness of the population (OECD, 2011).

The above factors provide for an interesting case to analyse Italy's e-waste management in particular. As the country has faced and is currently facing challenges in reaching national and EU waste targets in general, it can be expected for these issues to be reflected in the WEEE streams as well. It can also be expected that data availability for the study of this paper will be limited.

2.2.1 Background to case study: municipality of Parma

The city of Parma is in the northern region of Emilia-Romagna, amongst the wealthiest in Italy. The Province of Parma has 47 municipalities and a total population of around 448,000. The city has a population of about 200,000 people and is rich with culture, art, food, tradition and history. However, the region is also one of the top waste producers in Italy, producing 636 kg of MSW per capita in 2014, well over both the Italian and European average, 488kg and 475kg respectively (Eurostat, 2016). Of the collected MSW in Parma, around 58% is recycled and the rest is sent for incineration or landfill. Due to high rates of waste generation and stagnant separate collection rates within the whole region, an incineration plant was built in 2013 and several changes were made to the waste management system. Door-to-door collection was extended to cover the whole city and bio-waste collection was introduced in many neighbourhoods. As the political will was strong, also Iren Ambiente S.p.A., the waste management company, was engaged and pushed for change (Ferran, 2016). Hence, the city has seen a shift in both political objectives and consumer behaviour. This is reflected in the figures which show a 15% decrease in total waste generation and a 24% increase in separate collection between 2011 and 2015 (Ferran, 2016).



Figure 2-2 Map of Italy

Source: Co.As.It. (2016)

2.3 What is EPR?

Extended Producer Responsibility (EPR) was first introduced in 1990 by Lindhqvist in a report for the Swedish Ministry of the Environmental and Natural Resources (Lindhqvist, 2000). The principle suggests that producers should be responsible for managing the waste resulting from their products. The formal definition of EPR used in this paper is the following:

“Extended Producer Responsibility (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.” (Lindhqvist, 2000)

EPR’s goal is to reduce environmental impact through two channels: (1) guaranteeing proper and sufficient management of end-of-life products, and (2) providing incentives for producers to develop the design of their products so as to improve the overall life-cycle (Gui *et al.*, 2013). EPR addresses environmental impacts caused at all stages of the product life-cycle and the responsibility is given all to one actor (producer) to ensure that responsibilities are allocated and that a situation in which everybody’s responsibility becomes nobody’s responsibility is avoided (Lindhqvist and Lifset, 1997). The polluter-pays principle surfaces here, as EPR allocates the responsibility of managing waste for the environmental damage it is causing (Tojo, 2004). In essence, the producer is required to internalise the cost of pollution caused, which in the scope of this paper would be the environmental pollution of EEE throughout their life-cycle.

EPR is an important policy instrument that supports the implementation of the EU waste hierarchy (Monier *et al.*, 2014). By shifting the responsibility of waste management to producers, they become responsible for the products also after the point of sale (until end-of-

life treatment). In theory, this should also mean producers are incentivised to improve the design of their products (at source) to make them more efficient throughout their whole life-cycle (Tojo, 2004). In other words, producers are required to internalise costs of treatment and disposal so that they are incentivised to change the design of their products to make them longer lasting and more easily disposed of (Monier et al., 2014).

EPR supports the circular economy concept, which is gaining increasing importance in the EU policy agenda. The EU Circular Economy Package was introduced in 2015, proposing an extensive group of measures for “closing the loop” of product lifecycles to reduce waste and increase recycling and re-use (EC, 2015). The proposal strongly focuses on increasing recycling rates. Relating this to the scope of this thesis, improving waste management practices will contribute to increased collection rates, hence, amongst several other things, contributing to circular economy goals.

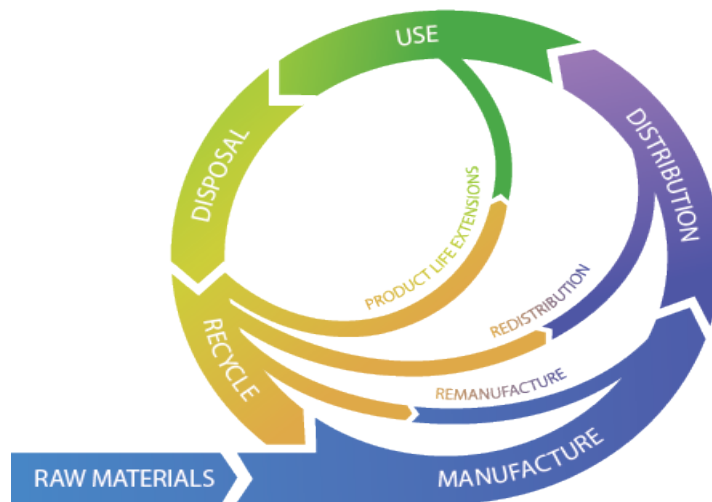


Figure 2-3 The Circular Economy

Source: own, adapted from Innovate UK

When talking about responsibilities of waste management, it is important to define what is meant by the term “responsibility”. Lindhqvist (1992) introduces various types of responsibilities that should be covered by EPR policy tools. These are: liability, economic responsibility, physical responsibility, informative responsibility and ownership. Lindhqvist (2000, p. iii) defines them as follows:

- **“Liability** refers to the responsibility for proven environmental damages caused by the product in question. The extent of the liability is determined by legislation and may embrace different parts of the life cycle of the product, including usage and final disposal.
- **Economic responsibility** means that the producer will cover all or part of the expenses, for example, for the collection, recycling or final disposal of the products he is manufacturing. These expenses could be paid for directly by the producer or by a special fee.
- **Physical responsibility** is used to characterise the systems where the manufacturer is involved in the physical management of the products and/or their effects.
- **Informative responsibility** signifies several different possibilities to extend responsibility for the products by requiring the producers to supply information on the environmental properties of the products they are manufacturing.

- *The manufacturer may also retain the **ownership** of his products throughout their life cycle, and consequently be linked to the environmental problems of the product.”*

EPR implementation can be carried out in different ways, especially in terms of how producers fulfil their goals. Producers can either operate under individual producer responsibility (IPR) or collective producer responsibility (Tojo, 2004). The former indicates that each producer is responsible for managing the waste arising from its own products only. The latter means that producers are collectively responsible for the waste arising from all their products, usually through consortiums (Dempsey and McIntyre, 2009).

There is wide discussion with regards to which implementation technique is preferred, especially at the EU level during the establishment of the WEEE Directive (Tojo, 2004). The reason for these discussions is mainly due to determining whether producers actually have incentives for design change (Khetriwal et al., 2009). Several authors claim that in an EPR system where producers meet their responsibilities collectively, they do not have the incentive for design change (Atasu and Van Wassenhove, 2011; Dempsey and McIntyre, 2009; Van Rossem et al., 2006; Atasu and Subramanian, 2012; Tojo, 2004; Huisman, 2013). If producers take on the management of their products through a collective system, any improvement in design of his products will be shared amongst the other producers and he will not see the advantages of his design change (Tojo, 2004). On the other hand, in an IPR system the producer is not confronted with this problem since he will directly benefit from the upstream changes he makes to his products. However, design change is not the main scope of this paper and will not be assessed fully, but only touched upon.

EPR legislation is now in effect throughout the European Union Member States in various waste sectors such as waste packaging, e-waste, batteries and automobiles (Mayers and Butler, 2013). EU policies perform differently across all Member States due to contextual factors (Börzel, 1998). Depending on the EPR scheme, producers are obliged to fulfil their responsibilities in various ways (Tojo, 2004). It is fundamental for producers to be given specific requirements for each type of responsibility in order for the EPR principle to be fully respected (Monier et al., 2014). The physical, economic and informative responsibilities within the WEEE Directive and the Italian national WEEE management system will be further analysed in Sections 2.4.3. and 2.5.4.

Lindqvist (2000) highlights five main factors that determine the successfulness of an EPR system: (1) improvement of lifecycle impact of products through design change; (2) shifting consumption towards more environmentally adapted products; (3) high secondary use of materials; (4) minimised bureaucracy within the system; and (5) good control over the target achievements (Lindqvist, 2000). These factors cover different stages of the policy in terms of immediate, intermediate and long-term outcomes of EPR (Tojo, 2004). They also require examination of the different policy objectives (operational improvements, enhanced eco-design and closing material loops).

Operational performance of EPR systems also receives attention from research. A study undertaken on EPR policies for waste management in Portugal finds that the conditions established by EPR positively contribute to increasing quantities of waste collected and quality of treatment (Niza et al., 2014). Moreover, the EPR systems introduced in Portugal allow waste management to be more organised, better monitored and better accepted by stakeholders. Cahill et al. (2011) conduct a study on the implementation of EPR for packaging waste and WEEE across eleven EU countries identifying the differences in engagement between stakeholders. The results of the study show that a forum for exchange and means of

cooperation between actors makes the EPR system more legitimate and has a positive influence on the overall performance (Cahill et al., 2011). Furthermore, Pridham (1996) suggests that the performance of EU policies at the national level highly depends on the national administration of the member state.

2.4 E-waste

E-waste is gaining rising importance in policy-makers' agendas since the quantities of this waste stream being generated are rapidly increasing (Khatriwal et al., 2009). This increase is estimated to be due to the recent ICT revolution, which has now brought us to a situation in which technological development is extremely fast-changing and products are bought and replaced at exceptional rates (Khatriwal et al., 2009).

E-waste is a very different kind of waste compared to traditional MSW streams and there are several characteristics that complicate the development of an EPR system for its waste management (Gui et al., 2013). Most importantly, it contains hazardous substances which are harmful to human health and the environment (Huisman et al., 2015). Furthermore, as opposed to most other waste streams, e-waste has a high value due to the raw materials it contains and that can be recovered (Khatriwal et al., 2009). This can be a challenge as it can lead to improper management of WEEE through illegal channels and can pose negative environmental and health impacts (Ylä-mella et al., 2014a). Also, electronic products have a relatively long life-span in terms of waste generation. That is, e-waste is generated on a much lower frequency per person than other MSW streams (packaging, food waste, etc.) (UNU-ISP, n.d.). However, the rapid technological advance we are facing calls for many products to be replaced despite the fact that they are still functioning and not at end-of-life. Furthermore, the high product heterogeneity within this waste stream is a major obstacle faced in its management. It implies that one standard treatment process is not suitable, but rather a system in which the entire diverse range of products can be treated is needed. These are some of the aspects that need to be accounted for in the creation and management of a system (Gui et al., 2013).

WEEE management systems are a relatively new field. Switzerland's SWICO, established in 1994, is the oldest national system in the world (Fredholm et al., 2007). Other countries such as Germany, Denmark and Norway had WEEE management systems in place before the introduction of the EU-wide legislation in 2002 (Khatriwal et al., 2009).

A recent report by Ivert et al. (2015) studies WEEE collection and treatment systems in Norway, Denmark and Sweden and compares their practical and administrative management. The study found that systems with more detailed legislation (e.g. Denmark), which have been developed in cooperation with system stakeholders, are generally more accepted. They also suggest that a system with more PROs (e.g. Norway) makes logistics less efficient. A study on the strengths and weaknesses of WEEE management in Romania finds that despite the increases in collection rates over the past years, the country still has to work on communication towards citizens, improving infrastructure and harmonising the system across the national territory (Ciocoiu et al., 2010). In Spain, the weak legislation is claimed to have a negative impact on compliance by stakeholders within the system, reducing its overall performance (Queiruga et al., 2012). These studies present a wide range of differing challenges identified across EU member countries in terms of WEEE management systems, underlining the importance of undertaking country-specific studies to better understand the difficulties encountered in each State.

2.4.1 WEEE Directive

One of the areas in which EPR is being used as a policy tool is in the management of e-waste. Currently, Europe is said to be leading the way in WEEE legislation (Ongondo *et al.*, 2011; Khetriwal *et al.*, 2011; Ylä-mella *et al.*, 2014a; Zoeteman *et al.*, 2010). The European Parliament and the Council of the European Union introduced the WEEE Directive in 2002 to better address the problems arising from the increasing consumption and rapidly changing technologies that are making EEE a growing source of waste. As mentioned in the introduction, the Directive introduces EPR principles for e-waste management in all its Member States. This means that producers shall finance the collection, treatment, recovery and disposal of WEEE resulting from their respective products.

The purpose of the Directive is the prevention of WEEE and the increase in reuse, recycling and other forms of recovery of WEEE to reduce the disposal of this waste stream (Directive 2002/96/EC). In other words, the three main objectives are: improved eco-design, improved waste management practices, and closing material loops. As previously mentioned, the scope of this thesis solely assesses improved waste management practices, thus looking at the operational improvements. This involves the operational aspects of the system which allow for the collection, transport and treatment of WEEE. This should be done primarily by encouraging the correct disposal of WEEE on behalf of consumers who are in turn provided with a collection system that allows them to dispose of the waste free of charge (Directive 2002/96/EC).

2.4.2 WEEE Directive 2002/96/EC

The WEEE Directive introduces the concept of producer responsibility in Europe for the management of e-waste for the first time. Member countries had to transpose the Directive into national law by the 13th of August 2004. This means that they are to implement a system including relevant laws, regulations and provisions that allow the country to comply with requirements set under the Directive. As it is a Directive (and not a Regulation), countries are free to choose how to transpose it and how to design the system, as long as they meet the requirements.

The scope of the Directive includes all products that fall under the definition of EEE (see Appendix I) except for EEE intended for military purposes. In the initial WEEE Directive, 10 categories of electrical and electronic waste are established in order to allow for proper treatment and recycling of the wide range of products covered by WEEE. These are shown in Table 2-1. Each category is assigned a minimum weight-based “recovery” and “recycling” target to be achieved by all Member States by the end of 2006. The Directive also provides a more general collection target for all WEEE from private households set at 4 kilograms per capita per year.

2.4.3 WEEE Directive Recast 2012/19/EU

Following an impact assessment undertaken in 2008 by the European Commission on the experience of the application of the Directive, a recast was proposed. After negotiations and revision of the text, in 2012 the WEEE Directive was updated and the recast (2012/19/EU) came into force. This Directive brings about several changes. Firstly, the collection targets have considerably changed. Whereas before they were weight based (4 kg/per capita/per year), the recast Directive now introduces percentage based targets calculated based on EEE placed on the market in the preceding years. Article 7 (2012/19/EU) specifies that:

“From 2016, the minimum collection rate shall be 45% calculated on the basis of the total weight of WEEE collected [...] in the given year in the Member State concerned, expressed as a percentage of the average weight of EEE placed on the market in the three preceding years [...].”

“From 2019, the minimum collection rate to be achieved annually shall be 65% of the average weight of EEE placed on the market in the three preceding years in the Member State concerned, or alternatively 85% of WEEE generated on the territory of that Member State.”

Whereas the prior 4 kg/per capita/per year target only covered household WEEE, the new targets also include professional WEEE. Furthermore, another important change brought about by the recast is the scope of the Directive. The recast proposes a new categorisation, going from the prior 10 categories (Table 2-1) to 6 new categories (Table 2-2), each one with its respective targets for “recovery” and “recycling” or “preparation for re-use and recycling”.

Table 2-1 WEEE Directive categories and targets until 2018

Categories until 14 August 2018 (10 categories under Directive 2002/96/EC)		1	2	3	4	5	6	7	8	9	10
		Large household appliances	Small household appliances	IT and telecommunications equipment	Electronic and consumer equipment	Lighting equipment	Electrical and electronic tools	Toys, leisure and sports equipment	Medical devices	Monitoring and Control Instruments	Automatic Dispensers
Targets until 14 August 2015	% recovered	80	70	75	75	70	70	70	70	70	80
	% recycled	75	50	65	65	50	50	50	50	50	75
Targets from 15 August 2015 (until 14 August 2018)	% recovered	80	75	80	80	75	75	75	75	75	85
	% prepared for re-use or recycled	80	55	70	70	55	55	55	55	55	80

Source: own, adapted from Perez-Belis et al., 2015

Table 2-2 WEEE Directive categories and targets from 2018

Categories from 15 August 2018 (6 categories under recast Directive 2012/19/EU)		1	2	3	4	5	6
		Temperature exchange equipment	Screens, monitors, equipment with surface screens >100cm ²	Lamps	Large equipment	Small equipment	Small IT and telecommunication equipment
Targets from 15 August 2018	% recovered	80	70	75	75	70	70
	% prepared for re-use or recycled	75	50	65	65	50	50

Source: own, adapted from Perez-Belis et al., 2015

In order for countries to adapt their systems to comply with the new requirements under the recast Directive, a transitional period has been determined between 2012 and 2018. The new targets and the new scope will be enforced starting from the 15th of August 2018. For Member States to achieve the required targets, they shall have a waste management system that addresses a wide range of aspects. Most of these aspects are introduced by the initial WEEE Directive (2002/96/EC) and continue to be important factors for Member States to consider. Some of the most prominent factors referenced from Directive 2012/19/EU are:

- Allowing private households to dispose of their waste at least free of charge (Article 5.2)
- Ensuring the financing of historical and orphan waste (Article 12.4)
- Ensuring end-consumers (mainly private households) are given the necessary information on how to dispose of WEEE, the potential negative effects of hazardous substances and the symbol used for WEEE products (Article 14)
- Ensuring that producers provide information on the preparation for re-use and treatment of their products (Article 15.1)
- Setting up a register of producers (Article 16.1)
- Ensuring proper monitoring and verification of the system, including the establishment of penalties for non-compliance (Articles 22 and 23)

As mentioned earlier, the WEEE Directive establishes producer responsibility for the management of this waste stream. The producers shall be **financially responsible** for the management of the waste resulting from their own products throughout the whole value chain (collection, treatment, recovery and disposal). To finance these activities, producers can choose to operate individually or through a collective system (Article 5.2.d). In the case where producers decide to collectively manage their responsibilities, they do this through a Producer Responsibility Organisation (PRO). These organisations serve as facilitators for producers as they allow to collectively manage the waste (OECD, 2001). PROs act as intermediaries in the system as they take on the organisational role in terms of collection and recycling, allowing producers' compliance to be achieved (Kunz, et al., 2014). Moreover, for financing of historical products, producers have to provide for this through a collective financing scheme (Article 12.4).

The **operational/physical responsibility** is left to the decision of Member States in the design of the national systems. In some countries most physical responsibility is given to municipalities (e.g. Germany), whereas in other countries the responsibility is given to producers and PROs (e.g. Sweden). Furthermore, producers also have **informative responsibility** towards recyclers and towards end-users. Liability and ownership are not directly covered by the WEEE Directive but could be elements in Member States.

As every Member State is given the responsibility to transpose and implement the WEEE Directive into national law, this naturally leads the EU to be characterised by many differing and unique national e-waste management systems (Van Rossem et al., 2006). For example, Member States across the EU allocate responsibilities for e-waste management in differing ways. The role of the Member States is to fulfil the requirements laid out by the Directive by setting up a system that allows for this. These differences can be seen when assessing the organisational structures of the national systems (Van Rossem et al., 2006).

2.5 E-waste in Italy

The table below presents the context behind the policy evaluation in this study. What can be seen is that the population density is quite high compared to most other EU countries. Also, Italy currently has around 8000 municipalities across the territory. Roughly 72% of the municipalities have a population of less than 5,000 (Fedele and Moini, 2007), resulting in a highly fragmented and decentralised local administration. This is interesting in the setting of this research since the WEEE Directive requires collection to be managed at the municipal level.

Table 2-3 Context – demographic information

CONTEXT (data for 2015)	
Population	60,795,612*
Area	302,071 km ² *
Population density	201 persons/km ² *
Regions	20
Municipalities	8048*

Source: *ISTAT

2.5.1 Transposition of WEEE Directive

The Italian national WEEE management system is in place and operational since the end of 2007 (Favot et al., 2016). The Legislative Decree (D. Lgs. n. 151/2005) lays out the foundations and transposes the requirements from the WEEE Directive. As of today, the 2005 decree is replaced by the recently introduced decree, D. Lgs. n. 49/2014, an update reflecting the changes brought about by the recast WEEE Directive. The main provisions are consistent with the EU requirements, namely: prevention and reduction of e-waste; promoting re-use and recycling; reducing hazardous substances contained in EEE; and increasing collection targets (Capurso, 2014).

Below is a timeline including the main dates for WEEE legislation in the EU and Italy. The darker shades represent dates specific for Italy whereas the lighter boxes represent EU dates. As several other EU countries, Italy is behind the general WEEE timeline. More specifically, the initial 2002 Directive was transposed and entered into force in 2005, one year after the deadline set for Member States. The recast Directive was also introduced with some delay.

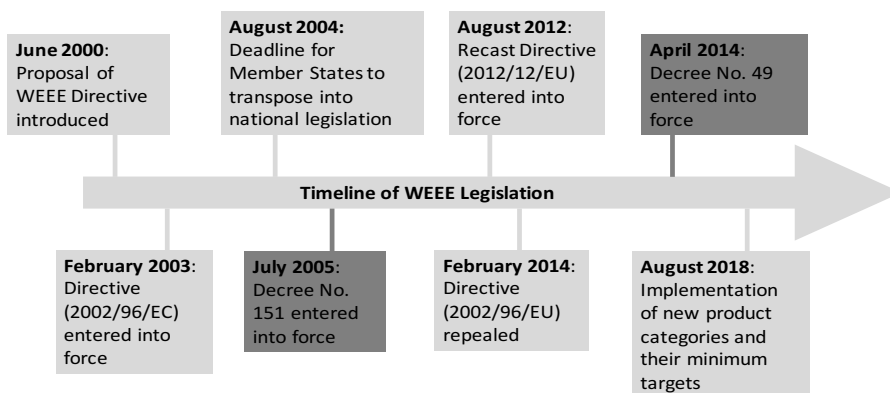


Figure 2-4 Timeline of WEEE legislation in EU and Italy.

Source: own, adapted from Ylä-mella et al., 2014b

The Italian legislation on WEEE introduces a national clearinghouse, Centro di Coordinamento RAEE (CdC RAEE), which must be set up and financed by the PROs. The CdC RAEE serves as the entity organising and managing the collection, transport, registration and data on the WEEE flows going through the PROs. All the PROs active in WEEE management are registered with the CdC RAEE (UNU-ISP, n.d.). There are currently 15 PROs operating on the national territory as non-profit companies and managing household waste (i.e. B2C) (Favot *et al.*, 2016). Most PROs manage both household (B2C) and professional (B2B) waste although most turnover and resources are related to B2C. The WEEE managed through the clearinghouse and PROs is denoted as the formal system, or clearinghouse system. Producers are free to choose which PRO to become members of (CdC RAEE, 2005). Today, the PROs are fairly different in their product coverage and market share (Capurso, 2014). Some of them manage all product types, whereas some only operate with certain types of products. In terms of market share, the top four PROs cover around 75% by weight of EEE put on the market (PoM) by their affiliated producers (CdC RAEE, 2015).

In 2015, according to data from the clearinghouse, a total of 249 million kg of household WEEE were collected in Italy, resulting in an average of 4.1kg per person, just above the 4kg per capita per year collection target set under the Directive (Cdc RAEE, 2015). This represents an 8% increase compared to 2014 figures. This increase is likely to be due to a combination of several factors. These include the increasing efforts on behalf of all the stakeholders, the two Programme Agreements signed in 2015, the increase in collection centres and the slight decrease in the cost of primary resources (CdC RAEE, 2015).

Household (B2C) WEEE, being responsibility of producers to manage, is channelled through the formal system, municipalities or distributors being in charge of collection (UNU-ISP, n.d.). The physical responsibility of collection is given to municipalities and distributors. The collection of WEEE is undertaken through municipal collection centres or regrouping points, the latter being the collection points for distributors. On the other hand, professional (B2B) WEEE, also responsibility of producers, does not necessarily depend on the clearinghouse system. Certain producers of professional EEE join a PRO and channel their products through the system anyways, but they can also manage these flows privately (e.g. sign a contract directly with the recycler, without going through a PRO and the clearinghouse). These flows are referred to as informal flows in this paper². The Directive suggests that any product that can be used both for household and professional purposes, shall be classified as household EEE (B2C) (2012/19/EU).

One of the peculiarities of the Italian system is the way household WEEE is categorised. It does not follow the WEEE Directive 10 categories fully and has changed the products around. There are 5 groupings, denoted as “raggruppamenti”, according to which PROs shall collect and manage WEEE (La Forgia, 2015). Table 2-4 presents the 5 groupings with some examples of products contained within each. For the complete list of products contained within each grouping and the respective Directive categories, refer to Annex I.

² Note: informal flows are different from illegal flows.

Table 2-4 WEEE product groupings in the Italian system

Grouping		Products (examples)
1	Products of refrigeration and air conditioning	Large cooling appliances; Refrigerators, Freezers; Air conditioner appliances
2	Other large household appliances	Washing machines; Dish washing machines; Electric stoves; Microwaves; Electric heating appliances; Electric fans; etc.
3	TV and monitor	Televisions; Monitors
4	IT and consumer electronics, luminaires	Computers; Printers; Calculators; Telephones; Video cameras; Musical instruments; Photovoltaic panels; Luminaires for fluorescent lamps with the exception of luminaires in households; Drills; Sewing machines; Video games; Thermostats; Automatic dispensers for hot drinks; etc.
5	Lighting sources	Straight fluorescent lamps; Compact fluorescent lamps; High intensity discharge lamps, including pressure sodium lamps and metal halide lamps; Low pressure sodium lamps; Other lighting or equipment for the purpose of spreading or controlling light with the exception of filament bulbs

Source: own

2.5.2 Program Agreements

The Legislative Decree (n. 49/2014) outlines the main requirements, targets and activities to be fulfilled by the system. One of the clauses introduced in the decree plans for the implementation of program agreements (“accordi di programma”) with the validity of three years. These agreements serve to define several details of the system, such as methods for collection of WEEE from distributors, allocation of rewards to collection centres and defining sanctions (D. Lgs. n. 49/2014). Separate agreements are signed with producers, distributors and recyclers, who respectively reach agreements with the CdC RAEE, industry associations and ANCI (the Italian municipality association).

In February 2015, the new program agreement was signed by producers and CdC RAEE (CdC RAEE, 2015). This agreement replaces the one signed in 2011 and specifies the main definitions, responsibilities and requirements for stakeholders. In July 2015, the program agreement between distributors, and CdC RAEE was signed and entered into force (CdC RAEE, 2015). By endorsing this agreement, the signatory parties agree to increase national collection according to EU requirements (CdC RAEE, 2015).

The main change brought about by the two 2015 programme agreements is the increase in efficiency rewards (“premi di efficienza”), a financial compensation given to the municipal collection centres and regrouping points on behalf of PROs (producers). This repayment mechanism has the objective of increasing the overall effectiveness of the system (Ancitel, 2013). It is awarded to the municipal collection centres and the regrouping points that show an increase in collection rates which fulfil the requirements set under the agreement (Accordo di Programma ex art. 16 del d. lgs. 49/2014). Furthermore, the agreement also sees the creation of additional funds to address other aspects such as infrastructure, monitoring and information communication (Accordo di Programma ex art. 16 del d. lgs. 49/2014).

2.5.3 Putting Italy’s WEEE performance into context

Furthermore, when looking at how Italy performs compared to other EU Member States in terms of collection rates, the country is placed mid-way through the range (Figures 2-6 and 2-7). Figure 2-6 presents collection rates for EU countries according to the prior target

calculation whereas Figure 2-7 shows the collection rates according to the new calculations set by the recast Directive. When looking at the prior figure, Italy is not only well-placed amongst other EU countries, but it also has well surpassed the 4kg/capita target (according to Eurostat data). However, when the targets are calculated as the weight collected according to the PoM in the three preceding years, the picture changes. As mentioned earlier, the target for Member States is set at 45% between 2016 and 2019 and will further increase to 65% from 2019. In 2013, Italy reached 44%, just under what would be the percentage target if applied to that year. This figure is interesting as it shows that although Italy is not far from the current targets, there still needs to do a lot in order to reach the future 65% target. A study by Huisman (2010) on the change between the “flat-rate” target to the percentage based target, estimates the weight of WEEE to be collected by each member state to reach the 45% and 65% targets set under the recast Directive. In the case of Italy, the study estimates that the 45% target (to be reached from 2016) requires a collection rate of approximately 10kg per person per year and the 65% target (to be achieved starting from 2019) requires a collection rate of around 16kg per person per year. Even if the target is calculated in order to reach a collection rate of at least 85% of the WEEE generated on the territory (alternative target from 2019), Italy is still very far from achieving the target. A study done by an Italian PRO (Remedia, 2012) estimates that in order to reach the 85% (of WEEE generated) collection target, around 17kg per person per year have to be collected. This figure is more than four times as much as the previous 4kg target set by the initial Directive.

It should be noted that there seem to be issues with data transparency within the national WEEE management system and that various sources report conflicting data. However, the overall trend, according to Eurostat data, shows that Italy has reached the targets set by the initial EU Directive. It also seems that Italy is not too far away from the recast Directive target (45%). The challenge now is moving towards the 65% target, to be reached starting from 2019.

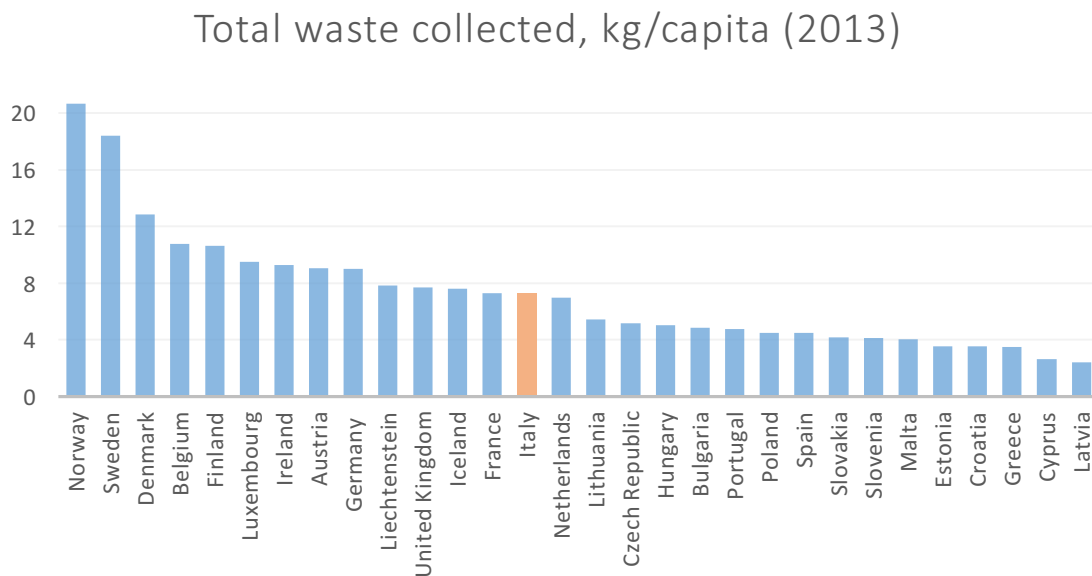


Figure 2-5 Total waste collected (kg/capita) in EU Member Countries, 2013.

Source: own, data from Eurostat.

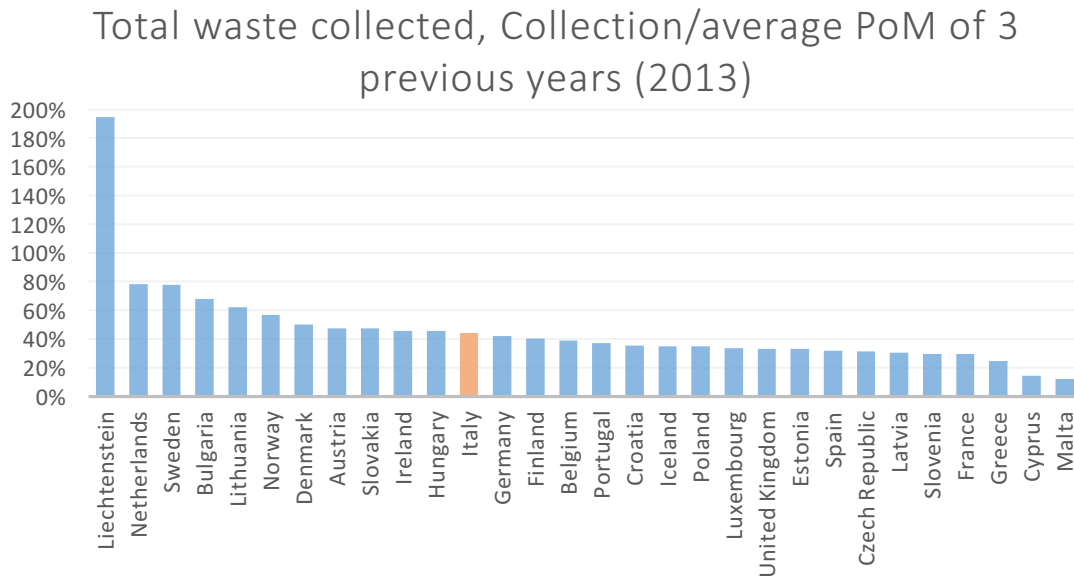


Figure 2-6 Total waste collected (collection/ average PoM of 3 previous years) in EU Member Countries, 2013

Source: own, data from Eurostat

2.5.4 Mapping out the system

This section looks at how the system stakeholders interact and share responsibilities amongst each other. The first research question (RQ1) is addressed by describing what the roles and responsibilities of the various actors are, how they interact and what the material flows are within the system. This is also underpinned by the framework used for this research: intervention theory. Intervention theory is a theory based evaluation which aims to reconstruct the intervention (policy/program) and how it was projected to run, in order to then assess its outcomes (Richter, 2015). This theory is used in order to reconstruct the policy and how it is projected to work in order to assess its actual outcomes and whether they coincide with the policy objectives (Vedung, 1997). Here, an initial mapping out of the system is done and will serve as a basis for the framework, introduced in further detail in Section 2.6.

As discussed earlier, the WEEE Directive follows the EPR principle and suggests three underlying responsibilities for producers: physical; financial/economic; and informative³ (Tojo, 2004). Although producers have the ultimate responsibility to meet the targets, other actors are delegated certain responsibilities, which contribute toward a well-functioning system (OECD, 2001). The three responsibilities within the Directive and the legislative decree are introduced here.

Physical responsibility is shared amongst various actors along the value chain. At the initial stages of manufacturing, the producers are of course physically handling the products. It is then the distributor or the producer itself who sell the EEE to consumers, household or

³ In the Italian transposed legislation, ownership and liability have not been directly covered. However, Italian general waste legislation explains that when an actor is physically handling waste, even if he has no ownership over it, the responsibility for proper management is his.

professional.⁴ Producers can sell directly to household consumers through online stores (e.g. HP online store). Consumers are then physically in hold of the product and shall dispose of it either through the distributor or through the municipality's services. If channelled to the distributor, the waste can then either be sent to the municipality's collection facilities or to a regrouping point. Once the waste is transported to the treatment plants, in charge of the commissioned transporters, it is the responsibility of the recycler to treat the WEEE according to legislative requirements. A simplified mapping of the material flows of the system is shown below (Figure 2-8). It should be noted that both the PROs and the clearing house are in charge of ensuring the system is operating and that responsibilities are being met (UNU-ISP, n.d.).

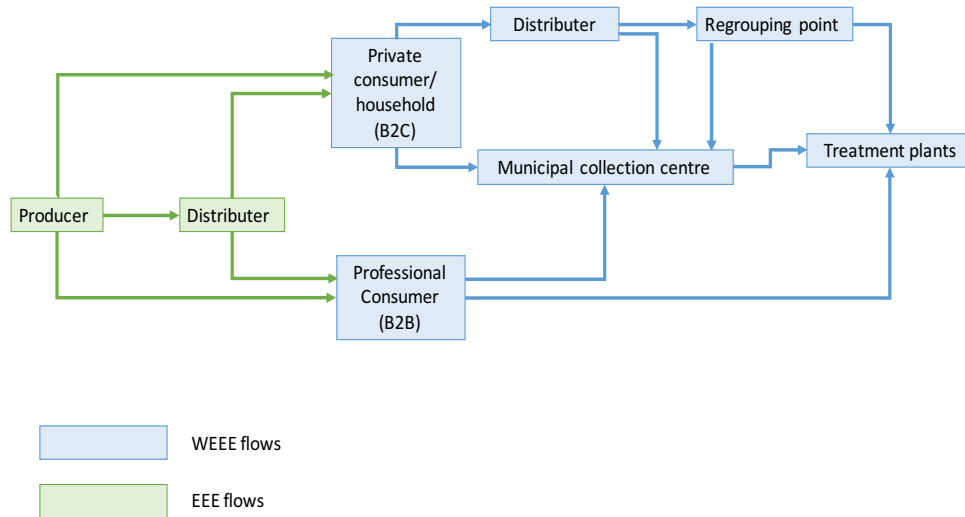


Figure 2-7 Mapping of material flows

Source: own

According to the WEEE Directive (2012/19/EU) and the Legislative Decree (D/ Lgs. n. 49/2014), the financial responsibility for the management of WEEE is on producers. This includes financing of historical and orphan products. The Italian legislation does not provide a fund for financing the collection and treatment of historical and orphan products. The way it works is that all producers are responsible for the total historical and orphan waste generated each year and the amount they have to pay is proportional to the products PoM by them that same year.

The Directive also allows for producers to charge a fee to consumers, called eco-contribution, which is added to the retail price and contributes towards system expenditures (Capurso, 2014). When producers join a collective system, the financial flows go through the PROs who are in charge of redirecting them towards pertinent activities such as the management of municipal collection centres, transportation and treatment (Fredholm et al., 2007). In theory, municipalities receive compensation from the clearinghouse system to finance the management of WEEE at their collection centres. However, it is not clear whether the management of WEEE is actually “zero-cost” to the municipalities or if they bear some of the financial burden. A study conducted by Favot et al. (2016) estimates that the compensation paid to municipalities is often much less than the cost they bear for the collection of WEEE.

⁴ Household consumers are those that buy household EEE and professional consumers are those that buy professional EEE as defined in Section 2.5.1.

The reimbursement municipalities receive is found to be between 25EUR and 38EUR per tonne collected, whereas the costs borne by the municipalities are expected to be over 200EUR per tonne (Remedia, 2012).

Lastly, but not of less importance, is informative responsibility. Producers are responsible for providing information to consumers on how to correctly dispose of WEEE and to recyclers on how products shall be treated (D. Lgs. n. 49/2014). Distributors are required to inform consumers of the one-to-one take back system that is available to them (D. Lgs. n. 49/2014).

Figure 2-9 represents the various responsibilities that are allocated through the WEEE Directive and the Italian Decree. It represents how the system should operate in theory. It will be through the findings and analysis that the actual conformity will be assessed.

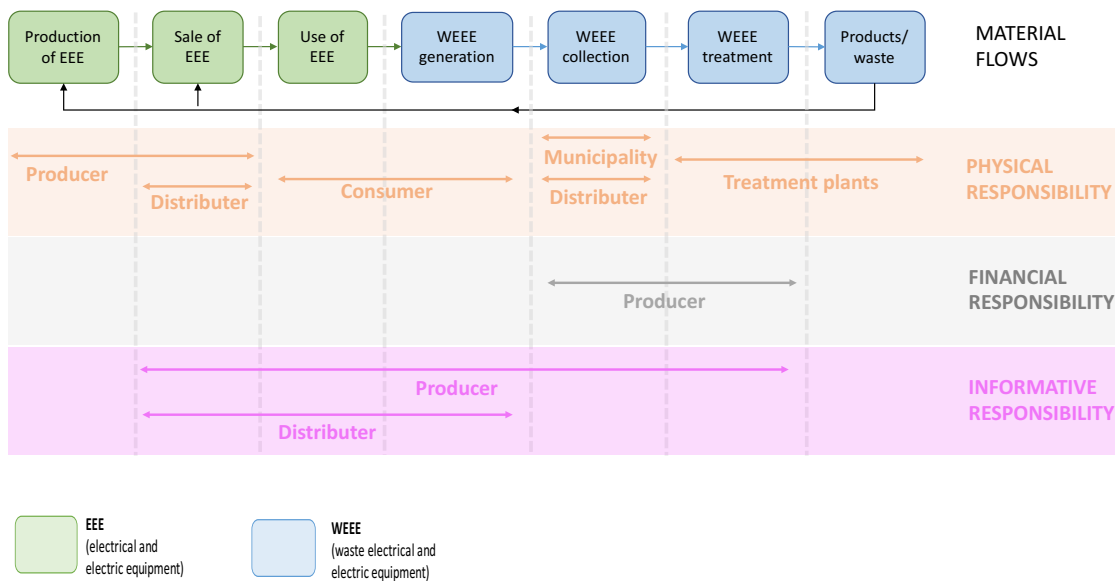


Figure 2-8 Mapping of responsibilities in WEEE management

Source: own

2.5.5 Stakeholders

Now that the material flows and the responsibilities within the system are mapped out, the main stakeholders along the value chain are presented in this section. The main actors in the Italian national system for WEEE management are briefly presented below, defining who they are and what their main responsibilities are. The mapping out of the system done above along with an analysis of the legal text helps to identify who the relevant stakeholders are within the system. It is important to analyse the different stakeholders as they directly affect the performance of the system. Hence understanding their view on the system is essential for identifying areas in which improvement is needed.

2.5.5.1 Governmental bodies

The implementation of the national management system, including the transposition of EU requirements is done by the appointed governmental body, the Ministry of Environment and Protection of Land and Sea. Its' responsibilities are vaguely outlined in the decree and include promoting cooperation between producers and recyclers, facilitating eco-design of EEE and

ensuring a market for recycled materials (D.Lgs. n. 49/2014). It is also in charge of establishing and operating the Committee of Vigilance and Control (Comitato di Vigilanza e Controllo) and the Steering Committee (Comitato d'indirizzo sulla gestione dei RAEE), both in charge of monitoring the implementation of the legislative requirements (La Forgia, 2015). Furthermore, the Committee of Vigilance and Control is also in charge of running the national register to collect data on the EEE declared PoM by producers.

2.5.5.2 Administrative body (clearinghouse)

The clearinghouse is in charge of the administrative aspects of the system, including national registers of producers and data collection of flows going through the formal stream (Kunz et al., 2014). It is the entity overseeing the logistics of waste allocation between PROs. Above all of the system activities is the Italian clearinghouse, CdC RAEE. Its main task, according to legislation, is to ensure the system is operating uniformly across the national territory (D. Lgs. n. 49/2014). This is done through a logarithm that annually assigns collection centres to each PRO according to the market share of their registered producers and other factors (Capurso, 2014). Furthermore, the CdC RAEE is in charge of implementing agreements with various stakeholders (e.g. municipalities and recyclers) in order to define general conditions and details on the system (CdC RAEE, 2015). The clearing house works closely with the monitoring bodies mentioned above, ensuring monitoring and data collection (D. Lgs. n. 49/2014). The clearinghouse has a central role because all activities are overseen and go through it. For example, they need to ensure that pick-up of WEEE from collection centres to go to treatment plants is done in a timely manner and across the whole national territory.

2.5.5.3 Producers

Producers are any person or entity that manufactures EEE in an EU Member State and/or sells EEE within an EU Member State (Directive 2012/19/EU). They are the main actors within the system as the responsibility of achieving EU targets is on them (Kunz et al., 2014; La Forgia, 2015). In being the main actors in the system, they have several responsibilities. These include enrolling and reporting to the national register and meeting targets through individual or collective systems. They shall also provide adequate information to consumers on how to dispose of products and the potential environmental impacts if WEEE isn't disposed of properly. They shall also provide information to recyclers on how to process and treat WEEE resulting from their products. As previously mentioned, producers can also apply an extra fee on their products, called eco-contribution, of which the proceeds go to the financing of the WEEE management system (D. Lgs. n. 49/2014). This is a way of shifting part of the financial burden to consumers. This fee can be visible or invisible, the latter meaning the fee is part of the product price (consumer/distributor does not know its amount).

2.5.5.4 Producer Responsibility Organisations (PROs)

Producers that decide to fulfil their responsibilities in a collective manner join one of the 15 national collective systems (PRO). As mentioned earlier, PROs are producer consortiums that act as organisational arm for producers, helping them achieve their requirements and targets (Kunz et al., 2014). Their activities usually include: organising the collection, transport and treatment of waste; managing the financial responsibilities of producers across the value chain; and ensuring their member producers comply with legislative requirements (Mayers and Butler, 2013).

In Italy, these entities are non-for-profit consortia in charge of ensuring the collection of WEEE from the municipal collection centres they have been assigned by the CdC RAEE (D. Lgs. n. 49/2014). They are also required to collect WEEE from distributors and ensure proper

treatment of WEEE. Essentially, they are in charge of many activities throughout the WEEE management system. All PROs shall operate under ISO 9001 and ISO 14001 certification or equivalent and they shall report data and annual action plans back to the CdC RAEE and the Ministry (La Forgia, 2015). PROs are also referred to as collective systems or compliance schemes (Rossem, 2008).

2.5.5.5 Distributors

Distributors are any person or entity that makes EEE available on the market (Directive 2012/19/EU). Essentially, any retailer that is selling EEE directly to consumers. They could also be producers in certain cases.

Distributors, selling EEE directly to end-users, also have responsibilities (physical) regarding the collection of WEEE. According to the decree, they shall collect WEEE under the one-to-one mechanism, which entails collecting a WEEE for every equivalent product sold to a consumer (D. Lgs. n. 49/2014). This means that when a consumer buys a new product (e.g. printer), the distributor they buy it from shall collect an equivalent product that the consumer is replacing at the time of purchase (e.g. old printer).

The 2014 decree also introduces the one-to-zero mechanism by which distributors collect WEEE free of charge from consumers without requiring the purchase of a new product. This is mandatory for all distributors with selling grounds larger than 400m² (La Forgia, 2015). Moreover, distributors are also required to inform consumers about this collection option either at the store or online. The WEEE collected at the retail point is delivered to a regrouping point or to a municipal collection centre. If delivered to a regrouping point, the waste can then be transported to a municipal collection centre or straight to the treatment plant (see Figure 2-8). Despite having several tasks as an actor within the system, the decree is quite hazy in defining these duties and leaves room for interpretation (La Forgia, 2015).

2.5.5.6 Consumers

A consumer is a person who buys an EEE, uses it, and then needs to dispose of it at the end-of-life (OECD, 2001). It can be both a private household or professional user (Directive 2012/19/EU). Consumers are the ultimate generators of WEEE and they are the ones holding the waste and needing to dispose of it properly to give the system fuel to operate. They can dispose of WEEE through their respective municipal collection centre, a distributor, and in some cases, through home collection. Their level of education is highly influential in determining the use of established WEEE management systems through the correct disposal of end-of-life products (Ylä-mella et al., 2014b). A study undertaken by Fiorillo (2013) on household waste recycling behaviour in Italy finds that higher levels of recycling are linked to higher awareness levels due to membership to NGOs, interest in politics and regular reading of newspapers.

2.5.5.7 Municipalities

Municipalities are local governments responsible for organising and administering public activities and affairs within their districts (OECD, 2001). In the Italian WEEE legislation, municipalities (as well as distributors) are given the physical responsibility of providing adequate collection centres in their territory. They are an important actor as they are closely related and communicating to citizens. In the WEEE management system, their role is to provide municipal collection centres for their citizens to conveniently dispose their WEEE free of charge (Kunz et al., 2014). If a municipality does not have a collection centre they can

use another municipality's facilities under a formal agreement (D. Lgs. n. 49/2014). In 2015, there were a total of 3906 municipal collection centres in Italy (CdC RAEE, 2015).

2.5.5.8 Waste management companies

Waste management companies are often the organisations that are delegated the task by municipalities of operational management of waste (Kunz et al., 2014). These companies usually work for municipalities, taking on the operational and logistical aspects of waste collection within the administrative divisions (OECD, 2001). This often includes aspects such as providing infrastructure for waste collection (Gui et al., 2013). At the collection centres, they receive WEEE and divide it into the five groupings so it is ready to get transported to treatment plants (La Forgia, 2015).

2.5.5.9 Recyclers

Finally, WEEE reaches the end of the extensive chain at the treatment plants⁵, where recyclers collect waste that is transported to them and they then operate the pre-treatment, treatment and recovery processes (Ylä-Mella et al., 2014b). These bodies have strict technical requirements to follow to ensure their operations do not in any way damage the environment. Products have to go through several stages (storage, shredding, separating of materials, etc.) for the treatment to be complete, making their tasks quite varied and complex (La Forgia, 2015). Additionally, they are supposed to report on the weight and components of the waste received and processed by them (D. Lgs. n. 49/2014). In 2015, there were a total of 957 registered treatment plants on the national territory (CdC RAEE, 2015).

2.6 Theory and framework

2.6.1 Theoretical background

The approach this research is taking to address the research questions is a policy evaluation in which the policy under consideration (transposition of the WEEE Directive, Legislative Decree n. 49/2014) is being assessed. Evaluation is defined as “the process of determining the merit, worth and value of things” (Scriven, 1991, cited by Vedung, 1997). Evaluation is often used as an approach for studying public interventions. A public intervention signifies the program or policy that is implemented by a public authority. Hence, intervention theory, is a theory based evaluation which aims to reconstruct the intervention (policy/program) and how it was projected to run, in order to then assess its outcomes (Richter, 2015). It is mainly used as a guide for data collection and analysis, helping to identify the areas in which a public intervention may be improved (Mickwitz, 2006). Vedung (1997) formally defines intervention theory as:

“All empirical and normative suppositions that public interventions rest upon; also referred to as a program theory, the program theory’s action, the impact model, the policy theory, or the reasoning undergirding the program (activity).”

An important aspect of intervention theory is identifying the stakeholders, as done above. A stakeholder is an actor affected by and having an interest in the intervention, its activities, implementation and outcomes (Hansen and Vedung, 2010). Identifying the key stakeholders (or actors) is important as their input contributes to the reconstruction of the public

⁵ Note: treatment plants are operated by recyclers. In this paper, when reference is made to treatment plants the relevant stakeholders are recyclers.

intervention (Richter, 2015) and their perspectives, concerns and expectations can be highlighted.

2.6.2 Intervention theory

Figure 2-10 introduces a schematic mapping of a general public intervention. The initial needs are what determine the underlying issues, which are then addressed by the policy intervention that seeks to achieve the intermediate and final outcomes through the output. The needs and the final outcome should correspond as a result of the policy intervention. However, since the needs and the final outcome are usually more general and of wider scope, they will not be assessed in this research. This paper zooms in and seeks to assess the policy intervention's success in bringing about the outputs and intermediate outcomes. In Figure 2-10, this is outlined by the dashed box. Outputs are what the target group (stakeholders) are faced with as a result of the implementation of the public intervention (Mickwitz, 2006). Outcomes are the resulting actions taken by those stakeholders with the use of the outputs as well as the consequences of their actions (Mickwitz, 2006).

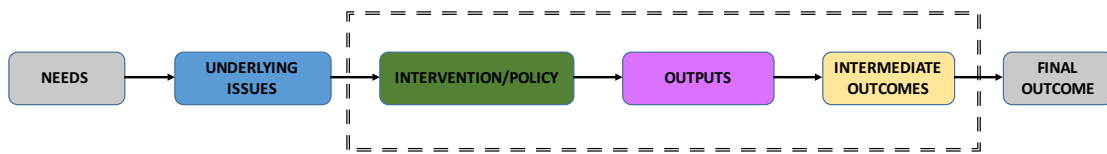


Figure 2-9 Mapping of a general intervention theory

Source: own, adapted from Vedung (1997)

2.6.3 Performance criteria

The focus here is on the causes and effects of public interventions through an *ex post* policy analysis (Vedung, 1997). Intervention theory is hence utilised to structure the first part of this research. Vedung (1997) proposes the use of intervention theory to outline how the policy is intended to function. It is used to guide the initial data collection and identify key stakeholders by reconstructing the policy intervention. Once this first step (policy reconstruction) is completed, the second step entails determining criteria against which the policy will be evaluated. As evaluation is a normative judgement, it needs to be based on a pre-established benchmark (Mickwitz, 2006). For this study, three criteria are determined for the policy evaluation: effectiveness, legitimacy and transparency. These criteria, here onwards referred to as performance criteria, are used to assess the intervention theory that has been laid out. Essentially, the performance of the public program (Italian WEEE management system) is assessed according to a set of criteria in order to determine whether the initial goals coincide with the resulting outcomes. The intervention theory together with the performance criteria represent the analytical framework for this thesis.

Effectiveness is a commonly used criterion in policy evaluation which looks at the policy outcomes in relation to its goals (Richter, 2015). This is also known as goal-attainment⁶ evaluation, where two questions are to be answered: (1) are the results in accordance to the goal?; and (2) are the results produced by the program? (Vedung, 1997). In the scope of this research, this includes assessing whether WEEE collection targets are being achieved (question

⁶ The terms goal-attainment and goal-achievement are used interchangeably in this thesis

1) and whether they are being achieved according to the procedures and rules set by the legislation (question 2). This addresses the goals of the WEEE Directive that this study aims to assess: improved management practices. Enhanced operational management is reflected in higher collection rates (Niza et al., 2014), explaining the reason why this criterion is being assessed in terms of target achievement. As mentioned earlier, the WEEE Directive, and subsequently the Italian implementing legislation, have other goals aside from improved waste management (operational improvements). These are improved eco-design (design for environment) and closing material loops (reusing recycled parts). However, as these are outside the scope of this thesis, they will not be assessed in terms of goal-achievement.

The second and third performance criteria, legitimacy and transparency, are not as straightforward and simple as the first as they involve stakeholder consultation, which seeks to incorporate actors' perspectives on various elements of the system. **Legitimacy** looks at various aspects of stakeholder concerns to determine the extent to which the policy is received and acknowledged by them. Suchman (1995) defines it as a “generalised perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions”. In the context of this study, it is not the legitimacy of one entity that is being assessed, rather that of the policy intervention as a whole. Essentially, legitimacy is the perception and the reaction of observers (stakeholders) to the policy and the support given to it based on their views, feelings and objectives (Bemelmans-Vidéc et al., 1998). It is important to have a legitimate system as it is the key in determining its performance and credibility (Parsons, 1960). This is closely related to **transparency**, the third criterion, which looks at how clear, straightforward and open the system is towards key actors operating within it. This criterion is very important as every citizen has the right to get information about a system to which they contribute (Monier et al., 2014). In addition, having a transparent system is essential for proper accountability and can help ensure participation from stakeholders (Stern and Holder, 1999). Lastly, transparency also allows for better predictability, both of regulatory changes and trends in future flows (Stern and Holder, 1999). Both legitimacy and transparency are determined by the level of stakeholder awareness of the overall system, duties, trends, targets, etc. In summary, the performance criteria are defined as follows:

Table 2-5 Performance criteria for policy evaluation

Performance Criteria	Definition
Effectiveness (goal-attainment)	The degree to which the intended goals of the policy instrument are in line with the achieved outcomes (Mickwitz, 2006)
Legitimacy	Degree of acceptance of the policy instrument on behalf of the stakeholders (Mickwitz, 2006)
Transparency	Degree to which the outputs, outcomes and process of the policy instrument are observable (Mickwitz, 2006) and the degree to which relevant information is available to all stakeholders.

Source: own

Other studies use these criteria for evaluation. For example, Mickwitz and Hildén (2004) use effectiveness and transparency (amongst others) to evaluate the wastewater permit system in Finland. Ylä-mella et al. (2014a) study the performance of the WEEE Directive implementation in Finland by assessing the collection rates and highlight the challenges to its effective management. A study conducted by Richter and Koppejan (2015) also uses

effectiveness as an evaluation criterion for WEEE legislation on gas discharge lamps in Nordic countries. Huisman *et al.* (2015) suggest several measures to enhance legitimacy in order to counter illegal waste handling. These include increasing the harmonisation of the system, keeping guidelines consistent, improving monitoring and having smarter inspections.

There are many other criteria that can be used for a policy evaluation. Mickwitz (2006) proposes several, such as: relevance; flexibility; predictability; persistence; efficiency; and equity. The OECD proposes five criteria for evaluation: efficiency; effectiveness; impact; relevance; and sustainability (OECD/DAC, 1991). Bemelman-Videc *et al.* (1998) suggest the use of effectiveness, efficiency, legality, democracy and legitimacy to evaluate public policies. The reason why effectiveness, legitimacy and transparency are chosen as criteria for this research is because of their relevance to the scope and research questions. The outcome that is being evaluated, improved management practices, can be assessed in various ways. Effectiveness looks at the rather objective side of the policy, evaluating whether the collection targets have been achieved or not. As seen in the above sections, Italy has met the prior target (4kg/per capita/per year). Looking at the trends in collection rates in the past years is useful to predict what path the country is taking in working towards the new targets set under the recast Directive.

On the other hand, legitimacy and transparency focus more on evaluating the perception of stakeholders and their roles within the system. Legitimacy is suitable in this context as there are several actors involved in the system, with several roles and activities to be undertaken (as seen in Sections 2.5.4. and 2.5.5.). Italy is a country with high levels of bureaucracy and often lengthy and complicated processes. Lastly, transparency is a highly relevant criterion since Italy provides for a good case in which data availability and communication are often somewhat disregarded. All in all, with these three criteria, many aspects that determine the degree of performance of this policy instrument are considered.

Furthermore, these criteria seem adequate for this evaluation due to the context in which the evaluation is undertaken. The case study on the municipality of Parma is integrated with this process as it follows the same steps and the same framework. The evaluation of the three criteria both at the national level and for the local case study correspond to the second research question (RQ2) guiding this thesis. The four sub questions relate to each criteria and to the case study respectively (Table 2-6). Beside each sub question is the relevant part of the evaluation that assesses it.

Table 2-6 Research question 2 and sub questions

RQ2: How is the national system operating with respect to the legislative requirements?	
Are the targets being met?	Effectiveness
How do the different stakeholders receive the policy?	Legitimacy
How transparent is the program?	Transparency
Is the performance at the local/municipal level consistent with the national level?	Case study

Source: *own*

2.6.4 Analytical framework

Figure 2-10 is the framework developed for this paper. It is further expanded from the general mapping of the intervention theory introduced above. Here the intervention theory is mapped out for the WEEE system in Italy. This is completed with the content retrieved from the literature review and will be the basis for evaluation. The intermediate outcomes (yellow) are

essentially the three main objectives of the WEEE Directive. Once again, the focus of this paper is on improved waste management practices. Eco-design and closing material loops are out of the scope despite their significant importance, explaining why they are greyed out in the Figure below.

The objective here is to assess whether the intervention succeeds at achieving the intermediate outcomes (for this thesis, solely improved waste management practices). This is done by evaluating the policy against the three criteria: effectiveness, legitimacy and transparency.

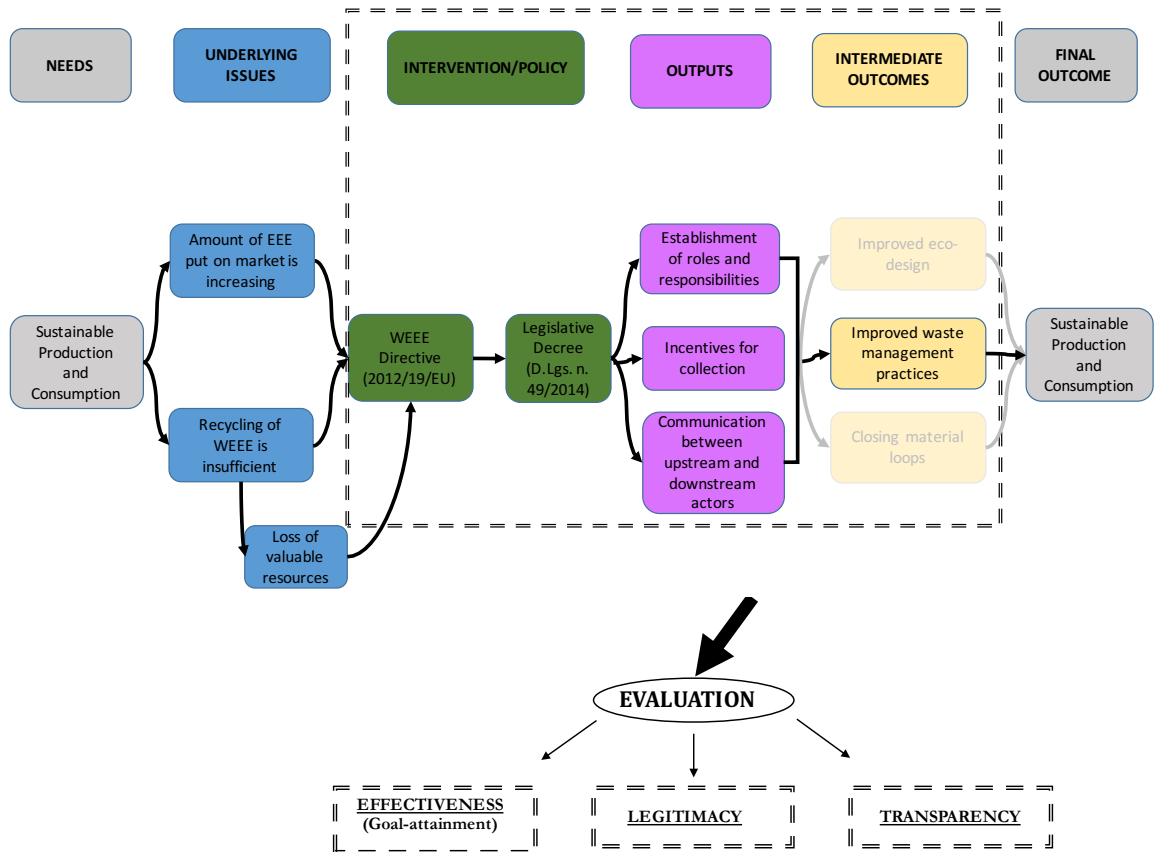


Figure 2-10 Framework for analysis

Source: own

3 Methodology

This chapter describes the design of this study, methods used for data collection and analysis. The main steps undertaken in this research are presented in Figure 3-1. Initially (1) the policy intervention is reconstructed through a literature review of existing and available sources. This is followed by (2) data collection, mainly including interviews with stakeholders but also quantitative data collection. The next step involves (3) data analysis. Here, the data collected is gathered and analysed using the framework presented in Section 2.6.4. This section also addresses the research questions and provides recommendations for improving system performance. Finally, the paper ends with a section on (4) reflections and conclusions, including suggestions for further research. The case study on the municipality of Parma is embedded and addressed throughout these steps as a way of assessing whether the findings at the national level are reflected also at the local level.

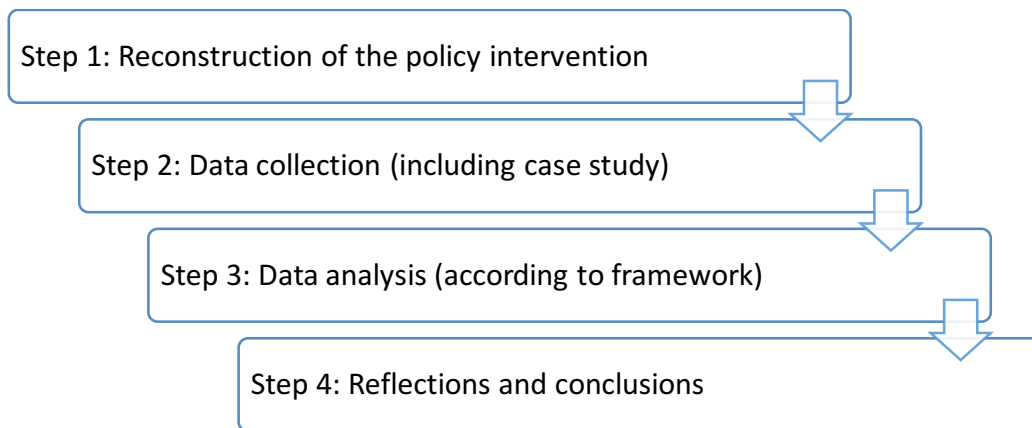


Figure 3-1 The 4-step approach to Policy Evaluation

Source: own, adapted from Vedung, 1997

Table 3-1 presents the research questions guiding this paper and the subsequent methods used to gather data to address each one. Each method is described in the following sections.

Table 3-1 Research questions and methods for data collection

Research questions	Method(s)
RQ1: What are the roles and responsibilities of the stakeholders involved in the national WEEE management system?	Literature review
RQ2: How is the national system operating with respect to the legislative requirements?	Quantitative data collection Interviews with stakeholders
RQ3: How can the performance of the national WEEE management system be enhanced in order to achieve EU targets?	Interviews with stakeholders

Source: own

3.1 Data collection

This paper uses the triangulation method for data collection, gathering data through various approaches (literature review, interviews and data collection). This method is used as it allows for a comprehensive study which takes into account various information sources and types, and facilitates the validation of the study. Using different methods for data collection is a way of enriching and confirming information and results from different sources. A literature review is conducted in order to collect information about: general EU environmental legislation, background on EPR, recent global and EU trends in e-waste and e-waste in Italy. Literature is also consulted to develop the analytical framework. Mostly academic literature and reports are reviewed and accessed through Google scholar and Lund University's search engine.

Data collection, quantitative and qualitative, is another method used for this thesis. The part on quantitative data collection is used to gather information on trends in Italy (e.g. collection rates). This is needed in order to assess the first criteria, effectiveness (goal-attainment). Several sources are used in order to compare and assess the validity of the information, including Eurostat database (EU statistical database), ISPRA (Italian National Institute for Environmental Protection and Research), CdC RAEE data, PRO data and waste management company data. As part of the data collection, reports and documents from various stakeholders are retrieved and used in conjunction with the other data gathered. These include annual reports, project reports, presentations, websites, etc. This is an important part of the research as it is key in determining several aspects, such as the degree of information availability and transparency within the system.

The third source for data collection are stakeholder interviews. The aim of the author is to conduct at least one interview with each stakeholder group. Most of the contacts with the stakeholders is facilitated by ERP Italia. A total of 15 interviews are conducted, either in person or on the phone, between June and July 2016. Unfortunately, the two stakeholder groups that are not interviewed are distributors and governmental bodies because of their lack of responsiveness despite the author's attempt to interview them. Through intervention theory and mapping out of the system, the key stakeholders to interview are chosen. Background interviews are also conducted with stakeholders indirectly involved in the system (noted as "other" in the list below). This is useful in giving an additional critical input to the research and giving the author an idea of what direction the research findings will take. The interviews that are conducted are the following:

- Producers: EPSON Italia S.p.A. and Stanley Black & Decker
- PROs: ERP Italia, Remedia
- Clearing house: CdC RAEE
- Municipality: Parma
- Waste management company: Iren Ambiente S.p.A.
- Recyclers: RELIGHT S.r.l., Tred Carpi S.r.l.
- Other: academics, industry association for municipalities (ANCI Energia & Rifiuti), regional waste management agency for Emilia-Romagna (ATERSIR), WEEE Europe AG

The findings from the Parma case study will be included in the findings and analysis where applicable. Taking an in-depth view of the WEEE management system at the municipal level is interesting as it reveals certain details and challenges that could be omitted when assessing

the system at the national level. In addition, the case study is undertaken in order to assess whether the findings resulting at the national level are reflected also at the local/municipal level. The stakeholders interviewed specifically for the case study are the following:

- Municipality of Parma - Gabriele Folli, Assessor for Environment
- Iren Ambiente S.p.A. – Luigi Zoni, Environmental Services Manager of Parma
- ATERSIR – Leonardo Malatesta, Waste Management Division

Through these interviews and on-site visits, several interesting findings are highlighted, some of which bring to light more general issues of the national system.

The interviews are all semi-structured and address various aspects of the Italian waste management system including challenges, communication and monitoring. These topics are addressed in the findings section. All interviews are audio recorded with consent of the interviewees to facilitate note taking. An interview guide is used in order to give structure and ensure certain concepts are covered throughout. Although there is a common structure to all the interviews, some of the questions are changed depending on the stakeholder. A sample interview guide can be found in Appendix III. Once completed, the interviews are transcribed and the relevant information is grouped into categories to be processed together with the other collected data according to the analytical framework. The interviews are not analysed in a quantitative manner (how many times one issue is brought up relative to another), rather a discourse analysis is undertaken along with a rough coding of the content. Discourse analysis studies the language used in communicating information about the policy and how society perceives and makes sense of it (Hajer & Versteeg, 2005). This means that it is not necessarily important how many times an argument is made, but who makes it and in what context.

3.2 Collaboration/partners

This research is undertaken in close collaboration with the European Recycling Platform (ERP) Italia, one of the 15 PROs in Italy. ERP is a Pan-European organisation which works to implement the EU's WEEE regulation. Constant contact is kept with them throughout the whole process of the thesis. They are very proactive actors within the system and are open to research, projects and collaborations.

4 Findings

This section presents the findings from the different methods used for this research: literature review, quantitative data analysis and interviews. The areas in which the observations from the literature review, interviews and data analysis converge are highlighted in this section as well as the aspects that reveal multiple perspectives. The results are presented in this chapter and serve as a basis for the analysis and discussion (Section 5), where the three research questions are addressed. The findings are structured in a way that follows the analytical framework. As a first step, a detailed mapping of the implementation chain for the policy intervention is completed (Figure 4-1). This is done through the findings from the literature review with additional input from the interviews.

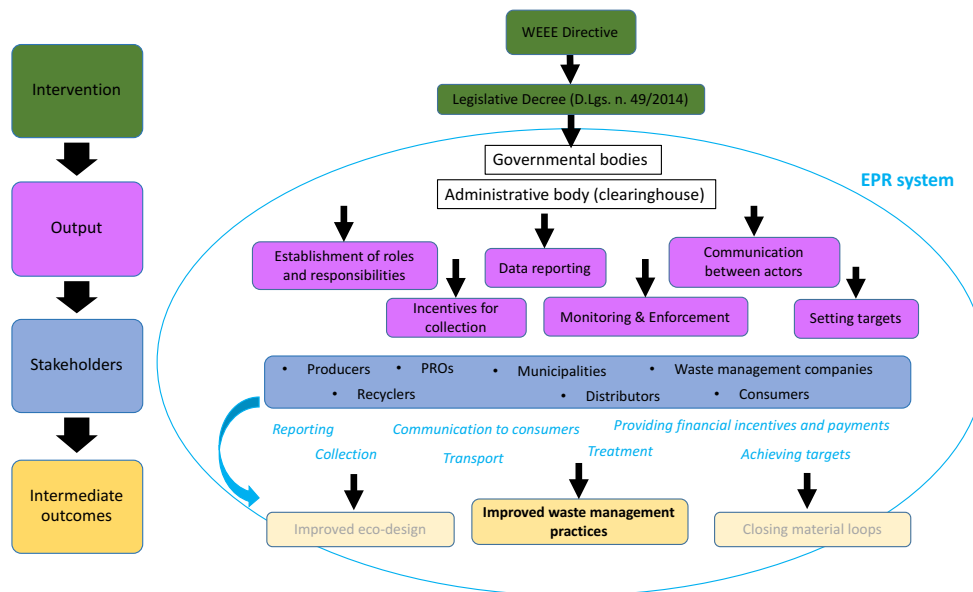


Figure 4-1 Implementation chain for WEEE system in Italy

Source: own

This figure presents an extension of the general intervention theory outlined earlier in Section 2.6. The process on the left recalls the main steps of the intervention that are being evaluated in this paper. What is being assessed is whether the intervention is successfully achieving the intended outcomes. The EPR system is delineated within the light blue sphere, which is subdivided into various processes/parts. In purple are the main outputs of the intervention. The yellow boxes represent the three main intended outcomes of the policy. Once again, the focus of this paper is on waste management practices and not on the other two objectives of the legislation (eco-design and closing material loops). Between the outputs and the outcomes are the system stakeholders and the activities and responsibilities that should be fulfilled by them in order to achieve the outcomes (e.g. reporting, collection, etc.). Essentially the top part looks at whether the roles and activities are properly implemented whereas the bottom part looks at whether the implemented roles and activities are being respected and fulfilled.

The findings from the literature review, quantitative data analysis and interviews is presented following the implementation chain. First, the findings from intervention outputs (Section 4.1.), followed by the findings relating to the intended intermediate outcomes (Section 4.2.). The findings mainly highlight challenges within the system, positive aspects are also touched upon but will be addressed further in the analysis and discussion section (Section 5).

4.1 Outputs

4.1.1 Monitoring and enforcement

Monitoring, one of the key factors required within a system with many stakeholders and activities, is a recurring issue brought up in most of the interviews. A representative of ERP Italy confirms that monitoring of activities is essential to ensure they are done correctly (personal communication). The Italian national WEEE legislation lays down the rules and conditions for the establishment of the Vigilance and Control Committee (“Comitato di Vigilanza e Controllo”) with the role of monitoring and implementing the legislative requirements. The interviews bring up several interesting insights regarding this monitoring body. Some of the comments made on the Committee are not coinciding, with some claiming it is existing but not functioning and others claiming it has never been established.

Certain stakeholders comment that the Committee exists in theory (in legislation) however it is not operational yet (Relight S.r.l., EPSON Italia S.p.A, Stanley Black & Decker). Bibiana Ferrari, CEO of Relight S.r.l. mentions that *“a body that can act as an arbiter doesn’t practically exist in Italy. And why is this the case? I guess because there is lack of funds.”* (B. Ferrari, personal communication, 22 June 2016). The two producers interviewed mention that the Committee should be up and running soon since a new decree just came out (July 2016) for financing its activities. The producers have received a request to contribute to the financing of the Committee but the modalities are not clear.

Contrastingly, certain actors mention that the Committee is up and operational despite the existence of many issues. The CdC RAEE claims that it exists but it is a big problem to get it to fully operate as there is severe lack of transparency on the Committee’s behalf. Marinella Favot, researcher at University of Udine, has tried several times to contact the Committee to get further information but has not been able to. Through the website it is not possible to find relevant contacts. She further comments that *“even if the Committee were operating, how could it function if it is impossible to contact them?”* (M. Favot, personal communication, 1 July 2016).

Free-riding is identified as another issue within the national system. Free-riders are those that enjoy the benefits of the system without contributing to it (Khetriwal et al., 2009). Some producers of EEE free-ride by not joining any PRO, hence not paying, but still allowing the waste resulting from their products to be channelled through the formal system (M. Favot, personal communication). This is a problem for the producers who are operating legally as it increases the costs for them (C. Parapini, personal communication). The online sector is also free-riding most of the time as the producers are not aware they need to register. With those that are registered, the challenge lies in monitoring and enforcing them (C. Ludwig, personal communication).

In terms of monitoring on behalf of the clearinghouse, certain stakeholders mention that the clearinghouse does monitor certain aspects. The representative for EPSON Italia S.p.A. states that CdC RAEE does random audits asking them to re-declare the amounts PoM in order to check if they coincide with what the producer has previously declared (L. Cassani, personal communication).

The SISTRI reporting tool, a national information system to monitor hazardous and non-hazardous waste in Italy, also appears to be a main point of controversy. This new tool is introduced to replace hand-filled registers, simplify the system for the stakeholders and improve traceability and monitoring. However, ERP Italy says that despite the software being operational and functioning, it is not useful and only provides extra bureaucratic weight. The

digital reporting tool is introduced with the intention of replacing all paper work involved in registration, however it does not replace anything but just adds an extra task. The current SISTRI tool is said to be “like a hurricane: it brings a lot of chaos but no benefits to anyone and it keeps on soaking up money from the system” (A Bizzi, personal communication, 6 July 2016).

4.1.2 Reporting

Data availability on material flows seems to be patchy for the case of Italy. Eurostat should include data from all Member States on WEEE flows as a total and for each of the ten categories. For Italy, there is somewhat complete data for total waste (Eurostat, 2016). However, when it comes to figures for each category, the only statistics that are available are the weight of “Put on Market” and the weight of “waste collection from households”. Data on “waste collection from other sources”, “waste treated”, “reuse”, “recovery” and “recycling and reuse” are not available for the last eight years and very limited prior to then. The clearinghouse together with ISPRA, have developed a conversion table to adapt the five groupings into the ten EU categories (Table 4-1). This table is meant to be used by the governmental bodies, in charge of verifying whether EU targets are being met or not.

Table 4-1 Conversion from five Italian product groupings to ten Directive categories

R1	100%									
R2	100%									
R3			17,282%	82,718%						
R4		20,168%	61,839%	12,122%	1,279%	1,834%	0,601%	0,551%	1,541%	0,065%
R5					100%					

Source: CdC RAEE, personal communication

There also seems to be some data inconsistencies amongst different databases (Tables 4-2 and 4-3). The inconsistency between the sources is likely to be due to different entities reporting to these sources. The CdC RAEE only reports on data flows going through the formal system, whereas in theory Eurostat also reports on parallel flows (i.e. individual producers, etc.). ISPRA seems to have the same figures as Eurostat. Since Eurostat should be reporting both on flows going through CdC RAEE as well as parallel flows, the figures reported should be of higher value. However, this is not the case for the dataset analysed here.

Table 4-2 Comparing data for products put on the market (PoM)

Source	2011 (tonnes)	2012 (tonnes)	2013 (tonnes)
Eurostat	993,997	892,910	864,720
ISPRA	na	na	na
CdC RAEE	894,782	781,623	760,320

Sources: own, data from Eurostat, ISPRA and CdC RAEE

Table 4-3 Comparing data for waste collected from households

Source	2011 (tonnes)	2012 (tonnes)	2013 (tonnes)
Eurostat	249,326	219,672	209,173
ISPRA	249,300	219,700	209,200
CdC RAEE	260,090	237,966	225,931

Sources: own, data from Eurostat, ISPRA and CdC RAEE

Nevertheless, despite this discrepancy, the data does seem to follow the same trends. That is, both products PoM and waste collected from households decreased between 2011 and 2013. A study undertaken by Favot et al. (2016) suggests that these decreasing trends are a result of the economic crisis that hit the country in those years, leading to a decrease in EEE sold and in turn households holding on to their old products for longer, reducing the flows going into collection and treatment.

4.1.3 Structural problems

The fact that Italy has a WEEE management system with many PROs is seen as negative by several stakeholders interviewed. On the operational level, it is hard to operate and monitor for the clearinghouse since each PRO is different but shall be provided with the same service regardless (S. Mussetta, personal communication). The risk of having so many PROs is to double up the infrastructure and create unnecessary costs if they are not coordinated properly (C. Ludwig; B. Ferrari, E. Baraldi, personal communication). It is a challenge to regulate so many entities, set rules that are adequate for all, control and enforce (I. Capurso, personal communication). Also, in being the coordination body, the clearinghouse is set up in a way that requires all activities and processes to go through it. It is however noted that one interviewed stakeholder in fact bypasses the clearinghouse as they find making their own arrangements (without going through the bureaucratic steps required by the system) is more expedient (anonymous, personal communication).

Furthermore, as previously mentioned, it is practically impossible for producers to operate individually although in theory it is allowed by legislation (A. Canni Ferrari, personal communication). It is only those producers that manufacture very rare products over which they have full traceability, such as luxury goods, medical equipment, etc. who can consider operating individually. Hence, the system is set up in a way that only allows collective producer responsibility to thrive (M. Favot, personal communication).

Aside from the challenges identified through the interviews, several positive aspects are mentioned as well. These include the existence of the clearinghouse, CdC RAEE, which is seen as a strength of the system, differentiating Italy from other countries. *“The CdC RAEE guarantees that the whole country has access to the system, from the big cities to the small hidden towns in the mountains”* (S. Mussetta, personal communication, 11 July 2016). Also, Christian Ludwig from WEEE Europe, a company providing services to producers across Europe, who has an EU perspective on the issue, confirms that the clearinghouse model seems to work quite well. The country manager of ERP Italy suggests that Italy is one of the best functioning systems in the EU, although it was set up a couple of years late, it is studied so that there is fair competition without negatively impacting other actors. More than half of the interviewed stakeholders agree that despite its flaws it is a system that operates relatively well.

The interview with Iren Ambiente S.p.A. is particularly interesting as it reveals certain practical challenges faced by the waste management company. For example, Luigi Zoni claims that the clearinghouse CdC RAEE should provide the collection centres with containers for WEEE but often these aren't the appropriate ones (personal communication). This issue falls within the output section of the implementation chain since it is likely that there is lack of role fulfilment on behalf of the clearinghouse.

The logistics of the system are also highlighted as a challenge in the case study by both the municipality and the waste management company in Parma. For Iren Ambiente S.p.A. the timing of collection is hard to manage logistically. Also, the coordination of how the WEEE is collected, where it is treated, etc. seems to cause concern. *“There is WEEE that is collected in*

Parma and then gets transported all the way to another region for treatment when there are plenty of treatment plants in this area. This is a flaw in the system that should be corrected” (G. Folli, personal communication, 8 July 2016). Only 37% of the collected waste was treated in the region in 2013 (Regione Emilia-Romagna & arpa, 2014). The representative of Atersir also comments on this issue claiming that the system in Italy is still too fragmented despite the clearinghouse’s efforts to harmonise it (personal communication).

4.1.4 Communication between actors

Filippo Bernocchi, delegate of ANCI Energia & Rifiuti, raises the point that in Italy the actors involved in the system are only aware of what is directly relevant to their functions, but lack overarching knowledge about how the system actually works. He further mentions that there are probably a handful of people with thorough knowledge of the Italian national WEEE management system, including policy-makers.

Communication between stakeholders happens mainly through industry associations (L. Cassani, B. Ferrari, personal communication). Industry associations usually represent each stakeholder group in the so called technical tables, or working parties (“gruppi di lavoro” and “tavoli tecnici”). Depending on the topic, there are different actors involved. Currently, the main topic that is being discussed is “loyal competition” between PROs (A. Canni Ferrari, personal communication). This means providing rules and common grounds for all the PROs to respect but at the same time allowing the system to remain competitive. Despite being a competitive system, there is consistent dialogue between PROs, especially regarding operational aspects of the system (I. Capurso, personal communication). *“The interface towards citizens has to be a functioning system and all PROs need to work together on this, of course maintaining competition amongst us (PROs) especially when it comes to producer membership”* (A. Bizzi, personal communication, 6 July 2016).

The clearinghouse, in being one of the central actors, communicates closely with many stakeholders, including waste management companies, distributors and recyclers (S. Mussetta, personal communication). However, Luigi Zoni from Iren Ambiente S.p.A., mentions that if they have a problem they turn towards CdC RAEE but no direct contact is possible (i.e. there is no phone number to call). The only means of communication is through email and this leads to lengthy and inefficient interactions (L. Zoni, personal communication). Producers, on the other hand, go to their respective PRO for help. Those interviewed are approving and satisfied with the support they receive (L. Cassani, C. Parapini, personal communication).

There are changes and updates to the clearinghouse system on a weekly basis and stakeholders stay updated either through newsletters or through personal research and word-of-mouth. Andrea Bizzi emphasises the importance of keeping all employees trained in order to ensure nobody misses out on any changes.

Furthermore, communication amongst actors is brought up as an important issue for recyclers. Bibiana Ferrari, CEO of the treatment plant Relight S.r.l., argues that recyclers need more information from producers. The only information they receive are the general guidelines on product disposal (those given to consumers). Since product technology is evolving so fast, it is a huge challenge for treatment plants to be able to put up with the changing products and identify the proper treatment practices for the whole range of incoming WEEE (M. Favot, personal communication). *“There is lack of information from producers on what they are doing and what they plan on doing with their products”* (B. Ferrari, personal communication, 22 June 2016). It is mainly policy-makers’ responsibility to address this issue; producers won’t spontaneously start providing this information to recyclers unless there is more communication between them and

recyclers (M. Favot, personal communication). When this issue is brought up with producers during interviews, they mention that they have no direct relationship with recyclers and that all interactions happen through PROs and the clearinghouse (L. Cassani, C. Parapini, personal communication). The recyclers are given very little voice in the broader WEEE management system. The clearinghouse settles agreements with other actors, indirectly including requirements for recyclers even though they have no negotiating position within this context (B. Ferrari, personal communication). The clearinghouse, CdC RAEE, has introduced “product cards” which are cards for general product categories including information on the parts, materials and treatment procedures (S. Daverio, personal communication). However, these cards are general and do not apply to single products.

The interview with the Assessor for Environment of the municipality of Parma reveals that they do not collaborate with any other municipality (other than the appointed waste management company) in the Province. He explains that every municipality does their own thing and manages WEEE alone unless they are very small and partner up with another small neighbouring municipality for collection services. Parma manages WEEE without any collaboration with other municipalities. Gabriele Folli continues explaining that:

“this is because there is no economic return to these activities, municipalities are not incentivised to collaborate since they won’t make more profit by collecting more or improving the efficiency of their collection. If we were to implement a project with other municipalities where we would make profit, then it would make sense. However, this isn’t the case.” (G. Folli, personal communication, 8 July 2016).

4.2 Intermediate outcomes

4.2.1 Distributors

The issue at cause here is the concern over the lack of action on behalf of distributors. In terms of the implementation chain, the distributors are one of the stakeholders within the EPR system and lie in between the system outputs and intermediate outcomes (blue box in Figure 4-1). The distributors, along with other actors, have the role of using the outputs in order to contribute to the realisation of the outcomes. This challenge (distributors) is being reviewed within the “intermediate outcomes” section because the challenge here involves the stakeholder group not fulfilling their prescribed tasks (outcomes).

This challenge emerging from the interviews is possibly the least obvious one judging from the literature review, but most of the interviewed actors show concern with regards to distributors’ responsibilities and their lack of performance. Interviewees representing producers, municipalities, PROs and Atersir (regional waste management agency) acknowledge that distributors are not collecting enough waste as they should be doing according to the one-to-one (or one-to-zero) mechanism. Isabella Capurso (Consorzio Remedia) mentions that medium and small distributors often aren’t aware of the system and its requirements or simply don’t engage with it in any way because it is not convenient for them. Furthermore, she adds that informing them and monitoring is very hard for the system. Also, it is revealed that it is hard to interact with distributors, especially the colossal multi-national ones, as they have other priorities on their agenda. The fact that certain distributors are not responsive to interview requests sent for this thesis is one of the limitations of this research but also confirms what interviewees argue (i.e. they are hard to communicate with).

The question of who is responsible for ensuring that distributors fulfil their tasks is posed by many actors. Iren Ambiente S.p.A. and Gabriele Folli from the municipality of Parma confirm that more effort is needed on behalf of distributors. However, it is not their responsibility to

ensure this is done and most importantly, the municipality or the waste management company do not have the power to do so. Luca Cassani from EPSON Italia S.p.A. indicates that despite the fact that producers have the responsibility of achieving targets, they do not have the authority to force distributors to collect products. He suggests that it should be consumers to push for this type of collection to happen as distributors are directly dependent on them.

Furthermore, Christian Ludwig from WEEE Europe, adds that the online sector is also an important challenge the system has to deal with today. He mentions that 25% of EEE is sold online in the EU today and that these online distributors are often not fulfilling their requirements in terms of WEEE management (e.g. not registering as producers). It is obvious that many of them are still not aware of their obligations and a lot of work is required to educate the sector and offer simple solutions to ensure compliance.

The challenge with distributors is also raised by both Gabriele Folli and Luigi Zoni where both acknowledge that distributors are not fulfilling their role in collecting WEEE (personal communication). They also add that it is not their responsibility to work on this issue and that it should be the clearinghouse who is in charge of this. The distributors are obliged to take in waste at their retail points but they don't advertise this at all and make it complicated for consumers to return the products (requiring several documents to be filled out by the consumer). Taking back WEEE increases costs for distributors and takes up more space and time, explaining why they are trying to avoid this. Leonardo Malatesta from Atersir emphasises that collection at retail points is an area that needs great development and if done properly could lead to substantial increases in collection rates (personal communication).

4.2.2 Communication towards consumers

Most interviews confirm this is one of the main challenges in the system since consumer knowledge is of very high importance and a key determinant of performance. The notion of who is responsible for providing information and increasing awareness of consumers seems to present a certain degree of discrepancy. Chiara Parapini (Stanley Black & Decker) says that distributors are the most responsible for providing information to consumers. Luca Cassani (EPSON Italia S.p.A.) on the other hand mentions that all actors within the system are responsible for communicating to citizens. Producers provide information to consumers on how to dispose of products in the instructions manual, catalogues and websites (Chiara Parapini, Luca Cassani, personal communication). PROs are also taking on this responsibility and are aware that this is one of their roles, however it is always with other actors that communication activities are undertaken (ERP Italy, Consorzio Remedia). There is a fund under the Program Agreement for communication campaigns directed towards consumers. However, the legislation seems to not clearly define who is in charge of communication. It is vague in suggesting that this role should be given to municipalities even if they lack the resources to do so (S. Mussetta, personal communication).

The interviewees at ERP Italy strongly emphasise the importance of communication towards consumers (A. Canni Ferrari, A. Bizzi, S. Charalambous, S. Daverio, personal communication). *"The citizen is essential in determining the functioning of the system, it is the major actor in the flow"* (S. Charalambous, personal communication, 6 July 2016). Although the PRO has been focusing on campaigns for battery collection, increasing attention is given to WEEE as well. However, WEEE is much more challenging as the nature of the product (size, material, etc.) limits its collection. The main challenge is trying to reduce the distance between the citizen and the point of collection; the closer they are the more waste they will dispose of. Lately, ERP Italy is using social media to increase awareness and education amongst citizens (e.g. mobile application for citizens to locate the closest collection point). ERP Italy has tried to initiate

projects with some municipalities to install permanent collection containers in schools, but this has not been realised due to lack of funds on behalf of municipalities.

Some examples of communication campaigns include RAEEScuola (WEEE school), an education program introduced in about 30 schools to increase collection of WEEE. In 2015, the fourth edition was launched. The campaign is introduced through the collaboration amongst many actors including the clearinghouse, some PROs, municipalities and waste management companies. The main focus of communication campaigns is on schools for now, but there is increasing effort to shift towards other means of communication and a broader target audience (S. Mussetta, personal communication). Most projects are with municipalities in the northern regions of Italy as they are the ones with more resources to allocate to these initiatives. However, the clearinghouse is trying to focus its attention on southern regions with less infrastructure and capacities (A. Bizzi, personal communication). The interviewed producers do not have any campaigns directed specifically to WEEE so far (L. Cassani, C. Parapini, personal communication).

The municipality of Parma is taking part in education campaigns such as RAEEScuola through the national municipality association (ANCI). Gabriele Folli comments that although the project is indeed quite successful in all the schools in which it is introduced, it is only a one-off activity and is not effective in increasing collection rates in the long-run (personal communication). The municipality (together with Iren Ambiente S.p.A.) has recently launched a project in 2015 that involves a moving recycling station which travels around the city on a pre-determined schedule and collects waste from citizens, including medium to small WEEE. However, this was also a one-off project. The municipality and Iren Ambiente S.p.A. have not initiated any WEEE specific projects themselves, only general waste communication for the city. This is because of the difficulties brought about by the nature of the products (hazardous, valuable, longer lifetime, etc.) (personal communication).

4.2.3 Financial incentives & payments

The Program Agreements, implementing acts of the Legislative Decree, are a very controversial topic amongst system stakeholders. Leonardo Malatesta (personal communication) claims that they are very important to implement as they help to ensure the system is achieving targets and functioning properly. More specifically, the need for financial incentives is tied to the fact that the real incentive for producers is missing today. Producers are not rewarded with discounts on WEEE compliance costs if they invest in eco-design, leading to little improvements despite the fact that this is one of the main objectives of the EU Directive (A. Canni Ferrari, personal communication).

The efficiency rewards are not subject to much appreciation despite the CdC RAEE claiming they allow for higher collection rates as they incentivise actors to collect more (S. Mussetta, personal communication). Sara Mussetta mentions these rewards are a very strong financial levy that push more actors to enter the system and fewer to operate outside it. However, several other stakeholders do not show much acknowledgment with regards to these financial incentives. The representatives from the interviewed recyclers argue that these rewards are not beneficial at all to the system and that they don't promote increased collection (E. Baraldi, personal communication). They claim that this money should be directed to recyclers and not to collection centres. They also suggest that the introduction of rewards has a discouraging effect on the individual collection and treatment (B. Ferrari, personal communication). Luigi Zoni (Iren Ambiente S.p.A.) agrees with this statement and further adds that rewards are used to optimise the system by filling up transport trucks to maximum capacity. He claims that in

small towns or cities it is hard to reach the levels required to obtain a financial reward. Parma has never received a financial reward (personal communication).

In addition, a point of discussion in interviews is which actor along the value chain is actually paying for the operation of the system. Either through a visible or invisible fee (included in price of product), it is the consumers who are paying for the system (S. Daverio, personal communication). Marinella Favot agrees that mostly tax-payers pay for the system up to the collection as it is heavily organised by municipalities, but mentions that producers are paying for it after collection and these costs might be internalised or passed on to consumers. The president of ANCI Energia & Rifiuti claims that all the responsibility is shifted to tax-payers (consumers) and that producers who should be financially responsible for collection are not.

Both Folli and Zoni show a somewhat neutral reaction to the topic of e-waste management and explain that the system closes at zero-costs, thus justifying the lack of motivation to go beyond current trends and further improve the system (personal communication). If the system does not offer profit to the municipality or the waste management company, there will be no additional effort to improve it beyond what is required by legislation. However, Marinella Favot adds that due to lack of economic data, it is impossible to know the financial burden on each stakeholder, explaining why it is still unclear who actually bears the costs of the system.

4.2.4 Target achievement

The stakeholders that identify target achievement as an issue are producers, PROs, the clearing house and the municipality association ANCI Energia & Rifiuti. The focus is mainly on the difficulty Italy is facing and will keep on facing in achieving targets, especially the ones set by the 2012 WEEE Directive recast. The CdC RAEE claims that in Italy, since the prior 4kg/per capita/per year target has been reached, nothing is being done to go beyond these targets to further increase collection rates (personal communication). Sara Mussetta also suggests that going beyond targets requires effort from all stakeholders, especially from policy-makers.

The new targets are calculated based on the weight of products PoM in the prior three years and some actors don't view this as an improvement to the system. Representatives from EPSON Italia S.p.A., ERP Italy and CdC RAEE also suggest that achieving targets is very complicated for Italy and is one of the major issues the system is faced with today. Filippo Bernocchi (ANCI Energia & Rifiuti) claims that having weight based targets is inappropriate as they do not take into account the reduction in weight of EEE in the past years. None of the interviewed stakeholders mention the possibility of using the alternative accounting method (85% of weight generated). Furthermore, he claims that another issue that is complicating target-achievement is the parallel market (informal and illegal) for WEEE, which represents a very high percentage of total flows but is mostly not accounted for in national data reporting. This relates to the comments made by the representative from EPSON Italia S.p.A., who personally thinks that in Italy the actual collection rates are higher than what is reported. He mentions that there is an accountability problem as products that are re-used (not sent for treatment) are not accounted for in the targets.

Going back to the case study, the only publicly available data that can be found on WEEE flows is at the Provincial level, no data is available solely on the municipality. However, Iren Ambiente S.p.A. provided the figures they have in their database on the amount of WEEE going through their collection centres (waste collected per year). There are a total of four collection centres in Parma, however only three of these collect WEEE as one of them is situated too close to a river to collect hazardous waste streams (G. Folli, personal communication). Iren Ambiente S.p.A. also collects large WEEE from households upon

request. Figure 4-2 shows the collection rates for the municipality of Parma and compares them to national collection rates. National figures are calculated according to the data provided by CdC RAEE, hence covering waste from collection centres only.

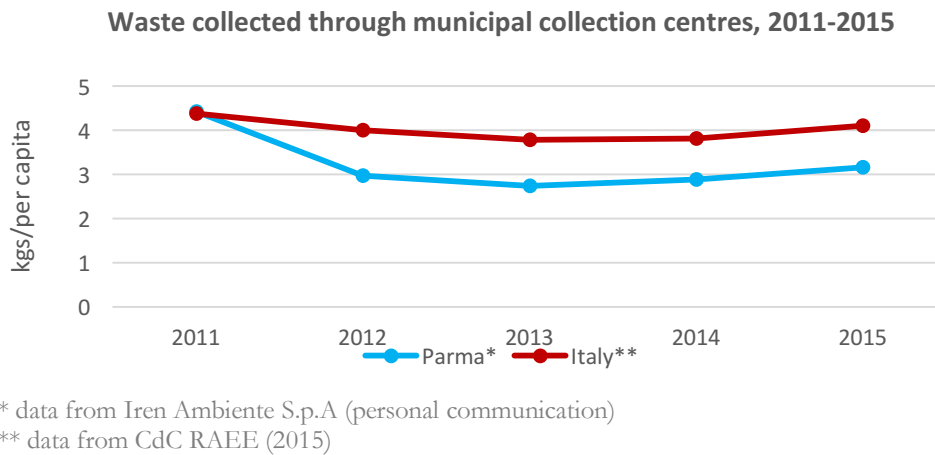


Figure 4-2 Collection rates in Parma vs. Italy⁷

Source: own

The first, most puzzling aspect that comes up when looking at the above figure is the decrease in collection rates between 2011 and 2013 both at the national and at the local level. Reports from the clearinghouse explain that this trend is due to the negative effects of the financial crisis on consumption of electronic and electrical goods (CdC RAEE, 2013). The decrease in purchasing of these products subsequently leads to a decrease in WEEE production. The CdC RAEE report further notes that the decrease in collection rates is smaller than the decrease in sales of these products, implying that the WEEE management system is maintaining its collection and treatment activities at a fairly constant rate.

The second interesting aspect about this figure is how collection rates in Parma compare to national figures. The two datasets seem to follow the same trend and proceed in a parallel manner. This suggests that what is found at the national level is also reflected at the local level, addressing the fourth sub question of RQ2: *Is the performance at the local/municipal level consistent with the national level?* However, while at the national level collection rates are very close to (if not reaching) the 4kg/per person target, at the municipal level the rates are well below the EU target.

It must be recalled that external flows to the PRO system are not included in this figure, solely what goes through the collection centres is included (Gabriele Folli, personal communication). In early 2016 a re-use centre opened in Parma (Altro Giro), where used EEE that is still functioning or can be re-used is sold on the second-hand market. The re-use centre also has a laboratory open to the public for fixing products. Gabriele Folli comments that although this activity is contributing to the system, it is not accounted for in the data and hence does not go towards target achievement (personal communication).

⁷ The demographic data (population) is taken from ISTAT for both the municipality of Parma and Italy.

5 Analysis and discussion

The first research question (RQ1) regarding the roles and responsibilities of the stakeholders involved in the national WEEE management system is addressed both in the literature review (stakeholders and system mapping) and the findings (implementation chain).

The aim of this section is to address the remaining research questions (RQ2 and RQ3) based on the findings reported in the above chapter (Section 4). Essentially, the significance of the findings is discussed here. This is done following the structure of the analytical framework. Each of the three criteria (effectiveness, legitimacy and transparency) are analysed with the findings and connected back to the literature review. This analysis is by no means comprehensive in itself but aims at highlighting important issues identified within the system. The case study is integrated with the general analysis.

Figure 5-1 depicts the implementation chain that is introduced earlier. As the EPR system for WEEE management in Italy is being assessed here, the challenges are highlighted with red boxes⁸. This locates the problems within the implementation chain, and more generally the policy intervention, showing where the system is weak and fails to work towards the intermediate outcome at stake (improved waste management practices).

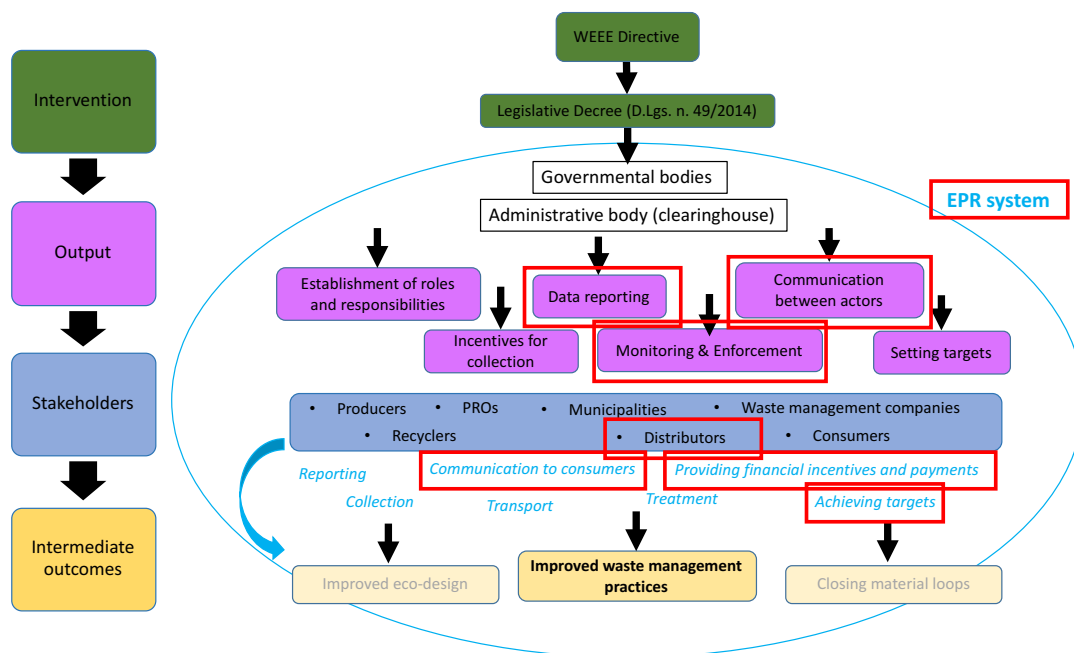


Figure 5-1 Challenges identified within the implementation chain

Source: own

Table 5-1 summarises all the findings and categorises them according to their location amongst the implementation chain and which of the three performance criteria they affect. The following sections provide an analysis of each criterion separately.

⁸ EPR system is highlighted in red to represent structural problems.

Table 5-1 Categorisation of findings according to the analytical framework

Identified challenges	Phase of implementation chain ⁹	Affected criteria		
		Effectiveness	Legitimacy	Transparency
Monitoring & enforcement (<i>on behalf of governmental bodies and clearinghouse</i>)	Outputs		X	X
Data reporting	Outputs			X
Structural problems	Outputs	X	X	
Communication between actors	Outputs	X		X
Distributors (<i>role fulfilment</i>)	Intermediate outcomes	X	X	
Communication to consumers	Intermediate outcomes			X
Financial incentives & payments	Intermediate outcomes	X	X	X
Target achievement	Intermediate outcomes	X		

Source: own

5.1 Effectiveness

To review, effectiveness is defined as “*the degree to which the intended goals of the policy instrument are in line with the achieved outcomes*” (Mickwitz, 2006). This criterion is assessed by answering two fundamental questions: (1) are the results in accordance to the goal? and (2) are the results produced according to the programme (Vedung, 2997). These two questions are addressed in this section.

The goals of this policy instrument are several, as discussed in the literature review. However, this thesis takes effectiveness as the achievement of collection targets. It should be kept in mind that there are several external factors that have an effect on the effectiveness of a policy instrument (Monier et al., 2014). These include population density, historical development of waste infrastructure, the value of primary materials and existence of other policy instruments. These contextual factors fall outside the scope of this thesis but shall be nevertheless kept in mind when assessing the system for its effectiveness.

5.1.1 Are the results in accordance with the goal?

In this thesis, **target achievement** is the factor that is being assessed for effectiveness. This is because the focus of this paper is on operational waste management improvements, which lead to higher collection rates. When looking at Eurostat data on Italy’s collection rates, it appears that Italy has reached the 4kg/per capita/per year target in the past years and that it has gone well beyond it. However, due to lack of categorised data, it is not known what is behind these figures for collection rate. For example, it is unclear what proportion of the WEEE collected is from households and how much is from other sources. This makes it impossible to analyse WEEE trends in greater detail. Capurso (2014) mentions that Italy has seen the development

⁹ Colors relate back to the policy intervention and implementation chain figure

of various parallel streams of e-waste, one is through the PROs and the CdC RAEE and the others include waste that is managed either individually or illegally. The implication is that many products are diverted to these other streams and are not accounted for in target achievement (Remedia, 2012). For example, this issue is highlighted in the case study where a re-use centre recently opened in Parma but waste that is now diverted to this centre is no longer quantified in the collection rates, hence not contributing to target achievement. However, with the new targets set under the recast Directive (see literature review), Member States now have to reach specific targets for “re-use” and “preparation for re-use and recycle” recycle for each product category. This means that countries have to quantify these streams as well, which require developments in reporting and monitoring procedures.

Furthermore, when looking at collection rates with the new target calculations (weight of WEEE collected based on the average PoM of the three preceding years), Italy doesn't seem to be as well off. In 2013 Italy was at 44%, with EU targets currently at 45% and rising to 65% from 2019. This shows that although the previous targets have been reached, Italy now has to focus on increasing collection rates further in light of the more stringent targets. Several interviewees mention that the system is satisfied because the 4kg target has been reached and there is no push to further increase collection rates. As seen in the literature review, even when calculating with the 85% (of WEEE generated) accounting method, Italy has to reach collection rates of around 17kg per person per year. Using this accounting method also requires the adequate data reporting and monitoring to be in place.

Looking into the case study provides some interesting results. Since 2012, Parma's collection rate is below 4kg per capita per year (see Figure 4-2). It should be recalled that these figures solely represent the flows going through collection centres and do not include other forms of collection and treatment (professional waste and individually managed waste). This is an interesting finding in itself as the city lies amongst those with the highest quality of life in the country but the collection rates aren't equally as high. This indicates that higher GDP does not necessarily mean higher collection rates. It could be other factors, including insufficient infrastructure (L. Zoni states that Parma needs more collection centre capacity for WEEE) or insufficient communication initiatives/projects to increase citizen awareness.

In the case study on the municipality of Parma, a very interesting point is raised regarding the incentives to reach targets. Both the municipality and the waste management company interviewees explain that the WEEE management system is a zero-cost system to them and they get no economic returns from the activities. This means there is lack of incentive amongst them to do better and reaching the target is merely seen as a mandatory goal prescribed by the regulation. Going beyond the collection targets is not in their interest as they won't gain anything from it. Hence, it is clear that WEEE is not at the top of the municipality's or the waste management company's agenda at the moment. This could be due to the lack of revenue. The issue regarding **distributors** comes up here as well. The findings from the interviews with the other actors in the system suggest that there is a problem with distributors not fulfilling their responsibility to collect WEEE. Since no interviews are conducted with the concerned actors, it is not possible to claim what the reason behind this is. It could be due to several aspects such as insufficient awareness of their responsibilities due to poor of information provision; lack of resources to collect and store WEEE; and lack of monitoring and enforcement by governmental bodies. The interviewees suggest that the general lack of monitoring and enforcement within the system is an issue that affects the level of action of actors. In this case, lack of monitoring and enforcement is likely to play to the advantage of distributors as they can get away with not fulfilling their task. Once again, it is possible that there exist other reasons behind this challenge.

Furthermore, as the system requires WEEE management to be organised at the municipal level and not at the provincial or regional level, each municipality is acting on its own and collaboration between them for WEEE collection purposes seems to be rare (**communication between actors**). Perhaps if there is more action taken at a higher level (regional, provincial, national) it can ensure municipalities collaborate together to optimise resource use and effectiveness. For example, this could be beneficial in optimising transport logistics and communication campaigns. In order for municipalities to collaborate together, especially the smaller ones, there needs to either be financial incentives or legislative requirements addressing this.

5.1.2 Are the results produced according to the programme?

This section looks at whether collection rates are achieved according to the provisions of the policy and whether they would also be achieved in absence of the program. It is not only the mere fact of achieving targets but how they are achieved that needs more attention. Waste management practices in Italy have heterogeneous trends across the 20 regions (Ferraris and Paleari, 2013). This is also reflected in the WEEE management system in particular. The literature suggests that northern regions have more advanced infrastructure and capacity, resulting in higher collection rates. The literature also suggests that the southern regions, which lack the resources to implement and maintain an adequate system, are dragging national rates down. This is highlighted as a challenge in certain interviews, where it is noted that certain activities (e.g. education campaigns) are concentrated solely on the northern regions as they have the capacity to receive and implement them. The clearinghouse is currently trying to focus on the regions with poorer infrastructure. However, nationwide programs or activities are likely to fall back on to the northern regions. For example, the financial rewards are offered for collection centres that have shown a certain predetermined increase in collection rates. It is unlikely for collection centres in the southernmost regions to be able to achieve these increases if they lack the resources to do so in the first place. Hence the financial rewards will inevitably go to the northern regions, accentuating the national discrepancy even more. According to 2015 figures, the regions receiving the most efficiency rewards are Lombardy, Tuscany, Veneto and Piedmont, all located in the north of the country (CdC RAEE, 2015).

The case study on Parma shows contrasting results though. It finds that despite the municipality being in the north of the country and fairly wealthy compared to the national average, the collection rates do not reflect this. On the contrary, the city has not been reaching the 4kg per person per year target for the past couple of years. This is an interesting finding which insinuates that the notion of northern and southern regions showing contrasting performance is not as extreme as thought to be. To summarise, this discourse fits into the evaluation of effectiveness as it shows that although targets may have been achieved, it is not necessarily the country as a whole improving its waste management practices in a harmonised way, rather it is certain regions that are progressing and bringing up national figures.

The increase in **financial incentives** foreseen by the latest Program Agreements is done with the goal of increasing collection rates. It is unclear if the increase in collection rates in the past years is due to the increase in financial rewards or also to other factors. Data for allocated financial rewards and collection rates follow the same increasing trend. However, several interviewees claim the financial rewards do not trigger increases in collection. There are other factors that could explain the increase in collection rates. These could be the recent decrease in price of primary resources, which has led to fewer products being managed illegally (CdC RAEE, 2015). If prices of primary resources change trend and start increasing again, it will be interesting to see if collection rates will be affected in any way. This could determine whether the price of resources actually has a strong influence on collection rates. Another point made

in the interviews is that financial rewards are being used in an instrumental way by the clearinghouse in order to optimise the logistics of the system. To sum up, although the rewards are introduced as a mechanism for goal-achievement, it is unclear if the financial incentives trigger an increase in collection rates and the achievement of the target.

Furthermore, as identified through the case study, the logistics of the system could in some way compromise the effectiveness (**structural problems**). The system is quite fragmented in that collection, transport and treatment are not allocated on a regional level but are assigned in order to ensure all PROs are acting everywhere across the national territory. This also means that treatment plants are not always allocated in proximity to the point of collection, sometimes making transport long and inefficient. Although the objective behind the fragmented structure of the system is to harmonise activities undertaken by all actors, this could lead to unnecessary complications and lengthened processes.

5.2 Legitimacy

In the context of this thesis, legitimacy is defined as the “*degree of acceptance of the policy instrument on behalf of the stakeholders*” (Mickwitz, 2006). This entails analysing the views of the different stakeholders on the policy intervention and the acceptance of the process. This includes the degree of credibility of the program and the subsequent degree of endorsement and compliance on behalf of the actors. Compliance is likely to be stronger if all stakeholders are satisfied and aware of the equity in the system (Khetriwal et al. 2009). The parallel illegal stream could also be reduced if the system’s legitimacy is increased. However, this paper focuses on the legitimacy of the formal (clearinghouse) system. The findings reveal some interesting points regarding this criterion.

The findings from the interviews suggest that **distributors** are a big difficulty within the system. It should be noted that no distributors are interviewed due to lack of contact, but most of the other actors bring up the problem regarding distributors. Interviewed stakeholders suggest that the main challenge with distributors is that they are not fulfilling their responsibility of WEEE collection. In being a main point of contact between the system and consumers, distributors should play a central role in the collection of WEEE and in increasing awareness levels of their clients. More specifically, actors such as producers and municipalities state that it is hard to communicate with distributors and that often they lack awareness of their responsibilities. There is confusion as to who should be responsible for ensuring distributors are fulfilling their responsibilities according to legislative requirements. Different interviewees claim different things. Some say it should be the task of governmental authorities, others claim that consumers should be pushing for distributors to increase collection.

This finding proves to be very interesting as it is not anticipated by the literature review. In terms of legitimacy, it reveals that on behalf of distributors there might be lack of acceptance of the policy and hence absence of action. It might also be the case that they accept the policy but are faced with other barriers (e.g. lack of resources or infrastructure to collect WEEE at retail point). However, since no distributor is interviewed, it is not possible to determine the cause or reason of their inaction. It is safe to say that lack of monitoring and enforcement within the national system (one of the identified challenges) also influences distributors behaviour. If distributors are not monitored by anyone, they will act as they please and not collect WEEE as it is solely an extra burden for them.

Structural problems are identified as another challenge as many interviewees evoke a sense of dissent with the way the system is currently set up. When questioned about their views on the structure of the system, many interviewees (recyclers, municipalities) do not show complete

acceptance or agreement. More specifically, dissatisfaction is raised with regards to the collective system having too many PROs, which leads to inefficiencies such as the creation of unnecessary costs and infrastructure, where both could be reduced if the system had fewer PROs. A complex system as the Italian one is seen as being difficult to monitor and enforce. In a system with this architecture, it is basically impossible for producers to manage their waste individually. Furthermore, as seen in the literature, according to the WEEE Directive and the Italian Legislative Decree, producers should be free to manage their waste both individually and collectively. From the interviews and the data collected it is not certain whether there exist any producers managing their waste individually in Italy as stakeholders provided contrasting insights. Therefore, it can be confidently claimed that the system architecture is generally not fully accepted or appreciated by the stakeholders since they identify a theoretical provision of the legislation (IPR) that is not being respected/ followed by the system. This does not directly imply that the actors reject the system but rather identifies an area in which the system displays a weakness.

However, it is important to note that comments on the structure of the program are not only of negative nature. Certain actors (clearinghouse, PROs) suggest that the Italian system is well-functioning and has a suitable structural setup. Therefore, summing up the findings regarding system structure, several aspects of the system architecture are criticised by the interviewed stakeholders. Despite this dissatisfaction, certain stakeholders show acknowledgment of the fact that targets have been reached and a complex system is indeed in place and running.

Furthermore, going back to the problems with **financial incentives**, many stakeholders interviewed seem to be unhappy with the mechanism introduced by the Program Agreements. There is not much approval of the use of these funds amongst the interviewed actors. These financial rewards are accused of being an instrument for the clearinghouse and the PROs to optimise the logistics of the system. Channelling capital to collection centres in order to increase their infrastructure and capacity of course does no harm to them, but it is questionable whether these funds could perhaps be utilised more efficiently. This is an area that requires further research in order to determine whether the way funds are being channelled currently is efficient and how they could be better utilised.

Another issue that comes to light in the interviews which affects legitimacy is **monitoring**. More specifically, the SISTRI reporting tool is seen very negatively and has very little credibility. The reason behind this is the delay in the introduction of the tool, it has been a very lengthy process that has not led to any major improvements in the reporting system. Furthermore, stakeholders do not see the purpose of the tool as it is not replacing others but just adding to the list of bureaucratic tasks to be completed. The reporting tool is just seen as an extra mechanism that decreases credibility of the system and of governmental bodies.

The issue of ownership is also raised through the interviews, whereby the WEEE legislation and the subsequent Italian legislation seem to lack a clear definition of property rights over the products and their resulting waste. If it is not clear who has ownership over the WEEE, then it is not possible to properly allocate responsibilities. Furthermore, the property of the secondary resources (recycled materials) that are extracted from the waste during treatment is not defined. Within the current system, the property is of the recyclers (unless there is a special agreement with the PRO handling the waste) however if it were specifically defined who has ownership at the various stages, there would be stronger incentives on behalf of the relevant stakeholder(s) to ensure the system is operating and fulfilling requirements.

5.3 Transparency

The third criterion for evaluation is transparency, here defined as the “*degree to which the outputs, outcomes and process of the policy instrument are observable (Mickwitz, 2006) and the degree to which relevant information is available to all stakeholders*”. Within the Italian context of general waste management, this criterion is often questioned due to ambiguities in legislation and lack of information availability (Ferraris and Paleari, 2013). We have seen through the literature review that this is especially the case for e-waste as it is subject to illegal management due to its high revenue potential (Germani et al., 2015). The main issues that are highlighted which impact the degree of transparency within the system are discussed below.

Communication both between system stakeholders and to consumers is central to the findings of this research. It is acknowledged by the literature and confirmed by the interviews that awareness levels in general are too low and that communication is key to enhancing the performance of the system overall. **Communication between actors** is one of the outputs of the policy intervention critical for the achievement of the outcomes. The findings from the interviews have revealed that there is lack of communication on many levels. Within the PRO system, communication between actors happens mainly in a formal context, through working parties and technical committees. Interactions amongst PROs and with the clearinghouse seem to be sound and constructive. This is seen for example in the education campaigns that are launched by CdC RAEE and the PROs (RAEEScuola). The PROs also seem to be fulfilling their roles in providing their actors with information and support when needed. This is extremely important as it increases the likelihood of all stakeholders fulfilling their requirements and the intended outcomes to be achieved. However, there do seem to be some issues with regards to stakeholder communication, specifically with regards to recyclers. The interviews reveal a lack of communication and information availability reaching recyclers. This mainly includes information from producers on product technologies and procedures for treatment. Although the product cards have been introduced to address this issue and provide support to treatment facilities, they are not sufficient as they are not specific enough and cannot keep up with the fast evolving technology. In being the actors at the end of the value chain, recyclers appear to be considered less in terms of information communication. Hence, this issue highlights a lack of transparency within the system in terms of communication. Transparency is crucial in allowing actors to enhance trust levels between each other, which in turn leads to more action being taken and roles being fulfilled as there are less doubts over other actors respecting the rules or not. The actions of one actor are influential to the behaviour of the surrounding actors. If an actor is aware that all other actors are acting according to requirements and roles are being achieved, then he will have the incentive to do so as well to not be “kicked-out” of the system. In order for this to be possible, there needs to be a high level of communication and transparency amongst them.

Moreover, **communication to consumers** is also important in ensuring a well-performing system. The interviewees all acknowledge that it is essential for a well-functioning system. Although certain efforts are taken in this regard, there is much more that can be done in order to enhance overall awareness levels. First of all, it is not clear to all actors who has what responsibility in terms of consumer education. This is something that lacks clarity within the legislation. Second, although to an extent communication to consumers is being addressed already, it is surely not being done to the extent required considering the importance of consumers as the primary trigger of the WEEE system. Communication towards consumers should not happen only through education campaigns (system to consumers) but also through the possibility of consumers seeking support and information from stakeholders. For example, the CdC RAEE website contains very little information accessible to consumers. It is important for consumers not only to have information on where to dispose of their product

but also of the whole system itself in order to perceive the ultimate objectives and advantages of proper WEEE treatment. Communication to consumers requires more attention in the southern regions of Italy, where collection rates are considerably lower. This of course shall be done in parallel with infrastructure improvements. Directing communication activities to consumer groups other than students is important in broadening the level of awareness and targeting a wider range of citizens. This challenge is relevant in terms of transparency as it aims to provide consumers with relevant information both on how to behave and on how the system works.

Furthermore, the research undertaken in order to assess goal-attainment in the national WEEE management system brings to light important issues with **data reporting**: availability, transparency and consistency. In particular, when looking at the data for products PoM and for waste collected from households in the past couple of years, inconsistency is found between data sources (see Tables 4-2 and 4-3). Furthermore, certain databases are lacking information and/or transparency in their reporting (e.g. ISPRA). The issue of data reporting is anticipated by the literature review where it is found that Eurostat has fairly incomplete WEEE data for Italy, especially when compared to the data of other Member States. This could be partially due to the different categorisation of products, although the interviews indicate that national reporting bodies have the means of converting the categories but are still not doing so. However, as introduced in the findings (Section 4.1.2.), there exists a conversion table so this shouldn't be the problem. There is no information available from the governmental authorities for the public. These entities do have national figures as they are the ones reporting at the European level, the problem is the lack of effective communication of the data they collect to the public and to system stakeholders. As the public bodies collect data for flows external to the clearinghouse system, they hold more comprehensive data sets. However, due to low transparency, little is known on these parallel flows. Furthermore, information on how data is collected and calculated doesn't seem to be very transparent. The ministry's website contains no information on WEEE data, making it complicated for anyone to access this information. Reporting entities such as ISPRA and Eurostat also lack comprehensive data on WEEE flows in Italy. It is not clear as to which figures shall be taken as representative of the national flows due to the existence of multiple sources of data, all reporting fairly different figures. This issue is responsibility of the governmental bodies in charge of reporting national figures, which should also include flows outside the formal/clearinghouse system.

On the other hand, the monitoring and reporting done by the CdC RAEE shows different results. The clearinghouse publishes annual reports with updated figures on WEEE flows going through their system. As these reports are complete and comprehensive, they are often used as the national figures by other studies, reports, etc. The explanation behind this is that the streams going through the clearinghouse system are the only ones that are well-known and easier to monitor. The flows external to these (informal and illegal) are therefore disregarded, although they are proven to be a high proportion of the total waste flow. Comprehensive data on all WEEE flows in Italy is missing to the public. Furthermore, another reason behind this challenge is the lack of **monitoring and enforcement** on behalf of governmental bodies. It is their task to ensure that the system is functioning and that all actors are fulfilling their roles (also those outside the clearinghouse system). All of this brings to light a problem on behalf of public authorities in fulfilling their role of data reporting and ensuring accessibility and transparency to all actors.

Lastly, the issue of **payments** and who is actually financing the system also faces transparency problems. Starting from the legislation which, apart from stating that producers have financial responsibility, does not clearly define how the financing of the system shall be organised in

detail. This is not clear to interviewed stakeholders either. The literature review suggests that in Italy financial responsibility is not fully assumed by producers through the PROs and that other actors are bearing part of the cost. Favot et al. (2016) find that compensations received by municipalities do not fully cover their costs of WEEE collection. This means that the remainder of the financial burden is most likely shifted to tax-payers. However, the study on the municipality reveals that the system brings no costs (and no revenue) to the municipality, likely implying that the costs are covered by the clearinghouse system. There is very little known on the financial flows within the system, reason for the lack of existing studies. This lack of transparency in figures is partially due to the competitive nature of the system, hindering PROs from releasing this information. Singling out different costs might also be a practical challenge for actors, providing another reason for this lack of transparency (Favot et al., 2016).

Perhaps in a system with greater levels of transparency, the issue of producers free-riding would also be reduced as there would be more information available, making it easier to spot the actors not fulfilling their roles. The Italian Legislative Decree does not provide any guidance on who is responsible for monitoring free-riders and addressing this aspect. This is an issue concerning also other EU countries and other waste streams (e.g. batteries) and not solely the Italian case for WEEE (Monier et al., 2014).

5.4 Discussion of research questions

Here the research questions are discussed and implications are presented. In this study, before mapping out the system and presenting intervention theory, the system context and architecture are presented in order to provide some background and basis for the study (Section 2). Finally, the performance criteria are addressed through the study and provide interesting findings to address the research questions.

RQ1: What are the roles and responsibilities of the stakeholders involved in the national WEEE management system?

The first research question is addressed by the literature review and is solely of descriptive nature in that it describes how the system works. The empirical data provides some interesting insights on how the stakeholders engage, or fail to engage within the system. The first sub question is *“how do the stakeholders interact?”*. This is assessed in the literature review, more specifically through the of mapping of the system and review of the key stakeholders (Sections 2.5.4. and 2.5.5.). The literature review provides a layout of how the stakeholders shall interact in theory. The practical reality has come afloat through the stakeholder interviews. What can be inferred from this comparison between theory and practice is that although actors seem to be generally fulfilling their main roles within the system, there are certain tasks that are not clearly defined or where there fails to be action. Within the formal system, it seems like most interactions between actors go through the CdC RAEE, making it lengthy and inconvenient. Although the clearinghouse model provides for a structured and centralised system which brings clear advantages, it might also decrease interactions that there would otherwise be due to inconvenience and extensive procedures.

The second sub question is *“what are the flows across the system?”*. This is addressed through the mapping out of the system, in which the main responsibilities (physical, financial and informative) are initially presented as they are found within legislation. Assessing the flows reveals differences in the way that they should be in theory and what they actually are in reality. The physical flows seem to be relatively straightforward and go through the long series of stakeholders, from the producer to the recycler. However, the financial and informative flows show several areas where there are complications within the system.

In terms of financial responsibility, it is unclear as to who exactly is paying for the management of WEEE within the Italian system. As suggested in the WEEE Directive and the national implementing decrees, producers can charge consumers a fee (eco-contribution) on their products of which the funds are channelled to the financing of the system. In Italy this happens, but the funds collected through this method seem to not fully cover the costs of the system. It is not clear who bears the extra cost of the system. The literature review and general findings suggest that it is likely to be the municipalities. However, the case study has not revealed this problem but has contrarily found that the municipality and the waste management company operate within the system at zero-costs. In conclusion, this confirms the issue that there is lack of financial information on the system, as also suggested by the literature review. If this data is not known, it will not be possible to understand who is holding this financial burden and where the system is not following responsibilities as laid out by legislation.

Further, informative responsibility within the system portrays certain challenges in that the flows are not always respecting the legislative requirements and stakeholders are often not satisfied with the reality of how things actually work (especially regarding communication between actors). Regarding the prior, an example is the information producers shall provide recyclers on how products shall be handled. Challenges are highlighted as there seems to be lack of stakeholder disclosure of information, especially with regards to inter-stakeholder communication. This can be linked to a greater problem of monitoring and enforcement. The latter includes the provision of information to citizens to increase awareness and education levels on WEEE. The requirement for producers to provide information for the correct disposal of products on the packaging does seem to be generally fulfilled. Efforts for further communication are seen on behalf of several stakeholders and projects have been undertaken to further boost awareness. This shows general acknowledgment of stakeholders that communication to citizens is the key determinant of a functioning system.

RQ2: How is the national system operating with respect to the legislative requirements?

This research question is very important as it addresses a great part of the thesis objective. The sub questions follow the analytical framework used for evaluation. That is, they address the criteria (effectiveness, legitimacy and transparency) and ask whether the findings at the national level evaluation are consistent with the findings from the case study. All of these sub questions then allow to answer RQ2, which questions whether the national system is actually operating as the policy prescribes. The purpose of using intervention theory is to lay down how the policy should work and then assess whether the outputs and outcomes are actually being achieved.

The first sub question is “*are the targets being met?*”, directly relating to the first criteria for evaluation (effectiveness). The effectiveness criterion is essentially assessing whether the collection targets are being achieved or not. However, it is also very relevant to determine how these targets are achieved and if the correct procedures are used in order to reach them. Through the effectiveness analysis, the main finding is that Italy seems to have reached the 4kg/per person/per year target set under the initial 2002 Directive but is now challenged as it has to work towards the new targets set under the recast Directive. This is currently and will be in the near future a difficult challenge for Italy to achieve due to problems with data reporting, monitoring and enforcement. More efforts need to be made in terms of accounting to provide more information and transparency with regards to all WEEE flows, particularly those outside the PRO system which are exceptionally disregarded. This is of course a problem that is present in waste management in general in Italy, hence needs to be addressed also at a broader level. Another aspect that appears to require attention in being influential in target achievement are the financial incentives offered to collection centres to boost collection rates.

Through this research it is not possible to confirm whether the financial incentives are fully beneficial to the system but it is safe to say that they bring no direct harm or disadvantage to. Even if these financial rewards were found out to be fully for optimisation purposes (as suggested in several interviews), although not satisfying their theoretical intent, they would provide benefits to the system in terms of more cost-effective collection. However, the role of financial incentives within the system is a whole research topic on its own and should be explored in more detail. This fits into the broader issue of financial responsibility addressed by the first research question.

The second research question asks “*how do the different stakeholders receive the policy?*”, which is essentially covering the legitimacy criterion. This criterion takes stakeholders’ perception as the central focus in order to evaluate whether the policy is accepted by them and determine how credible they find it. Many interesting aspects are brought up here. Firstly, distributors are found to be a big challenge within the system. This is interesting as it is not expected from the literature review. Distributors are found to be insufficiently collecting WEEE at their retail centres. This could be due to the fact that they don’t accept the system because the legislation does not clearly define who is responsible for monitoring distributors and they aren’t aware of their responsibilities. This finding shows that where there is lack of legitimacy, the system is likely to fail in meeting its intended outputs and outcomes. Stakeholders also showed low confidence in the way the national system is set up, specifically in terms of the competitive nature of the formal system. The fact that producers are basically obliged to partake in a collective scheme does not mean that they accept and are satisfied with this option. This could be due to the fact that it is practically impossible for producers to manage their waste individually. Furthermore, another interesting finding from this research is that, from the interviews conducted, legitimacy levels seem to be higher amongst the coordinating actors (clearinghouse and PROs) and less amongst other actors (recyclers, waste management companies, etc.). This could perhaps mean that the viewpoints of the other actors are not voiced or considered enough within the system. This is important to note as the actors are essential to the operation of the system and their acceptance of the system is critical. Finally, legitimacy is influenced by other factors such as the lack of consistency in monitoring requirements and the uncertainty as to who has ownership over the WEEE. Hence, what can be said about the legitimacy of this program is that there is general acceptance on behalf of stakeholders which is shown by the general functioning of the system. However, there are many aspects in which stakeholders show low acceptance and these are crucial to address as they will help improve waste management practices by making the system more credible and getting more actors to approve of it.

The third sub question is regarding the transparency criterion and is “*how transparent is the program?*”. The main challenge that is identified here is communication (both between actors and to citizens) and data reporting. There seems to be lack of transparent information communication between actors. This is essential in determining the performance of the system, especially due to the fast changing nature of EEE and the complex system at hand. All actors should be aware of the system details and of any changes that occur. In Italy there is lack of a common, uniform means of communication between all actors (with the exception of industry association meetings). Although it is important for these working party meetings and workshops to take place, it is essential for information to reach all relevant actors. For example, this could be done through a centralised platform for communication, set up and operated by the clearinghouse which could for instance allow recyclers to directly contact producers. More can be done also regarding communication to citizens. For now, only a specific audience is targeted (schools) and more efforts need to be put into broadening the scope of communication campaigns and enhancing transparency and access to information for all

citizens. The first step in this process is to ensure all actors provide information on their websites and are easily contactable. Furthermore, the lack of transparency in data reporting clearly means that there are problems with monitoring and enforcement on behalf of authorities and lack of provisions for data reporting in the legislation. This problem with data transparency also affects the awareness of who has the financial responsibility within the system (as discussed in RQ1). If clearer data is available, then it will be possible to determine how the financial flows are structured.

Lastly, the fourth research question concentrates on assessing whether the case study on Parma has suggested similar findings to the rest of the research. The question is *“Is the performance at the local/municipal level consistent with the national level?”*. The findings from the case study do seem to fit in with the rest of the research. Many aspects are confirmed by the case study, such as the lack of transparency in data reporting, structural and logistical problems and insufficient communication between actors. However, both the municipality and the waste management company clearly note that WEEE is not a priority on their agenda and that within general waste management it represents a small stream. It is of course natural for these actors to have other issues to focus on, contrary to actors such as the clearinghouse, PROs and recyclers. This does however imply that actors within the system that have other priorities (this also includes producers and distributors) require more incentives to improve their roles within the system. This effort needs to come from the clearinghouse, PROs, recyclers, and industry association, essentially those actors that are solely involved in WEEE management. The case study also reveals that there is barely any interaction or collaboration between municipalities on the topic of WEEE management. This is important as it can allow for sharing of best practices and pooling of resources. Furthermore, the case study reveals an interesting finding with regards to the differences in system effectiveness between northern and southern regions of Italy. Although Parma is in the northern region of Emilia-Romagna and has a high quality of life and developed waste management practices, WEEE collection rates seem to be well below the national average (although following a parallel trend). This is an important finding as it suggests that the differences between regions are more complex than predicted and it is not simply higher GDP leading to better performance. In conclusion, the author is confident in confirming that the national WEEE system is rather well reflected at the local/municipal level and that the challenges arising in both settings are compatible. This increases the degree of generalisability of the findings of this research (more in Section 6.1.4.).

RQ3: How can the performance of the national WEEE management system be enhanced in order to achieve increasingly ambitious EU targets?

The final research question is answered based on the findings and analysis of the research. Recommendations are provided for improving the performance of the national WEEE management system. This includes both addressing the challenges the system is likely to face and enhancing the strengths of the system. The recommendations are for the system stakeholders (mainly governmental bodies and administrative bodies, but also for all other actors). Although these final recommendations strive to be as generalisable as possible, due to context specific factors, this is only true to a limited extent. The following suggestions are developed and recommended for enhancing system performance:

Vigilance and Control Committee – Efforts shall be put into ensuring that monitoring and reporting bodies are up and effectively running. Although the committee is projected to start working shortly, the major challenge is ensuring their work is sustained over time and is permanently ‘established’ within the system. System stakeholders should show their interest and expectations for the monitoring committee to be established and transparently operating.

This is one of the areas that should be given the most attention as it has implications for effectiveness, legitimacy and transparency of the system, meaning it is highly influential in determining system performance. The work of this body shall also emphasise the identification of free-riders.

Uniform reporting system – Although the SISTRI reporting tool is introduced with the aim of harmonising and simplifying data reporting for all actors, it is not leading to improved reporting but is rather adding an additional burden for the relevant actors. If data is reported and accounted for correctly, it is likely that national figures on collection rates will be higher and will show Italy's true position amongst the EU average. This study thus suggests for a new reporting system to be developed. This tool shall be organised to cover all activities (with no exceptions as in the current tool) and shall ideally be introduced in one step and not phased in. This tool shall be set up to take into account the EU data requirements and make it easier to calculate and report information to the EU. Streams going to second-hand markets for re-use shall be monitored and included in the reporting system and be accounted for. The governmental bodies should consider requiring actors to submit economic data.

Setting up a mechanism for dialogue between stakeholders – As found in this research, communication amongst stakeholders is key to ensuring a transparent system with trust amongst stakeholders. This includes both communication amongst the same stakeholder group (e.g. amongst municipalities) as well as between stakeholders (e.g. between producers and recyclers). Introducing a platform or system by which actors can easily communicate amongst each other without having to go through any intermediaries will contribute to improved system performance. This system will allow for actors to share practices, voice their questions and possibly find opportunities to collaborate. This can also allow for best practices to be pooled and subsequently shared at the EU level.

Focusing on distributors for collection - Although distributors have not been consulted directly through this research, it is found that they create a major problem within the system as they seem to not fulfil their responsibility as collection points for WEEE. First, this situation shall be explored and the reason they are not succeeding in their role is to be determined. Then their role as collectors shall be focused on, with emphasis on the advantages one-to-one or one-to-zero collection can bring to them (e.g. improved relations with customers). Wider benefits will arise for the system since options for collection will be more easily accessible to consumers and possibly less funds will have to be channelled to infrastructure for municipal collection centres. The possibility of giving distributors specific collection targets conditional on their market share or the amount of WEEE sold can help address this issue and should be looked into.

Consumer education – This aspect is stressed through the interviews and by the literature. In being the disposers of WEEE, consumers are the actors that fuel the system. Consumer education is identified and acknowledged as highly relevant and this is reflected in the initiatives that are already being introduced. However, existing efforts mainly focus on schools. This study suggests for consumer education programs to be targeted to a wider audience and to be longer-term (not one-off projects). Distributors also come into play here since they have direct communication with consumers. Consumer awareness efforts shall consider channelling their resources to campaigns at retail points (distributors). Furthermore, citizens should be offered more publicly available information. This includes all stakeholders providing information on their websites and most importantly providing a means of direct contact in case of queries.

Introducing new methods for collection – As a means of increasing system performance, new methods of collection shall be studied and considered. These include alternative solutions where collection is made more convenient for consumers, especially for smaller WEEE which is easier to transport and store. For example, (acknowledging regulatory restrictions) the possibility of introducing small/medium containers in locations such as shopping centres, sports centres, universities, and other popular places shall be considered. The initiative shall come from governmental bodies, the clearinghouse and the PROs and they shall provide support and incentives to facilitate their introduction. For greater impact, action should be taken at the national level and enforced by authorities with a specific focus on regions with less infrastructure for waste collection.

6 Reflections and conclusion

A review of the methodology used as well as the identification of further areas of research is addressed here, followed by concluding remarks.

6.1 Review of methodological and analytical choices

This section reflects upon the methodology, framework and research objectives that are used in this thesis. Study limitations are addressed in this section.

6.1.1 Methodology

This research paper aims to answer three research questions in assessing the Italian WEEE management system. The aim is to describe the system in detail and obtain an insider perspective of the key stakeholders to locate where the main challenges and strengths lie. The thesis uses three research methods: literature review, quantitative data collection, and interviews. With the information retrieved from the research methods, a framework is applied for the policy evaluation.

Despite the use of three research methods it was difficult for the author to access certain information. This is especially true for the case of quantitative data analysis. Certain databases are not publicly available and it is not possible to get complete figures from other sources. This is perceived as a limitation but also as a finding since the lack of data availability (transparency) is identified as a problem within the system.

A further identified limitation is the source of the information retrieved for the literature review. Online websites and grey literature were used. It is therefore important to recognise that much online information is not verified and may be biased. This is taken into account when processing the information and the interviews also served as a means of verifying this information.

The literature review is undertaken following the scope of the research. This limits the study of the WEEE Directive and the subsequent Italian legislation to operational waste management aspects. Little attention is given to the eco-design and closing material loops aspects of the EPR policy. In scoping them out of this research, these concepts are not addressed despite indications in the literature and interviews that they are important to look into. In retrospect, these two concepts are found to be more prominent than expected as many stakeholders felt compelled to comment on them. For the purpose of this study, the scope is suitable to start addressing one of the several research gaps in the existing literature. If the research could have been of wider scope and of longer duration, the inclusion of all three concepts would have been preferred as would have given a more complete overview of the WEEE system. Furthermore, economic flows are not addressed within the literature as there is lack of information availability due to the competitive nature of the national system. This is seen as a limitation (although not specific to this study) as it does not allow to assess whether the financial flows are following the legislative prescriptions and what challenges are specifically relating to this responsibility.

The municipality of Parma is chosen for the case study as it provides a good example of a municipality with high living standards and relatively developed waste management practices but still confronted with challenges in WEEE management. The collection rates of the city lie very close to the national average, therefore providing a good representation of the system. The choice of a case study at the municipal level is appropriate and provides interesting

findings for the research. The inclusion of additional municipalities to the study would allow for more generalizable findings.

The interviews conducted with stakeholders prove to be very useful for the purpose of this thesis, especially in identifying the main areas of concern and challenge for the actors. The author is however aware that the range of stakeholders interviewed is limited. 15 interviews were conducted and valuable information is gathered but there are a few stakeholders that were not consulted. Efforts were made to include a wider range and number of actors within the empirical data collection in order to increase the coverage and validity. However, aside from the interviewed stakeholders which were all proactive and interested in taking part in the research, the other contacted stakeholders either lacked time, enthusiasm or were not reachable. Many contacts simply did not respond to the interview requests. Nobody from the Ministry of Environment, the Vigilance and Control Committee or the Steering Committee is interviewed as they did not make themselves available for the interview requested by the author. Interviewing policy-makers or people working closely with them would be very valuable for this research as they would likely provide more insight into the greater picture of how the WEEE Directive has been transposed in Italy. However, it must be noted that the clearinghouse (CdC RAEE), one of the most relevant administrative agencies, is interviewed and provides large amounts of useful information. Another stakeholder group that is not interviewed due to the same reasons are the distributors. If this stakeholder group would have been consulted during this research, stronger claims could be made on the challenge the system faces with distributors not fulfilling their responsibilities. Getting the distributors' perspective on the system would allow to identify the reasons underlying their lack of role fulfilment. However, due to lack of contact with distributors, this study can solely suggest that they provide a major challenge within the system and that it should be studied and addressed further.

Also, although a wide range of stakeholders are interviewed, they only cover a few (if not one) representatives from each group. While the lack of response of certain stakeholders is understandable, it is acknowledged as a limitation of the study. It is also recognised that the interviews undertaken are with proactive stakeholders with higher levels of awareness and (possibly) compliance within the system compared to the average stakeholder. This could create a slight bias in responses. Conversely, the response on behalf of these actors might be due to their desire to voice their dissatisfaction and concerns regarding the system.

6.1.2 Analytical framework

The analytical framework chosen for this research is based on the established and commonly used intervention theory proposed by Vedung (1997) for policy evaluation. The intervention theory is used to map out the system and essentially address the first research question (RQ1). The policy evaluation is then done through the identification of three evaluation criteria: effectiveness, legitimacy, and transparency. The choice of these criteria was made to fit the scope of the research and ultimately address the research questions. To the authors' knowledge, an evaluation of the Italian WEEE management system using intervention theory or similar frameworks does not exist to date.

Also, the three criteria chosen for the policy evaluation are scoped down in order to fit the objectives of this research. The effectiveness criterion is assessed in a relatively straightforward manner and is well addressed by the findings. Legitimacy and transparency are found to be more complex to assess are less tangible. However, outlining clear definitions for all criteria helped guide the evaluation. Within the scope of the research, this study aims to apply these

criteria in order to evaluate the performance of the system. Overall, the criteria are well addressed and give productive results.

6.1.3 Study legitimacy

The research is conducted with the aim of answering the three research questions. The first (RQ1) is answered mainly in the literature review (Section 2) with some additions brought about by the findings (Section 4). The second research question (RQ2) is addressed through the findings and analysis (Sections 4 and 5). Finally, the third question (RQ3) is addressed in the final parts of the analysis (Section 5.4). The objective of the thesis is quite broad and allows for the findings from the research methods to determine what are the main challenges to focus on. This is deemed appropriate considering the research is of exploratory nature and designed to incorporate stakeholder perceptions and concerns regarding the system.

The research questions are addressed under the scope that was chosen for this thesis. However, as acknowledged earlier, there are other ways in which the research questions could be answered if a different approach and scope are used. For example, if the objective of the research is assessing whether the policy has achieved its outcomes in terms of eco-design or closing material loops, this would likely bring to different findings and thus differing answers to the research questions. This is not considered a limitation of the research as it is a choice of scope but it is acknowledged and considered a way of identifying areas where further research is needed. These will be addressed in Section 6.2 below.

6.1.4 Generalisability

The findings from the literature review are generalisable nationally for the most part, and at the EU level for certain aspects. Similarly, the findings from the quantitative data analysis are also generalisable. All EU Member States are faced with more stringent targets set by the WEEE Directive recast and may be facing issues that are identified in this study. The situation this study finds might not be unique to Italy in all aspects. However, the author recognises that the findings from the stakeholder interviews are not fully generalizable as they are contingent on the stakeholders that were interviewed and not necessarily the results that would be given by other stakeholders. Considering that the findings from the literature review, quantitative data collection and interviews are quite compatible and consistent, the author is confident that the results of the research can be generalisable and representative of the current state of Italian national WEEE management.

Moreover, the author acknowledges that the lack of comparative analysis could be noted as a limitation. Nevertheless, focusing on a single case, both for the country and the municipality, provides for more in-depth information and insights.

6.2 Further research

Due to the numerous research gaps within the field of WEEE management in Italy, this section could be a report in itself. The research undertaken in this paper is helpful in providing a good starting point for identifying gaps for further research. This section will present areas for further research that have stemmed from this research.

Starting from the choice of scope for this thesis, several areas that need more research are been identified. Since this paper's focus is solely on improved waste management practices for WEEE, the remaining objectives of the WEEE Directive, eco-design and closing material loops are not addressed. These concepts are often brought up within the interviews conducted for this thesis and acknowledged as being crucial by the interviewees. Since these aspects are

extremely important within the system and are often disregarded or not properly addressed, it would be helpful to study whether these aspects are being addressed in Italy, how they are being addressed and whether they are leading to the intended outcomes. This could be done following the same analytical framework and theory used in this thesis (intervention theory for policy evaluation with the use of performance criteria).

Analysing the differences between Italian regions in terms of system performance and determining the explanation for these differences is interesting to explore due to the results from the case study that suggests that the north/south gap is not as straight-forward as it seems. It would also be interesting to study other EU Member States with the same methodology and research objective in order to understand whether the findings of this thesis are specific to Italy or if certain aspects are found also in other countries.

Furthermore, remaining within the scope of this paper, certain issues that are brought up provide interesting areas for further in-depth analysis. For example, in assessing the system architecture both through the literature review and the interviews, many arguments for and against the competitive nature of the Italian system are identified. Studying the implications of having a high number of PROs as in Italy and what benefits and drawbacks it leads to would be interesting. This type of study could be useful if done in a comparative matter, assessing various system architectures across Europe and identifying the pros and cons of each. This ties in with another topic that requires further analysis which is the implementation of individual producer responsibility (IPR). There are several studies that have been undertaken at the European level on the debate concerning IPR vs. collective producer responsibility. It would be interesting to see how this plays out in the Italian context and how big of a challenge it is. This issue is closely related to the topic of eco-design and could be studied together.

Another topic that is brought up within this research and deserves further research is that of financial responsibility, i.e. who is actually paying for the system and what economic burden the various actors have. Looking at the economic flows within the system has not yet been addressed by research as it is extremely difficult to obtain the appropriate figures and information. However, this type of study would be very useful in identifying further challenges within the system and where responsibilities are or aren't being met by stakeholders. For example, studying the financial costs for municipalities in order to determine how much of the system is actually covered. Remaining on the monetary aspects of the system, an analysis of the role of incentive mechanisms and their impact on the system would be useful to consequently study alternative ways for funds to be more efficiently allocated throughout the system.

In being one of the main challenges identified in this thesis, distributors deserve a whole study to be undertaken on their role and influence on the system. Research is needed to further assess how this stakeholder group is influencing the system, who it is influenced by and what needs to be changed in order for them to better contribute to the system. The possibility of introducing specific targets for distributors shall be studied, also at the EU level.

6.3 Summary and final thoughts

Today, amounts of e-waste are increasing worldwide and so are concerns regarding their impact on the environment and human health. As a consequence, the stringency of EU targets for collection and treatment have been increased and Italy now has to make headway and increase its performance to achieve these goals. The aim of this study is to examine the Italian national WEEE system with particular focus on the involved stakeholders in order to suggest

potential improvements to enhance the system's performance. The research questions guiding the evaluation are the following:

- *RQ1: What are the roles and responsibilities of the stakeholders involved in the national WEEE management system?*
- *RQ2: How is the national system operating with respect to the legislative requirements?*
- *RQ3: How can the performance of the national WEEE management system be enhanced in order to achieve EU targets?*

This thesis uses literature review, quantitative data analysis and stakeholder interviews to answer the above questions. The operational performance of the policy is evaluated for its effectiveness, legitimacy and transparency with the use of intervention theory.

The results of the study show a system that despite the highlighted complexities and challenges, is functioning and has placed itself close to the EU average in terms of collection rates. The challenges that are found through this research include: lack of proper monitoring and enforcement on behalf of governmental bodies; improper reporting of data on behalf of governmental bodies; insufficient communication amongst stakeholders; distributors seem to not be sufficiently collecting waste at retail points; concerns over the financing of the system; the need to increase consumer awareness further; and finally, achieving EU targets set under the recast Directive.

These challenges shall be addressed in order to further boost the system's performance in the future. The system seems to lack the momentum and stimulation it needs to go beyond its current standing and continuously increase its performance. Action needs to be taken primarily by the governmental bodies and the administrative body (clearinghouse), however all actors need to be constantly engaged and part of the system evolution.

On the basis of the findings and analysis, this paper suggests a set of recommendations for improving the system and addressing the challenges that have been identified (Section 5.4). If these suggestions are attended to, they will contribute to improving the operational performance of the system.

This paper provides insights and contribution to all audiences: the system stakeholders, academia and relevant organisations/NGOs. For the prior, aside from presenting the set of recommendations, the paper also highlights aspects of concern and of challenge through the integration of various stakeholders' point of view. This brings to surface issues that may have been disregarded by certain actors and helps to raise the overall awareness of the system amongst them, providing insights into areas they may not have known about previously. Furthermore, this paper contributes to academia by addressing issues that haven't been studied yet in this context. The findings also highlight various areas that require future exploring by academia. This design of research can also be applied to other EU member states to then provide a basis for comparison amongst countries.

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Directive 2012/19/EU of the European Parliament and the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE). OJ L197/38, 24/7/2012.

Appendix I. WEEE Groupings

	Grouping	Products	Respective categories in WEEE (2012/19/EU)
1	Products of refrigeration and air conditioning	Large cooling appliances; Refrigerators, Freezers; Other large appliances used for refrigeration, conservation and storage of food; Air conditioner appliances	Category 1: Large household appliances
2	Other large household appliances	Washing machines; Clothes dryers; Dish washing machines; Cookers; Electric stoves; Electric hot plates; Microwaves; Other large appliances for cooking and other processing of food; Electric heating appliances; Electric radiators; Other large appliances for heating rooms, beds, seating furniture; Electric fans; Other fanning, exhaust ventilation and conditioning equipment	Category 1: Large household appliances
3	TV and monitor	Televisions; Monitors	Category 3: IT and telecommunications equipment
4	IT and consumer electronics, luminaires	Centralised data processing; Mainframes; Minicomputers; Printer units; Personal computing; Personal computers; Laptop computers; Notebook computers; Notepad computers; Printers; Copying equipment; Electrical and electronic typewriters; Pocket and desk calculators; other products and equipment for the collection, storage, processing, presentation or communication of information by electronic means; User terminals and systems; Facsimile machine; Telex; Telephones; Pay telephones; Cordless telephones; Answering systems; and other products or equipment of transmitting sound, images or other information by telecommunications; Radio sets; Video cameras; Video recorders; Hi-fi recorders; Audio amplifiers; Musical instruments; and other products or equipment for recording or reproducing sounds or images; Photovoltaic panels; Luminaires for fluorescent lamps with the exception of luminaires in households; Drills; Saws;	Category 3: IT and communications equipment Category 4: Consumer Equipment and Photovoltaic Panels Category 5: Lighting equipment Category 6: Electrical and Electronic Tools (With the exception of large-scale stationary industrial tools) Category 7: Toys, leisure and sports equipment Category 8: Medical devices (with the exception of all implanted and infected products) Category 9: Monitoring and control instruments Category 10: Automatic dispensers

		<p>Sewing machines; Equipment for turning, milling, sanding, grinding, sawing, cutting, shearing, drilling, making holes, punching, folding, bending or similar processing of wood, metal and other materials; Tools for riveting, nailing or screwing or removing rivets, nails, screws or similar uses; Tools for welding, soldering or similar use; Equipment for spraying, spreading, dispersing or other treatment of liquid or gaseous substances by other means; Tools for mowing or other gardening activities; Electric trains or car racing sets; Hand-held video game consoles; Video games; Computers for biking, running, rowing, etc; Sports equipment with electric or electronic components; Coin slot machines; Radiotherapy equipment; Cardiology equipment; Dialysis equipment; Pulmonary ventilators; Nuclear medicine equipment; Laboratory equipment for in vitro diagnosis; Analysers; Freezers; Fertilization tests; Other appliances for detecting, preventing, monitoring, treating, alleviating illness, injury or disability; Smoke detector; Heating regulators; Thermostats; Measuring, weighing or adjusting appliances for household or as laboratory equipment; Other monitoring and control instruments used in industrial installations (e.g. in control panels); Automatic dispensers for hot drinks; Automatic dispensers for hot or cold bottles of cans ; Automatic dispensers for solid products; Automatic dispensers for money; All appliances which deliver automatically all kinds of products.</p>	
5	Lighting sources	<p>Straight fluorescent lamps; Compact fluorescent lamps; High intensity discharge lamps, including pressure sodium lamps and metal halide lamps; Low pressure sodium lamps; Other lighting or equipment for the purpose of spreading or controlling light with the exception of filament bulbs</p>	Category 5 – Lighting equipment

Appendix II. Personal communications

Company/Organisation	Interviewee	Date of Interview	Type of Interview
ANCI Energia & Rifiuti	Filippo Bernocchi – Delegate	30 June, 2016	Skype
ATERSIR (Territorial Agency of Emilia-Romagna for waste and waste services)	Leonardo Malatesta – Waste Management Division	15 June, 2016	Phone
Avfall Sverige	Britta Moutakis – Technical advisor on hazardous waste, recycling centres and collection of source-separated food waste	27 June, 2016	Phone
Consorzio Remedia	Isabella Capurso – Project Manager	23 June, 2016	Skype
CdC RAEE (Centro di Coordinamento RAEE)	Sara Mussetta – Technical and administrative secretariat	11 July, 2016	Phone
Elektronikåtervinning I Sverige	Joseph Tapper – CEO	17 May, 2016	Skype
EPSON ITALIA S.p.A.	Luca Cassani – Supplies Consumer Product Manager	21 July, 2016	Phone
European Recycling Platform	Alberto Canni Ferrari – Country Manager Andrea Bizzi – Technical Regulation Manager Samantha Charalambous – Italy Marketing Manager Simone Daverio - Italy Field Officer	6 July, 2016	In-person
Iren Ambiente S.p.A.	Luigi Zoni – Environmental Services Manager for Parma	8 July, 2016	In-person
Municipality of Parma	Gabriele Folli – Assessor for Environment	8 July, 2016	In-person
RELIGHT S.r.l.	Bibiana Ferrari – CEO	22 June, 2016	Skype
Stanley Black & Decker	Chiara Parapini – EHS Regional Manager South & East Europe Matteo Villa – RSPP/EHS Coordinator	22 July, 2016	Phone
Tred Carpi S.r.l.	Enrico Baraldi – CEO	11 July, 2016	Email
University of Udine	Marinella Favot – Postdoctoral Researcher	27 May, 2016 1 July, 2016	Skype
WEEE Europe AG	Christian Ludwig – CEO	23 June, 2016	Skype

Appendix III. Sample interview guide

This interview will be conducted for a master thesis at Lund University. If you wish, no third parties other than our fellow students and the IIIEE research staff will see its contents. Sensitive and internal information will be treated confidentially. (*ask if they agree to be recorded, start recording*).

The objective of my research is to analyse the WEEE management system in Italy and highlight the factors of success and the challenges faces. The municipality of Parma will be used as a case study. The major stakeholders along the value chain will be contacted in order to obtain a comprehensive overview of the system and draw valid conclusions. Since _____ is a company/organisation representing some of these stakeholders and constituting a centre of expertise in this field, getting input from the company/organisation will provide gainful insights into my research.

We will start with some general questions about _____ and then move on to more specific questions before we close the interview. This is a semi-structured interview, so if you are not sure about what to answer to a specific question, we can come back to it later on during the interview. I would like to highlight that there are no right or wrong answers to any of the following questions. If you do not feel comfortable answering a question, please let me know.

Background questions on the company/organisation

1. Can you introduce me to your activities/work in WEEE management (treatment, sorting, transport, etc.)?
2. Where does your company operate?

E-waste

3. How would you define your responsibility as a stakeholder in the WEEE management system?
4. How do you make sure you are complying with the legislative requirements?
5. What are the major challenges you face under the WEEE management system?
6. What improvements do you think shall be made to the system in order to improve the overall effectiveness?

External relations

7. Which actor within the system do you communicate the most with?
8. If you have a concern/problem regarding the e-waste system, who do you approach?
 - a. If it is an actor within the WEEE management system (e.g. PRO, CdC RAEE), do they provide the support that you expect and need from them?
9. Who do you think should be responsible (amongst stakeholders) for information communication to consumers?

Monitoring

10. Do you receive any audits? If yes: how often and by who?
11. Who is monitoring your activities and how?

Concluding questions

12. Is there anything else you would like to add to your answers?
13. Is there anything you would like to ask me?
14. May I contact you for follow-up questions and clarifications, if necessary?