INSTITUTIONAL ANALYSIS

OF CIRCULAR ECONOMY IN PORTUGAL

THREE ROADS TO CIRCULAR ECONOMY: REDUCE, REUSE, RECYCLE (3R2CE)

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1. INTRODUCTION

The Circular Economy (CE) concept has been gaining traction among scholars, organisations, and governments as an alternative economic model for today's traditional linear 'take-make-dispose' model and a possible solution to societies' environmental problems (Ellen MacArthur Foundation, 2015). However, the transition to a Circular Economy continues to be a demanding task for all the EU Member States – including Portugal.

To better understand how CE is currently perceived at the governance level in Portugal, this report illustrates an in-depth institutional analysis of the CE setting in Portugal, by establishing the grounds for comparison between what is happening in the country at a CE level from the public authorities' perspective, especially from the ones who are directly involved in the implementation of CE practices in the country, and what has been originally planned on the Portuguese Circular Economy Action Plan (PAEC). This comparison should allow to clearly identify what are currently the main barriers and drivers for a successful transition to CE in Portugal, and from there, derive concrete recommendations for improvement in this matter. This report has been divided in 6 sections:

- **Methodology:** focuses on the choice of the methodology, and the sources from primary and secondary data.
- **State of Play from a Planning Perspective:** an in-depth analysis of the current institutional setting for the CE in Portugal, using exclusively as secondary data the information provided in the official national documents.
- **State of Play from a Stakeholder's Perspective:** a series of semi-structured interviews were conducted with a diverse group of stakeholders. The findings of these interviews provide valuable insights into the common barriers and drivers to CE implementation in the Public Sector.
- **Assessment – Maturity of Portugal's CE Institutional Setting:** the analysis has been structured as the following: the different barriers and drivers identified have been categorized into one of the eight elements of the Maturity Model, and were subsequently evaluated either as basic, advanced, or strategic according with the criteria outlined in the referred model.
- **Improvement of Strategic Implementation of CE:** this section focusses on the explanation regarding the foundation of the network governance theory and clear recommendations for overcoming the barriers identified, including EU best cases examples, such as the Netherlands.

The report concluded with specific recommendations for improvement of the Portuguese institutional setting based on the analysis made on the third section and relevant academic literature, such as the network governance theory. These recommendations included using "transition brokers" as orchestrators of the CE initiatives; mainstreaming of CE principles, instruments, and indicators across action levels; and setting up an effective monitoring system for CE practices.

2. METHODOLOGY

2.1 Methodological Choice - Model for Institutional Analysis

This institutional analysis has an exploratory nature, which is characterised by being flexible and adaptable to change. Thus, it was decided to use in this report a multi-method qualitative approach:

- utilising the secondary data collected through relevant literature,
- national documents to evaluate the institutional setting in Portugal,
- semi-structured interviews as the primary data to establish the grounds for comparison regarding what is supposed to be occurring and what is happening in the country at a CE level from the public authorities' perspective.

The process behind the data collection and analysis will be further explored in the next section.

2.2 Data Collection

2.2.1 Secondary data

The first step of the data collection process concerns about secondary data that has been utilised in Section 3: Institutional Analysis of CE in Portugal – The State of Play from a Planning Perspective.

Considering that the ultimate objective of this report is to provide clear guidelines regarding how to improve the Portuguese institutional setting to better implement CE at the national level, it was perceived as relevant to develop, in the first place, an institutional analysis having as basis exclusively secondary data - the information provided in public national reports such as the prevailing Portuguese Action Plan for the Circular Economy (PAEC), the APA and DGAE report "Review of PAEC Activities and Achievements between 2018 and 2020", as well as the 2023 National Budget. By using these documents as supporting tools, it was possible to draw a clear picture of the current state of the CE planning at the country level, since these documents work as the official guidelines to the implementation of CE in Portugal.

'Secondary data' was also used as a complementary tool for the analysis of the 'primary data' in section four. A small literature review was conducted regarding the drivers and barriers for a successful CE implementation at a country level. These data were used to understand if the findings resulting from the interviews were aligned with the academic results.

'Secondary data' was also relevant in the recommendation section of the report (section six), since to provide accurate and valid suggestions about how to improve the CE institutional setting in Portugal, it was deemed as necessary to use relevant academic literature (e.g.: Network governance theory) and other countries' official national data as reliable supporting sources of information.

2.2.2 Primary data

To better understand the Portuguese CE institutional setting and draw a clear comparison from what is outlined in the PAEC and what is perceived by the key public authorities directly involved in the implementation of CE in Portugal, it has been decided to use as primary data the collection method one-to-one semi-structured interviews to further develop the institutional analysis.

These interviews were also planned having *Norion's Model for Institutional Analysis* as baseline. The questions were structured according to a (I) general introduction, followed by (II) CE Technical Areas; (III) CE Vision, Principles and Policies; (IV) CE Leadership; (V) CE Strategy; (VI) SCP Structure; (VII) CE Systems;

Institution, staff, competences; and (VIII) CE Culture. Follow-up questions were also asked for further clarification when necessary. All the interviews were conducted in Portuguese, lasting between 30 and 60 min and were recorded and transcribed with explicit agreement from the respondents.

The respondents selected were categorized by APA through the level of importance from High, Medium to Irrelevant for this institutional analysis. In total, 17 institutions were interviewed, ranging from public authorities to non-governmental bodies. It was also considered previous interviews from the Project Closing the Loop, which was focused on the use secondary raw materials in Portugal.

2.3 Data Analysis

2.3.1 Secondary data – Scope of institutional analysis

The secondary data derived from the PAEC, the APA & DGAE report and from the 2023 National budget, was analysed through the lenses of the *Norion's Model for Institutional analysis* – a model comprising eight closely interrelated organisational elements providing a clear picture of an organisation's strengths and weaknesses in terms of achieving desired outcomes: its visions, structure, leadership, employees, strategies, culture, systems and networks/partnerships. Together, these elements constitute the institutional model.

This model emphasises that the institutional elements are closely interrelated in a dynamic entity, meaning that all components are interdependent; thus, making changes implemented within one institutional part imply consequences for other institutional factors. Simultaneously, it is rarely sufficient to focus on one or only a few of the institutional elements if the overall performance has to be improved. The key features for the analysis are:

1. **Vision and policy:** A vision and policy express the ambition for national efforts in the medium and long term. In some – few – Member States, a consolidated circular vision and policy with matching budget lines have been prepared; however, in most countries, the CE principles are incorporated in sectoral policies – typically with the environmental policy setting the framework. The clear vision points out the direction of central and decentral public institutions and also for private businesses and the public.
2. **Leadership:** Since government entities face different and often contradictory expectations from many stakeholders, leadership is needed to set the direction of the national organisations by expressing visions and values, allocating budgets, formulating strategies, and supporting staff in implementation. Good leadership, demonstrating organisational values and good use of delegation, inspires the staff to perform at their best.
3. **Strategy:** A national strategy spells out the priorities of the Member State and a roadmap outlining the way ahead –again, with a matching budget. The strategy defines how objectives are to be reached and can be seen as a framework management plan involving four steps, all of which will be investigated and discussed during the present project: Where are we now? –Current state of play (including assessment of statutory obligations); where do we want to go? -Definition of goals (based on the vision); How do we get there? -Formulation of targets, objectives and actions; Are we succeeding? -Monitoring and review. The strategy illustrates the objectives and success criteria for all parts of the government and offers a benchmark against which the organisations' performance can be measured and reviewed.
4. **Staff:** Vision, policies, leadership and strategy are crucial in creating motivation for staff (and stakeholders). Without competent, committed, and responsible staff, the government will be unable to deliver environmental goals. Therefore recruitment, capacity building and staff motivation are among the management's most essential functions.

5. **Structure:** An effective CE structure entails a transparent and conducive formal and informal division and coordination of activities and responsibilities. The main structural challenges concern the distribution of roles, decision mandates, and fields of knowledge within the government.
6. **Systems:** Well-functioning systems to support CE processes, activities, communication, and decision-making form the basis of a well-functioning GE-organisation. Systems can increase consistency and effectiveness in daily practices and help to avoid uncertainty and achieve the desired quality of work. The current project will support systems by defining requirements for a platform to support secondary raw material transactions.
7. **Culture:** The culture makes the organisation stick together. It is crucial to foster a culture around CE, so that government, businesses and the public all draw in the same direction.
8. **Networks and partnerships:** The EU Member States all strive to harvest the benefits of a CE, and many ambitious initiatives have been launched in the individual Member States. Close networking with peers in other Member States can strengthen the probability of achievement of outcomes. Internally in the country, partnerships between authorities, research organisations and the business community have been demonstrated to be effective for reaching remarkable results.

By analysing the information available in the national documents through these eight elements, it became possible to get a better and clearer overview of the state of play of the national CE institutional setting.

2.3.2 Primary data – Interviews' analysis

In a second stage of analysis, there was the aim of taking one step further on analysing the Portuguese institutional setting for CE by directly taking into consideration the perspective of the national public authorities. This would allow the understanding of what are the gaps between what is happening from the stakeholders' point of view in comparison with what has been originally outlined in PAEC for the Circular Economy, and from this comparison, clearly identify the drivers and barriers for a successful CE implementation.

Therefore, several statements were highlighted from the different interviews which were subsequently categorized in one of the eight elements of the Institutional analysis model: Vision, Leadership, Strategy, Structure, Culture, Staff, Systems and Network. Afterwards, these same statements were categorized either as a barrier or as a driver. It is important to highlight that to be validated either as a barrier or a driver, the statement being considered had to be identified at least three times thorough the interviews or has been confirmed through the academic literature specialized on this matter.

2.3.3 The Maturity Model – A joint analysis of the primary & secondary data

As a final stage of analysis, the findings resulting from the secondary and primary data were brought together through the lenses of the *Norion's maturity model.* This model has also as its foundation the above-mentioned institutional model.

The maturity model enables the assessment of a nation's institutional setting from the perspective of theoretical principles and experienced performance of different institutional settings. The maturity assessment shows the development stage of the national CE organisation – and points out avenues of improvement.

The model below (Table 1) describes each organisational element in three levels - basic, advanced, and strategic – enabling the benchmarking of the Portuguese CE institutional setting.

	BASIC	ADVANCED	STRATEGIC
Vision	• Internal vision with some circular aspirations in national organizations; • prioritization of competition over circular economy; • focus on recycling	• National circular goals for waste reduction and resource productivity; • Circularity goals for specific sectors and organizational structures; • Both consumption and production covered • Goals for expected share of GPP contracts with circular requirements;	• Ambitious goals on expected outcome of circular economy action plans; • aspirations for strategic support for circular national business development; • Industry guidelines for material efficiency, reuse, recycle, resource cascading, symbiosis
Leadership	• National institutions have a shared and undefined common responsibility for implementing circular economy; • Leadership voices are mainly heard in speeches and public statements	• Appointed national focal institution for Circular economy; • Some articulation of the importance of circular economy; • Interest in volume of circular procurement; • Some communication on circular strategies; • Support of informal behavioural norms	• Explicit attention on circularity from government and key institution's management; • Overall CE leadership expressed by one institution • Clear communication on the importance of CE • Sectoral leadership clearly expressed • Application of a mix of instruments to ensure progress within circular economy; • Learning from outcome monitoring as basis for preparing of follow up actions; • Involvement of business actors and experts in target formulation and action plan development; • Business associations perceive CE as an opportunity • Laws and taxation support CE at all levels • Public authorities as role models for private and industry actors
Strategy	• Soft goals indicating some priorities • Recycling as key CE focus area • No clear targets • No action plan with budget	• Strategy with some output-oriented targets related to key CE strategies – for example reduse, reuse, repair, recycle (refer to the ten R-strategies in the table beneath) • Strategy with focus on specific key sectors, for example electronics, textiles, bio, agriculture, plastics, batteries, (see Green Deal) • Strategy with focus on outcome – economic benefits, job creation, CO2-emissions, resource use • Action plan pointing towards achievement of strategic targets • Budget allocated for implementation of the CE strategy, including research and support programmes • Stakeholder/market dialogue and participatory approaches; • Identification of options for terms of reuse, recycling, refurbishment, and repair key product emission areas • Clear emphasis on consumption as driver for CE production	• CE strategic framework with long term SMART targets and plans with cross sectorial approach; • Well-reasoned priorities focusing at societal benefits • Tangible mid-term SMART targets for key sectors and types of outcomes; • Organisational strategy including development of national capacity, structure, communication, monitoring • Strategic coverage of all relevant CE strategies (the ten R's) • Strategy covering urban and rural areas; • Analysis of costs and benefits of circular endeavours; • Clear CE action plan, with responsibilities and budgets • Local governments with own CE strategies • Support for investigation of new approaches for circular practices; • Financial institutions have role in CE implementation • Transregional and international cooperation

Structure	• Responsibility for CE in key areas not distributed; • Scattered (not structured) efforts for CE; • Governmental institutions work with CE in silos	• Some central level governmental institutions committed to CE • Local government association assumes CE responsibility • Business associations in dynamic cooperation with the public sector • Government institutions communicate on responsibility allocation. • Public procurement acknowledged as important factor in CE	• Transparent and logical CE structure with responsibility distributed and accepted for all key sectors and R-strategies • Proactive advisory and support structure in place for all key sectors and thematic areas, including local government level • Close cooperation between government institutions, no overlap in responsibilities • Monitoring tasks well distributed • Public procurement as enabler and driver for CE
Staff	• Little knowledge of CE capacity needs in public institutions • No focus on expanding public sector staff's circular competences • Business associations in governmental and private organizations	• Capacity needs within key public institutions analysed • Some capacity building taking place for selected key sector institutions • Some involvement of external competences • Some business associations and sectors acknowledge societal and economic perspectives in CE	• Institutional capacity needs assessment with derived plans • Support to conduct of high-quality CE training • Realized capacity building within all key government institutions • Local governments capacitated within relevant areas such as green business models, sustainable procurement, waste prevention, reuse and recycling • Involvement of external expertise when relevant
Systems	• Few and meagre systems established to support CE • •	• Some relevant guidelines, procedures, and case examples for CE prepared – including SPP, green business, local level CE efforts, … • Some monitoring of CE outputs and outcome established • Systematic prioritisation of (relatively sparse) CE public sector resources • Some systems working against CE vision (focus on cheap products; limited	• Analyses of CE strategies and initiatives conducted with recommendations disseminated countrywide • Countrywide joint development and operation of systems and guidance for circular business, waste prevention, reuse, recycling, Sustainable Public Procurement etc. • LCA and TCO based circular criteria in public procurement; • Systems established to enhance longevity of products • Public institutions and the private sector in practice pursue product quality and longevity, including support to Product Service Systems • Multi-level collaboration and national support for regional public organizations; • SPP guidelines disseminated focusing on circular procurement • Systematic monitoring of output and outcome of CE efforts, with involvement of key stakeholders and use of results to optimise strategies • Broad internal and external communication on actions • Databases and tools for circular initiatives in SMEs; • demonstration projects through private-public partnerships; • technical and juridical consultation with SMEs

Culture	• Limited consideration of circular aspects in working practices; • Sparse dissemination from governmental institutions of knowledge supporting CE	• Circular consideration well anchored among private and public actors; • Circular goals are visible through leadership actions; • Public collaboration with NGOs on behavioural changes	• CE mainstreamed in governmental institutions a • Residual materials considered a resource • Circular agendas are incorporated in everyday work practices and strategic planning; • The Circular agenda as a part of institutional identity as well as internal and external communication;
Network	• No national coordination committee or network • Limited sparring with national key stakeholders of international peer organisations	• Participation in national conferences •	• Active networking with MS with similar industrial challenges • Active exchange of experience with CE frontrunner countries • Financing and facilitation of national networks with key stakeholders

Table.1 Norion's Maturity Model

On section five, Assessment – Maturity of Portugal's CE Institutional Setting, the different barriers and drivers identified in the institutional analysis using both primary and secondary data were categorized into one of the eight elements (Vision, Leadership, Strategy, Structure, Culture, Staff, Systems and Network). These elements were subsequently evaluated into basic, advanced, or strategic, depending on criteria provided in the above presented Maturity Model.

3. INSTITUTIONAL ANALYSIS OF CE IN PORTUGAL – THE STATE OF PLAY FROM A PLANNING PERSPECTIVE

This section presents an in-depth analysis of the current institutional setting for the CE in Portugal, using exclusively as secondary data the information provided in the official national documents which work as the guidelines for the implementation of CE in the country, such as: the prevailing Portuguese Action Plan for the Circular Economy (PAEC), the APA and DGAE report "Review of PAEC Activities and Achievements between 2018 and 2020", as well the 2023 Portuguese National Budget.

This analysis was conducted utilising the eight elements of Norion's institutional analysis model as the supporting tool. Each of the elements (Vision, Leadership, Strategy, Structure, Culture, Staff, Systems and Network) were individually considered in the subsequent sub-sections.

3.1 The Portuguese, National CE vision – The Portuguese Action Plan for the Circular Economy (PAEC)

In 2017, the Portuguese Circular Economy Action Plan (PAEC) is officially launched. The plan enabled Portugal to make commitments aligned with the Action Plan for the Circular Economy of the European Union, the Paris Agreement, the Industrial Policy Strategy of the EU, and the Sustainable Development Goals set by the United Nations for 2030. The PAEC resulted from approximately one year of inter-ministerial work that brought together representatives from the Ministry of the Environment, the Ministry of the Economy, the Ministry of Science, Technology and Higher Education and the Ministry of Agriculture, Forestry and Rural Development (APA & DGAE, 2021).

The overall goal defined by PAEC is a successful transition to a circular economy to be achieved through a roadmap. The PAEC has a holistic and systemic approach, which is required to successfully transition to a new economic model and also interacts with the following national plans and strategies:

- National Roadmap for Carbon Neutrality 2050
- PNPOT - National Programme for Land Planning Policy
- I&I Agendas - Research and Innovation Agendas
- ENEA - National Strategy for Environmental Education
- ENCPE 2020 - National Strategy for Green Public Procurement
- ENCDA - National Strategy to Combat Food Waste
- PNUEA - National Programme for the Efficient Use of Water
- PERSU - Strategic Plan for Municipal Waste
- ENAB - National Strategy for Organic Farming
- PENSAAR 2020 - New Strategy for the Water Supply and Wastewater Sanitation Sector
- ECO.AP - Programme for Energy Efficiency in Public Administration
- ENM - National Strategy for the Sea 2013-2020
- Tourism Strategy 2027
- PERH - Strategic Plan for Hospital Waste
- PNAEE - National Action Plan for Energy Efficiency
- PNAER - National Action Plan for Renewable Energies
- PNPAS - National Plan for the Promotion of Healthy Eating
- National Water Plan
- Programme to Support Electrical Mobility in Public Administration
- National Programme for Education for Health, Literacy and Self-Care of the Population
- Sustainable Cities Strategy 2020

The Government of Portugal has established four main objectives for 2050, to leverage and spur development of work within the PAEC and covering all actors in the economy (government, companies and civil society) (PAEC 2017/2020):

1. **A carbon neutral economy** efficient and productive in its use of resources.
2. **Knowledge as impulse:** focusing on research an innovation to create the most efficient and effective solutions at product, services, business models, consumption, and behaviour levels.
3. **Inclusive and resilient economic prosperity** against price and risk volatility, and gradually decoupled from negative environmental and social impacts.
4. **A flourishing, responsible, dynamic, and inclusive society** guided by being and caring rather than wanting and possessing.

PAEC also aims to set out a "middle-out" action platform for Circular Economy (Figure 1) where initiatives enabling the interaction between governance actors (public institutions) and circular economy implementation actors (companies, municipalities, consumers) are regularly and systematically being held with the goal of sharing knowledge and best practices, contacts, and experiences.

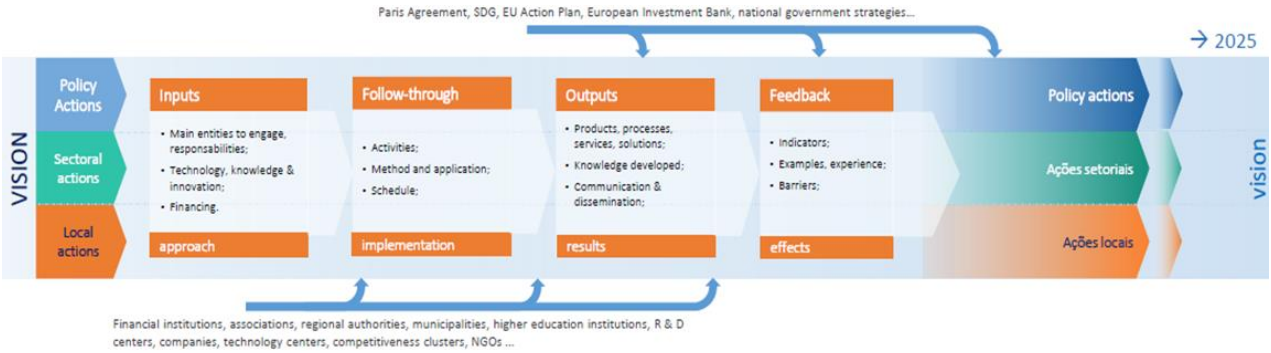


Figure 1. "Middle-out" action platform for Circular Economy (Source: PAEC 2017/2020)

3.2 Portuguese CE leadership and structure – Stakeholder mapping

To understand which stakeholders are responsible for CE in Portugal (at the elaboration, management and monitorisation level) and how their interaction occurs across the three levels of action defined in the Portuguese CE action plan, a stakeholder map has been developed (Figure 2.1 and 2.2).

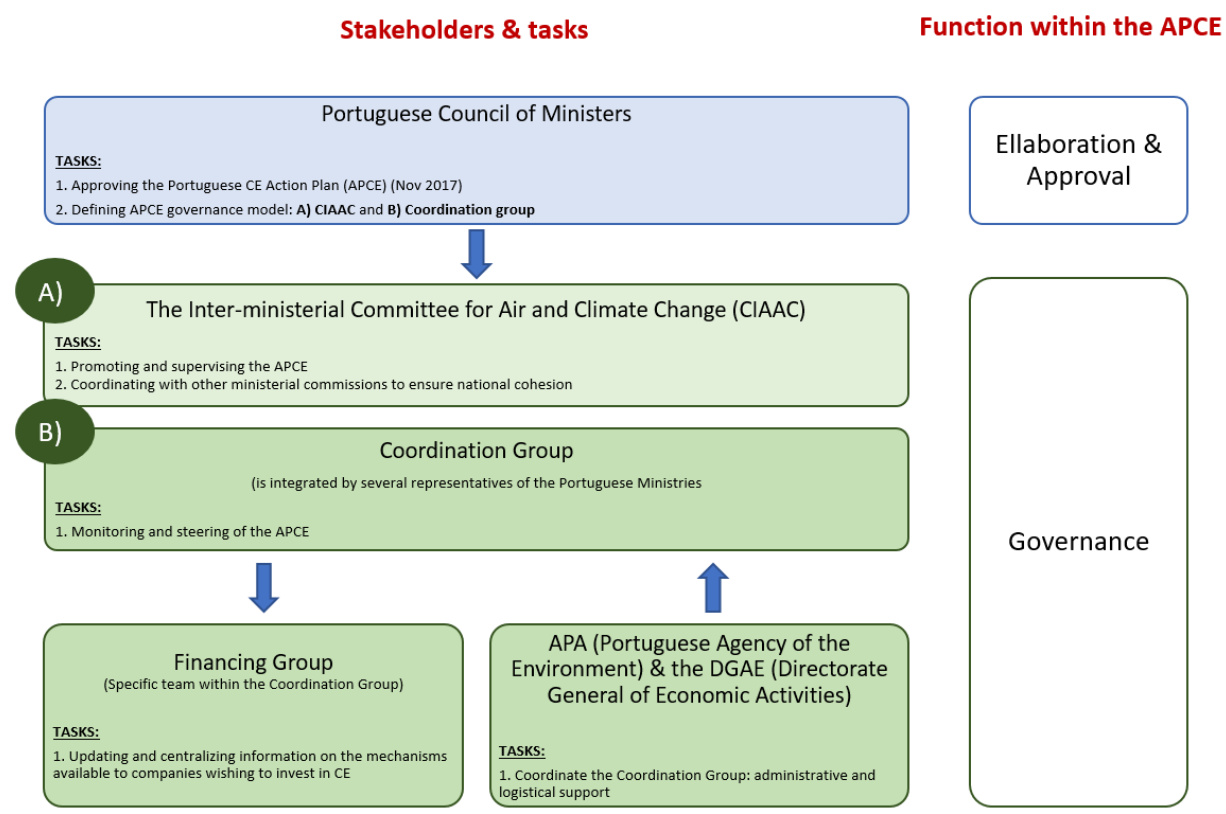


Figure 2.1: Stakeholders responsible for the elaboration, management and monitorization of the PAEC (Source: adapted from PAEC 2017/2020)

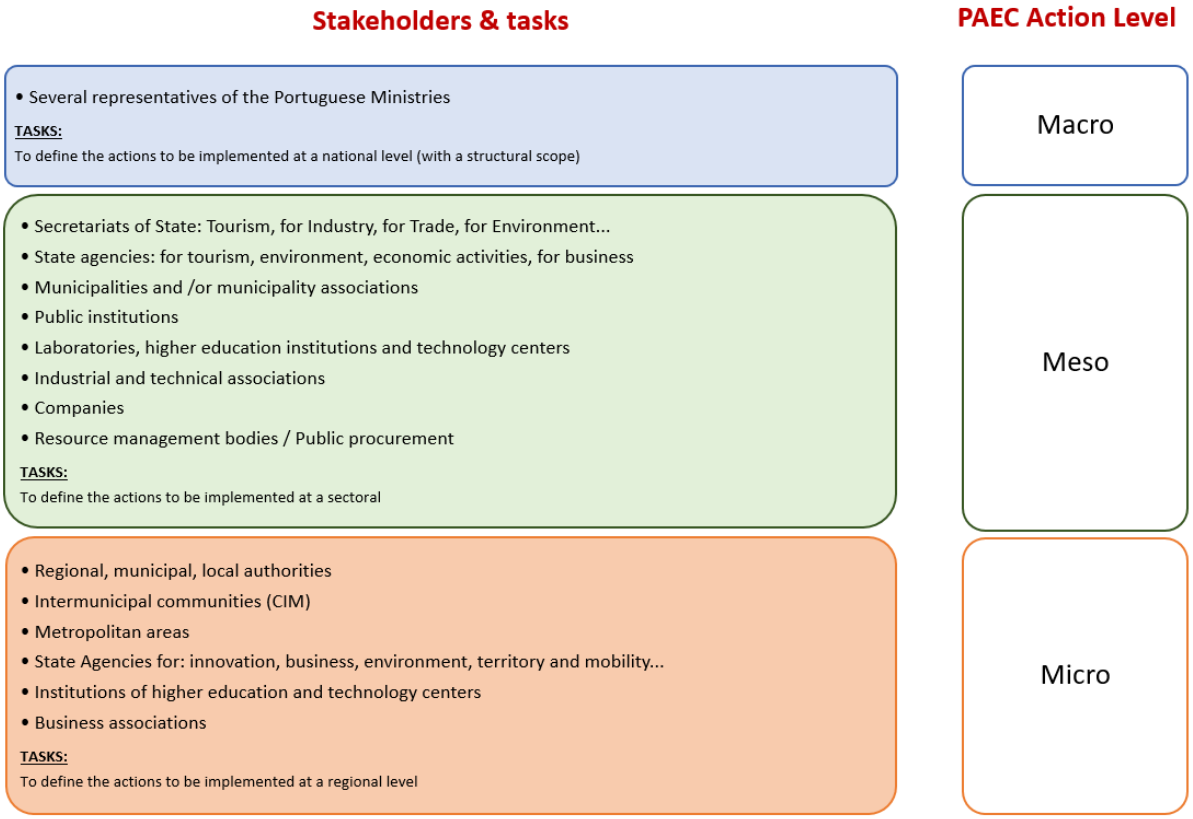


Figure 2.2: Stakeholders by the different PAEC Action Levels (Source: adapted from PAEC 2017/2020)

3.2.1 Responsibilities & structure of institutions

As it possible to identify in figure 2.1, the approval of the PAEC was determined by the Portuguese Council of Ministries, which also has the responsibility of defining the plan's governance model, which comprises two main components:

- **The Inter-ministerial Committee for Air and Climate Change (CIAAC) is** a decision-making¨ structure at the political level responsible for promoting and supervising the PAEC, aligning the circular economy topic with the work under development and ensuring political oversight. Due to the relevance of the CE topic for European development and financing policy as well as for national compliance with the SDGs, this commission should work closely with other inter-ministerial commissions to ensure coherence at the national level (e.g.: The inter-ministerial Commission for Foreign Policy or the Coordination of the Partnership Agreement).
- **The PAEC Coordination Group**, is integrated by representatives of the ministries of European Affairs, tax, local authorities, science, technology and higher education, health, planning, economy, environment, agriculture, forestry, and maritime affairs (see table 2.1). This group has the responsibility of monitoring and steering the PAEC: spreading the principles of the CE in government policies, promoting, and facilitating the execution of the PAEC's guidelines and ensuring the liking and national contribution to the measure in the EU Action Plan for the Circular Economy.
    - This group is coordinated by the representatives appointed by the economic and environmental ministers from APA (Portuguese Agency of the Environment) and the DGAE (Directorate General of Economic Activities).

Coordination group – List of representatives
a) Directorate-General for European Affairs;
b) Agency for Administrative Modernization, I. P.;
c) Planning, Strategy, Evaluation, and International Relations Office;
d) Directorate-General for National Defence Resources
e) Directorate-General of Local Authorities;
f) General Secretariat of the Ministry of Justice
g) Directorate-General for Economic Activities, which it coordinates, jointly with the representative of the Portuguese Environment Agency, I. P.;
h) Office for Cultural Strategy, Planning and Evaluation;
i) Foundation for Science and Technology, I. P.;
j) Directorate-General for Education;
k) Institute of Employment and Professional Training, I. P;
l) Central Administration of the Health System, I. P;
m) Development and Cohesion Agency, I. P;
n) Institute for Public Markets, Real Estate and Construction, I. P;
o) Portuguese Environment Agency, I. P., which shall coordinate, jointly with the representative of the Directorate-General for Economic Activities;
p) Planning, Policy and General Administration Office;

q) Institute for Nature Conservation and Forests, I. P;
r) Directorate-General of Natural Resources, Security and Maritime Services.

Table 2.1.: List of the representatives of the different ministries which integrate the PAEC Coordination Group (Source: PAEC 2017/2020)

A specific team has been created within the Coordination Group for the financing component, with a responsibility to update and centralise the information on the financial and tax support mechanisms available to companies who wish to invest in a circular economy, to compile and analyse the outcomes of these mechanisms, identify gaps and propose solutions; and to draw up proposals to support projects. The list of the representatives integrating the financing group is presented below (table 2.2).

Financing group – List of representatives
a) Representatives of the managing entities of the Operational Programmes of Portugal 2020;
b) Portuguese Environment Agency, I. P.;
c) IAPMEI - Agency for Competitiveness and Innovation, I. P.;
d) Instituto do Turismo de Portugal, I. P.;
e) Foundation for Science and Technology, I. P.;
f) National Innovation Agency;
g) Development Financial Institution, S. A.;
h) National Association of Portuguese Municipalities;
i) AICEP Portugal Global, E. P. E.;
j) European Maritime and Fisheries Fund Coordinating Commission;
k) Blue Fund;
l) Enterprise Europe Network;
m) EEA Grants Management Unit;
(n) Planning, Strategy, Evaluation, and International Relations Office.

Table 2.2: List of the representatives of the Financing Group (Source: PAEC 2017/2020)

Looking into Figure 2.2, it became clear that decision-makers are not the same across action levels. The macro-level actions have a structural scope. They are the responsibility of several national Ministers. In contrast, at the sectoral level, the initiatives and efforts developed are the responsibility of stakeholders in each sector, such as other state agencies, industry representatives, or municipalities. At the regional level, the actions are mainly responsible for regional and local agents with knowledge of their own regions' economic profile and value.

3.3 Governmental CE structure & mandates

The PAEC structure follows a tripartite approach based on macro (national), meso (sectoral) and micro (regional/local) actions (Figure 3). These actions contribute to achieving several Sustainable Development Goals (SDGs) set by the United Nations, especially Goal 12 (Responsible consumption and Production).

However, the Promotion of the Regeneration of Natural Capital, Impact on the Built Environment, Emissions Reductions, Reduction of Plastic and the Economic Effects of Innovation and Employment also impact other SDGs (e.g., Goals 4, 6, 8, 9, 11, 15 and 17) (Figure 4).

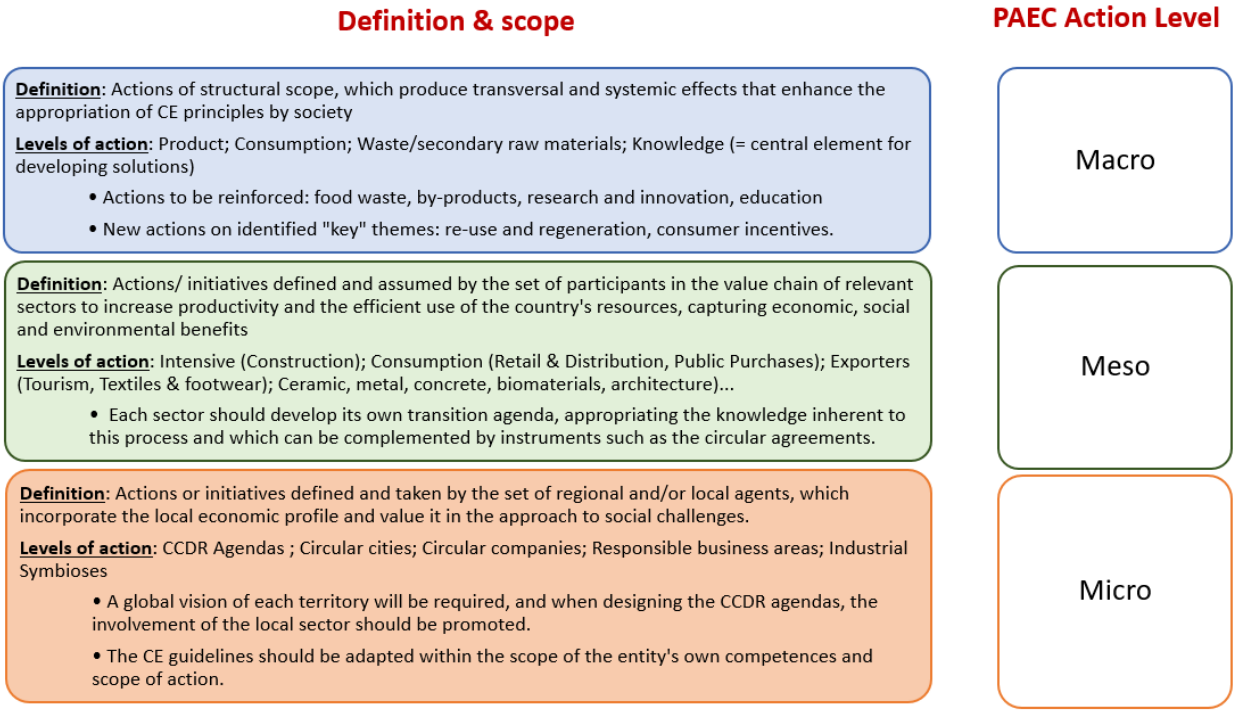


Figure 3: PAEC structure – definition & scope (Source: PAEC 2017/2020)

Figure 4: UN SDGs

This governance model of PAEC is based on an understanding and experience expected of four areas of government: a) science, technology, and higher education; b) economy; c) environment, agriculture and forestry and d) rural development, aiming to bring together the necessary knowledge and skills to advance the guidelines via specific instruments, and to combine the support, monitoring and feedback necessary to evaluate and adjust the PAEC.

At the national level, the initiatives are based on dedicated policy instruments (e.g. green taxation, voluntary agreements, Portugal 2020's environmental network, etc.), while at sectoral and regional levels (e.g. industrial symbiosis networks, circular cities, circular enterprises, etc.) the initiatives have been implemented through specific support for the development of solutions, such as planning, and technological solutions, through mechanisms designed for this purpose (e.g., Environmental Fund, Fund for Innovation, Technology and Circular Economy, Portugal 2020).

3.3.1 Governmental support & mandates - CE in Portuguese National Budget for 2023

As reiterated in the European Green Deal (European Commission, 2021), national budgets can play a vital role in the green transition. The greater use of “green budgeting” can be crucial to "*reorienting public investment, consumption and taxation towards green priorities rather than harmful subsidies*." (Portuguese National Budget, 2023).

'Green Budgeting’ can be defined as a budget review and structuring process in which CE/environmental policies, public revenues and expenditures are clearly identified in budget plans and implementation reports. The European Commission has to collaborate with the Member States to analyse and benchmark budget greening practices, by developing and promoting a training course on green budgeting to be delivered to the Member States that has requested it, in which Portugal has participated in 2021 (Portuguese National Budget, 2023).

As a result, the Ministry of Finance plans to define the basis of a national green budgeting procedure, embodied in a guiding document that describes the coverage, methodology and processes, the actors, as well as the respective timetables, both in terms of budget planning and in terms of monitoring of their execution. The outlined goal should allow the National Budget for 2024 to come already equipped with a green budgeting perspective that covers a significant part of the Central Government's revenue and expenditure, allowing its tracking and reinforcement, respectively, in the planning documents and monitoring of budget execution (Portuguese National Budget, 2023).

For 2023, a first step in green budgeting has already been taken, through the implementation of Climate Basis Law (Law no. 98/2021, of December 31), which establishes a set of guidelines and actions for the budgetary process and green taxation. This means a total expenditure of **2,519 M €** distributed across 616 different activities, with **6.7%** of these being applied to the “Waste and/or Circular Economy” category (Portuguese National Budget, 2023).

3.4 Portuguese CE strategy

3.4.1 PAEC goals & targets

The PAEC does not set specific targets since it aims to contribute to the attainment of proposed goals in different plans and strategies that work towards the same end, such as the national goals and targets set out in the waste plans, water and sanitation plans, climate action plan and energy plan, and also the goals advocated at the European and international level (e.g., sectoral directives, Portugal 2020, Paris Agreement and SDGs).

However, to align the different players’ goals for Portugal in 2020 and 2030, it was decided to add to the PAEC the strategic macro-goals and respective targets to which Portugal is committed – therefore expressing the desired effects and results of transition to the CE. The goals benchmarked were set out through

the Green Growth Commitment and proposed under the National Reform Programme: "Promote the efficient use of resources"; "Contribute to sustainability" and "Territorial Enhancement" (Figure 5). The binding goals are envisaged by considering the innovative instruments presented in the PAEC (Circular Agreements, Sectoral Agendas and Regional Agendas). To understand their impact on the transition to the circular economy, the aim is to quantify and establish the relative contribution of each instrument to achieving the aforementioned macro goals (PAEC 2017/2020).

Strategic instrument	Goal	Indicator	Unit	Base information		2020 TARGET	2030 TARGET
				Year	*Figure*		
National Reform Plan	*Territorial enhancement*	Increase urban waste prepared for recycling	%	2016	38%	50%	65%[1]
		Cut biodegradable urban waste going to landfill	%	2016	41%	35%	10%[2]
		Cut primary energy use in all sectors	Mtoe	2015	21.7	22.5	3)
Green Growth Commitment	*Promote the efficient use of resources*	Raise resource productivity in the national economy (LCC - GOAL 4 / PNGR)	€/t	2013	1.14	1.17	1.72
		Increase the incorporation of waste into the economy (LCC - GOAL 5 / PNGR)	%	2012	56%	68%	86%
		Focus on urban rehabilitation (LCC - GOAL 6)	%	2013	10.3%	17%	23%
	Contribute to sustainability	Raise energy efficiency (cut energy intensity) (LCC - GOAL 7 / PNAEE)	toe/€m GDP	2013	129	122	101
		Raise water efficiency (LCC - GOAL 8 / PENSAAR2020)	%	2012	35%	25%	20%
		Cut CO_2 emissions (LCC - GOAL 10 / PNAC 2020-2030)	Mt CO_2 eq.	2005	87.8	68-72	52.7-61.5
		Boost the share of renewable energy (LCC - GOAL 11 / PNAER)	%	2013	25.7	31%	40%

Figure 5: Strategic Portuguese macro-goals and respective targets related to CE (Source: PAEC 2017/2020)

3.4.2 Strategy per action level

The strategies considered in the Portuguese Circular Economy Action Plan involved a survey of current performance, known measures, an analysis of the European Action Plan, and benchmarking against other circular economy plans. It has allowed the creation of proposals and respective guidelines to be developed at the three levels of action.

The focus was not limited to policy instruments but also to creating awareness mobilisation and responsibilities of the different stakeholders.

Macro-level actions

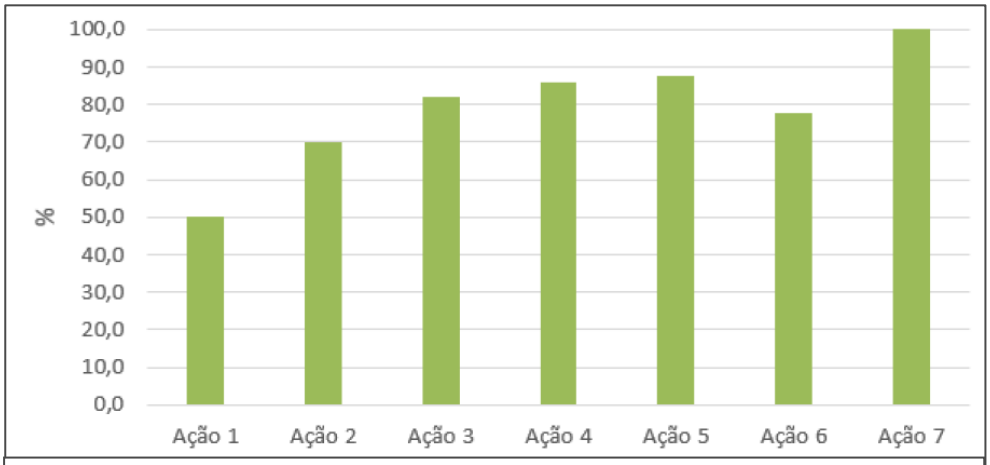
With knowledge being the critical element for solutions development the plan applies the same focus areas as the EU´s action plan for the CE – product, consumption, waste/secondary raw materials.

The most relevant actions envisaged in the plan can be categorised into seven categories:

- Action 1 - Design, Repair, Reuse: an extended producer responsibility producer responsibility
- Action 2 – Incentivize a circular market
- Action 3 – Educate for Circular Economy
- Action 4 - Feeding without surpluses: sustainable production for sustainable consumption
- Action 5 – New life for waste

- Action 6 – Regenerate resources: water & nutrients
- Action 7 – Investigate & innovate for a circular economy

In the final report, "Review of PAEC Activities and Achievements between 2018 and 2020" (APA & DGAE, 2021) , it is stated that between 2018-2020, from a total of 57 suggested orientations in the PAEC within these categories mentioned above, 44 of the orientations (around 77% of cases) were addressed by several initiatives developed by the entities/bodies that make up the GC-PAEC, with Action 1, Design, Repair, Re-use: an extended producer responsibility, being the one with a lower percentage of guidelines being approached (50%), and Action 7, Research and innovate for a circular economy, the only one in which all the associated guidelines were addressed (Figure 6).



Action 1 - Design, Repair, Reuse: an extended producer responsibility producer responsibility
Action 2 – Incentivize a circular market
Action 3 – Educate for Circular Economy
Action 4 - Feeding without surpluses: sustainable production for sustainable consumption
Action 5 – New life for waste
Action 6 – Regenerate resources: water & nutrients
Action 7 – Investigate & innovate for a circular economy

Figure 6: Orientations/Measures by Macro Action, achieved (Source: APA & DGAE, 2022)

Meso-level actions

At the meso-level, the focus was sectoral, where the entire value chain associated with a specific activity was considered. In this context, each sector was responsible for defining its own transition agenda, being the PAEC's lines of action mainly guidelines that could be used by the different sectors and which should be complemented with other initiatives developed by these sectors.

In the final report "Review of PAEC Activities and Achievements between 2018 and 2020" (APA & DGAE, 2021) there were seven sectors considered which presented a circular economy agenda:

- Green Public procurement
- Retail and Distribution
- Construction
- Tourism
- Textile
- Footwear
- Tunning

All these sectors were considered relevant for accelerating the transition to the circular economy since they are materials-intensive, export-oriented and have a significant consumer impact.

It is important to highlight 'The Resolution of the Council of Ministers No. 38/2016, of 29 July', which approved the National Strategy for Green Public Procurement 2020 (ENCPE 2020), which advocates for the establishment of working groups for the development of environmental criteria for different categories of priority goods or services. The follow-up and monitoring of the ENCPE are ensured by a working group that includes the APA, which coordinates, IMPIC, ESPAP and SPMS.

Micro-level actions

At this level, it was necessary to coordinate and develop the Regional Agendas for the Circular Economy tailored to the economic profile of each region – this task has been developed and conducted by the five Regional Coordination and Development Commissions of the Continent (CCDRs).

Between 2018 and 200, the main initiatives developed were the following:

- Identifying industrial symbiosis networks in the regions: ongoing synergies and development potential
- Establishment of a network of circular economy solutions, practices, and knowledge in an urban context
- Support for the identification of circular economy opportunities in companies and good practice networks.

These initiatives were characterised by the participative involvement of municipalities, companies, non-governmental organisations, higher education institutions and populations in all regions.

3.5 Staff

One of the macro strategies under the PAEC is "Educate for a Circular Economy", which has the goal of establishing a collaborative, strategic and cohesive commitment to creating environmental literacy in Portugal through the National Environmental Education Strategy (ENEA), and therefore having circular economy as one of its key pillars.

More specifically, one of the guidelines under this strategy concerned the promotion of the training of people who can intervene at the public policy level and its implementation regarding concepts of sustainable development, circularity, and the need to promote reduced consumption, as the importance of innovation – which according with the final report "Review of PAEC Activities and Achievements between 2018 and 2020" (APA & DGAE, 2021) was successfully achieved.

Viewpoints on the relevant staff competences of the CE key institutions – based on interviews with key stakeholders – are included in the Maturity Assessment in section 3 of this report.

3.6 Systems

As supporting tool for the implementation of a circular economy in Portugal, several actions were considered under the PAEC, yet not all of them have been implemented. The actions originally mentioned in the PAEC are presented in Figure 7.

- Survey and interlink of current policies and those under development: to promote the consolidation of policies that impact on the transition to the circular economy and ensure the options and goals of different policy areas are linked (e.g. National Program for the Territory, Road Map for Carbon Neutrality, National Science & Technology Plan);
- Activities Plan: to realise the responsibilities, activities and timeline for the actions;
- Portugal 2020 Environmental Network: to boost the network in line with Article 61.2e) of Decree Law No. 137/2014 of 12 September to harmonise environmental criteria in the operational programmes and support for establishing specific lines of investment (reprogramming);
- Circular agreements: to establish the protocol associated with "circular agreements";
- Interaction with stakeholders: to establish a network and interaction with specific stakeholders (e.g. National System of Policies and Measures (SNPM), Green Growth Coalition, National Council on Environment and Sustainable Development (CNADS), Economic and Social Council (CES), National Association of Portuguese Municipalities (ANMP) and circular economy working groups, and those belonging to the Portuguese Association of Sanitary and Environmental Engineering (APESA), Society of Engineers, amongst others);
- Monitoring: to establish a "protocol to monitor and check monitoring needs" to gauge the need for information (existing or which needs to be created) in order to better measure national progress in the transition to the circular economy;
- ECO.NOMIA portal: should be capable of better aggregating and divulging all information developed by the Coordination Group on the circular economy and also consider the prospect of making external and international communications.

Figure 7: Actions to be developed in the short-term (Source: PAEC 2017/2020)

The importance of monitoring the progress and determining the success of the policies and actions chosen is emphasized under the PAEC. However, the existing CE indicators, presented in figure 8, have a limited scope since they focus on material inputs, production and emissions, but are not able to address all the elements of circularity such as sharing, reusing and repairing.

AREA		Indicator	Past (2005)		Present (2016)		PT/ EU	Change 2005-2016	
			PT	EU	PT	EU		PT	EU
RESOURCES	PRODUCTIVITY	**Resource productivity (€/kg)** Defined as gross domestic product (GDP) divided by domestic materials consumption.	0.891	1.5456	1.08	2.07	52%	21.36%	34.11%
		Productivity of artificial areas (PPP (purchasing power parity) millions per km²) [2009 (corresponds to just 23 countries, not including BG, CY, HR, MT, RO); 2012] Defined as a country's gross domestic product (GDP) divided by its total artificial areas. Artificial areas: urbanised areas (surfaces covered with buildings and greenhouses) except towns (roads and sealed surfaces). Shows whether the productivity of built artificial areas is used efficiently to generate added economic value.	44.8	71.5	48.5	80.8	60%	8.25%	13.01%
ENVIRONMENTAL IMPACT	MATERIALS	**Domestic materials consumption (ton/ capita)** Defined as the total amount of materials used directly in the economy and is equal to direct material input (domestic extraction plus imports) less exports.	18.65	16.03	15.58	13.02	120%	-16.45%	-18.79%
	ENERGY	**Energy productivity (€/kg of oil equivalent)** Defined as GDP divided by gross domestic energy use in a certain calendar year.	6.40	6.70	7.50	8.30	90%	17.19%	23.88%
		Share of renewable energy (%) Percentage of renewable energy compared to total energy consumed	19.50	9	28	16.70	168%	43.59%	85.56%
	EMISSIONS	**GHG intensity in energy use (Index 2000=100)** [-; 2015] Ratio of energy-related GHG emissions (carbon dioxide, methane and nitrous oxide) to gross domestic energy use.	97.60	96.80	87.80	89.10	99%	-10.04%	-7.95%
		Per capita GHG emissions (tons of CO_2 eq per capita) [-; 2015]	8.63	10.81	6.95	8.75	79%	-19.47%	-19.06%
TRANSFORMING THE ECONOMY	TRANSFORMING WASTE INTO A RESOURCE	**Waste production excluding mineral waste, dredging waste and contaminated soils (kg/capita)** [2004;2014]	1825	1907	1184	1716	69%	-35.12%	-10.02%
		Landfilling rate with the exclusion of mineral waste, dredging waste and contaminated soils (%) [2010; 2014] Defined as the volume of waste sent to landfill (directly or indirectly) divided by the volume of treated waste (exclude mineral waste, dredging waste and contaminated soils).	43	29	31	25	124%	-27.91%	-13.79%
		Urban waste production (kg/capita) [-; 2014]	452	515	453	477	95%	0.22%	-7.38%
		Urban waste landfilling rate (%) [2010; -]	62	38	34	-	-	-45.16%	-
		Urban waste recycling rate (%) [-; 2014]	15.20	n.d.	30.40	43.70	70%	100%	-
		Packaging waste recycling rate (%) [-; 2014]	44.30	n.d.	57.10	65.50	87%	28.89%	-
		Electrical and electronic waste recycling rate (%) [2008; 2014]	21.80	n.d.	42.70	n.d.	-	95.87%	-
	SUPPORTING RESEARCH AND INNOVATION	**Eco-innovation index** (EU=100) [2010; -] Index with 16 indicators (e.g. green investment, jobs, patents)	72	100	95	100	95%	31.94%	-

Figure 8: Current CE indicators used in Portugal (Source: PAEC 2017/2020)

Measuring "circularity" is a challenge for all Member States. To address this gap, the European Commission is developing a monitoring framework for CE, in which member states are participating (APA & DGAE, 2021).

Under the original PAEC, it was mentioned that a protocol would be developed to follow and verify monitoring needs by the Coordination Group to define complementarity indicators to understand the level of transition and the national level by sector and intervention area (PAEC, 2017/2020) – however this protocol was not developed until the current date.

The Portuguese Circular Economy performance, given the statistical indicators defined by the European Commission (Eurostat, 2019 data) is presented in Figure 9:

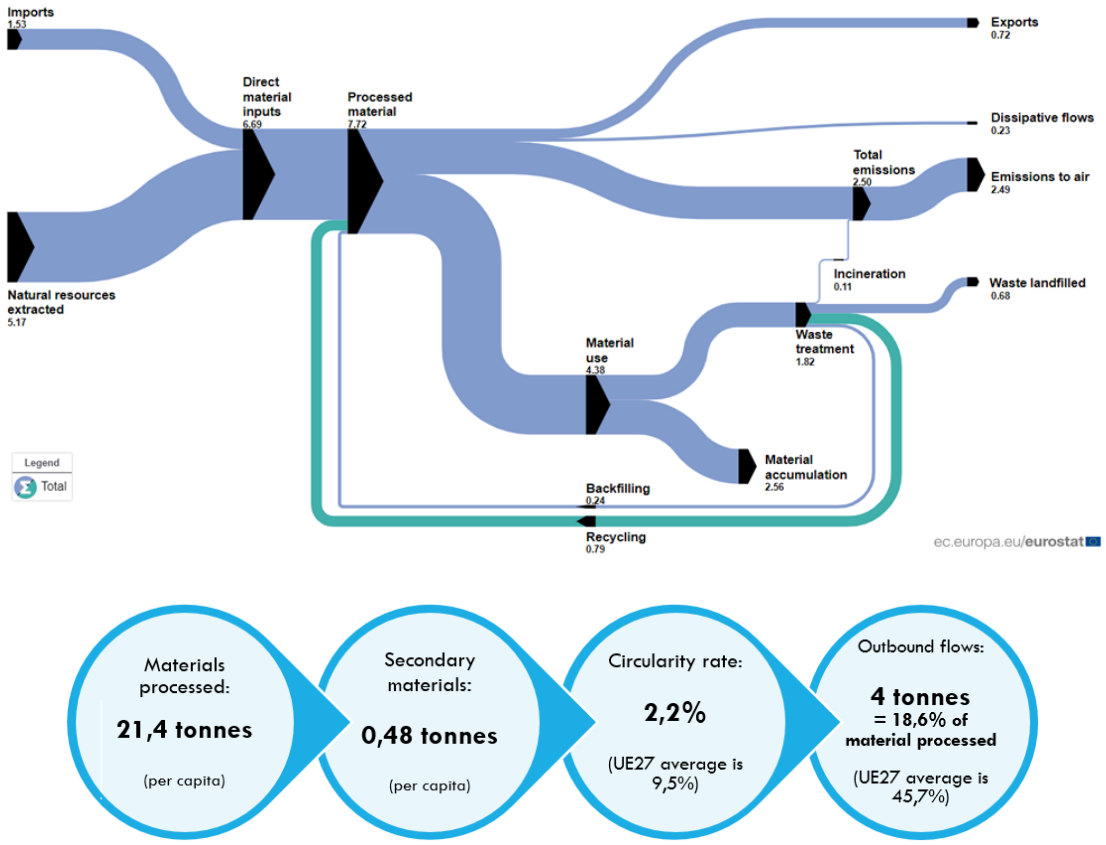


Figure 9. The Portuguese CE performance (Source: APA & DGAE, 2021)

- As regards production and consumption, there has been an increase in the production of urban waste per inhabitant, and Portugal has recently surpassed the EU average.
- The consumption of materials per inhabitant has also shown an increasing evolution in the recent past, being higher than the EU average.
- The evolution of resource productivity has stabilised, with this evolution in Portugal (1.16 per kg) below the EU average (2.09 per kg).
- In relation to waste management, Portuguese progress has been limited, particularly regarding the recovery/recycling of municipal waste which is below the EU average (28.9% vs. 47.7%).
- In terms of competitiveness and innovation and taking into consideration the sectors of recycling, repair and reuse, rental, and leasing services, their representativity in GVA in Portugal is below the EU average, with 0.8% of GVA, while employment is responsible for 1.9%, above the EU average (1.7%).

(Source: APA & DGAE, 2021)

Despite the many initiatives that have taken place and the dynamics that have been effectively generated across many activities in Portugal, the statistical indicators show that the country is generally performing below the EU average, maintaining the characteristics of a slow metabolism and low productivity of resources.

The results of the performance in terms of the CE show that there are still many challenges to overcome to accelerate the transition towards what is intended to be a new economic, social, and environmental model (APA & DGAE, 2021).

3.7 Network

The relevance of building the right partnerships and collaborations for a successful transition to a circular economy is an idea embedded in the Portuguese Action Plan for Circular Economy that applies a holistic and systemic approach. The PAEC is built as an action platform to connect the various national ministries, civil society, and organisations, enabling the interaction between the governance and the circular economy implementation actors (PAEC, 2017/2020).

The PAEC prioritises establishing a CE network and interaction with stakeholders for short-term endeavours (e.g. National System of Policies and Measures (SNPM), Green Growth Coalition, National Council on Environment and Sustainable Development (CNADS), Economic and Social Council (CES), National Association of Portuguese Municipalities (ANMP) and circular economy working groups, and those belonging to the Portuguese Association of Sanitary and Environmental Engineering (APESA), Society of Engineers, amongst others) (PAEC, 2017/2020).

4. INSTITUTIONAL ANALYSIS OF CE IN PORTUGAL – THE STATE OF PLAY FROM A STAKEHOLDER'S PERSPECTIVE

4.1 Drivers & Barriers to CE implementation – findings from the interviews

In an effort to better understand the challenges and opportunities faced by public authorities in implementing Circular Economy practices, a series of semi-structured interviews were conducted with a diverse group of stakeholders. The findings of these interviews provide valuable insights into the common barriers and drivers to CE implementation in the Public Sector.

The identification of barriers and drivers to CE implementation in the Public Sector is an important step in the further development of the institutional analysis, as it provides a starting point for identifying areas where institutional arrangements can be improved to support the implementation of CE practices in the Public Sector.

The purpose of this section is to present a summary of the barriers and drivers identified through these interviews and provide a foundation for further discussion on how these findings can inform upcoming efforts to promote and implement CE practices in the Public Sector.

In the assessment of interviews, it has been perceived that the most common barriers inside the Public Sector are (table 3):

- Lack of promotion of CE (dissemination of CE criteria, good practices, and successful implementation; training/improving qualification of CE competences;
- Lack of understanding/knowledge-sharing on CE;

- Lack of incentive structure;
- Lack of initiative of the public sector;
- Lack of CE supporting legislation (reuse, recycling, refurbishment...);
- Lack of governmental support to redirect market pressure and lack of (perceived) financial aid, or communication on CE transitions;
- Low valorisation of waste and high prices of recycled materials, hindering market drivers.

All the barriers identified can be found on the table below:

Theme	Barrier	Nr. times identified
CE Scope (informational)	Lack of understanding/knowledge sharing on CE	34
	Lack of promotion of CE (dissemination of CE criteria, good practices, and successful implementation; training/improving qualification of CE competences)	47
	Lack of (dissemination of) CE actions to affected target groups	27
	Lack of alignment of the country needs with the Portuguese CE plan	23
	Lack of coherence in the Portuguese CE plan	21
Structural	Too many entities involved in CE, no front figure	20
	Lack of alignment and of concreate and realistic goals	28
	Lack of transparency	15
	Lack of human resources/competences in public authorities	14
	Lack of Green Public Procurement, promoting transitions in the market and industry	24
	Lack of overview of competences	9
	Lack of initiative from the public sector	30
	Lack of incentive structure	38
	Lack of willingness/interest/capabilities of business and industrial actors to commit to CE actions	25
	Cultural barrier	14
Collaboration	Lack of multi-disciplinary and multi-institutional/willingness to collaborate	18
	Strained relations/lack of trust	3
	Lack of connection between governing bodies	23
	Lack of alignment between the public and the private sector when drafting new legislation	4
Tools (implementation & quantification)	Lack of quantification tools (material level, emissions, or even results)	11
	Lack of CE structural tools to support CE actions (e.g.: technology)	24
	Lack of CE data alignment between entities	17

Regulatory, supervision & responsibility	Lack of governmental commitment to overall responsibility	17
	Inefficient delegation of plans and actions to governmental bodies, leading to inefficient monitoring	17
	Lack of aligned monitoring practices and national monitoring guidelines	30
	Lack of reinforcement of legislation	28
	Lack of revised green taxation	13
	Lack of CE supporting legislation (reuse, recycling, refurbishment...)	33
	Bureaucratic obstacles	19
Economic/Market	Budget for CE actions is not part of the national budget	6
	Lack of governmental support to redirect market pressure / Lack of (perceived) financial support, or communication CE transitions	54
	Too expensive and time-consuming for companies and other private entities to take on CE actions	23
	Low valorisation of waste and high prices of recycled materials, hindering market drivers	32
	Lack of trust of recycled materials / on the waste management process	13

Table 3: Barriers to CE implementation in the Public Sector from the stakeholders perspective (Source: Interviews)

Regarding the drivers, the most common ones identified across the interviews were the following (table 4):

- Collaborations between entities and different stakeholders;
- Knowledge-sharing between institutions;
- Provision of the right incentives and tools to stimulate a behavioural change;
- Creation of environmental compliance legislation and plans;
- Clear delegation of responsibilities.

All the drivers identified can be found on the table below:

Theme	Driver	Nr. Times identified
CE Scope (informational)	To have detailed goals and actions in CE plan, aligned	12
	Governmental engagement with CE actions and monitoring	11
	Communicating of CE actions and achievements by governing body	5
	Knowledge dissemination regarding CE	11
	Change of mindset towards sustainability	12
Structural	Focus on R&D with CE and green transition in mind from the beginning	7
	Mapping of CE competences	3

	Public entities should give the example to be followed by	4
Collaboration	Collaborations between entities and different stakeholders	29
	Governmental collaboration with industry and business actors	6
	Collaboration between governmental departments	4
	Knowledge-sharing between institutions	21
Tools (implementation & quantification)	Clear quantification tools and easy data-sharing	4
	Provide the right incentives/tools to stimulate a behavioural change	19
Regulatory, supervision & responsibility	Environmental legislation awareness	7
	Creation of environmental compliance legislation/plans	23
	Clear delegation of responsibilities	18
Economic/market	Availability of funds	6
	Prioritization of sustainability KPIs over financial aspects	4
	Decrease taxation of sustainable products and practices	6

Table 4: Drivers to CE implementation in the Public Sector from the stakeholder's perspective (Source: Interviews)

The findings of the assessment of interviews in the Public Sector suggest that the most common barriers to Circular Economy in Portugal are: a lack of promotion and training on CE, insufficient understanding and knowledge sharing, a lack of incentives, insufficient initiative from the public sector, limited supporting legislation, insufficient governmental support and market pressure, and low valorisation of waste with high prices of recycled materials. These barriers hinder the implementation of successful CE practices and the transition towards a more sustainable economy. On the other hand, the drivers identified include collaborations between entities and different stakeholders, knowledge-sharing between institutions, provision of the right incentives and tools to stimulate a behavioural change, creation of environmental compliance legislation and plans, and clear delegation of responsibilities. These drivers support the implementation of CE practices and can help overcome the identified barriers.

4.2 Drivers & Barriers to CE implementation – findings from the literature

Aligning the findings of the semi-structured interviews on the barriers and drivers to Circular Economy (CE) implementation in the Public Sector with academic literature is an important step in ensuring the validity and robustness of the results.

In this section, it will be provided a summary of the relevant academic literature on Circular Economy (CE) to serve as a basis for comparison with the results obtained from the semi-structured interviews with public authorities. This will provide valuable insights into the similarities and differences between the perspectives of the academic literature and the views of public authorities on CE implementation.

Inside the CE literature, there are several assessments of what can be considered either a barrier or a driver, aligned in different categories, such as economic, environmental, social, institutional, technological & informational, supply chain and organizational (Tura et al., 2019). Anyhow, most of the available research are focused on enterprises and SMEs and not so much on public organizations. Therefore, the CE literature tends to consider the public sector as a driver for circular economy initiatives since they are the

ones formulating new policies and frameworks, stipulating green budgets, and establishing the parameters for circular public procurement.

As it was stated before, for the public sector, the drivers for CE implementation at the organizational level have not been explored yet in detail. However, the absence of those factors might represent challenges, since part of the literature has focused on identifying barriers to overcome to accelerate CE implementation (Klein, et al., 2021).

For public organizations, the main barriers identified, according to the CE literature, are the lack of CE awareness, lack of CE knowledge, skills, and training, especially in public procurement procedures and the presence of bureaucratic mindsets, isolated and hierarchical structures preventing information flows and collaboration. It has also been noticed the lack of interaction and engagement with external stakeholders.

Therefore, having a leadership team active towards CE at the organizational level has been emphasised as one of the most important success factors for CE implementation in organisations. However, studies have shown that there is little to no leadership interest in organizational circularity in the public sector**,** which is something noticed during the interviews conducted with public stakeholders in Portugal. Klein et al. (2019) state that to be able to examine CE implementation in the public sector, it is crucial to inquire about evidence of leadership.

In summary, the findings from the semi-structured interviews with public authorities align with the academic literature on Circular Economy in several ways. The barriers previously identified in the interviews, such as lack of promotion and dissemination of CE criteria, lack of understanding and knowledge-sharing on CE, lack of incentive structure, and lack of governmental support, are also highlighted in the CE literature as challenges for the implementation of CE in the public sector.

On the other hand, the drivers identified in the interviews, such as collaborations between entities and different stakeholders, knowledge-sharing between institutions, and clear delegation of responsibilities, are also emphasized in the literature as important factors for successful CE implementation in organizations. The literature also highlights the importance of strong leadership in promoting CE and the need to overcome bureaucratic mindsets and isolated structures.

However, while the literature emphasizes the role of the public sector as a driver for CE, it also acknowledges the lack of interest in circularity among public sector leadership and the need to explore this issue in more detail. In essence, the findings from the interviews are aligned with the academic literature and provide valuable insights into the barriers and drivers to CE implementation in the public sector.

5. ASSESSMENT – MATURITY OF PORTUGAL'S CE INSTITUTIONAL SETTING

In this section the assessment of the institutional setting will be performed, having as basis:

- The secondary data explored in section three: the Portuguese Circular Economy Action Plan published in 2018; the APA and DGAE report "Review of PAEC Activities and Achievements between 2018 and 2020", as well as the 2023 National Budget,
- The primary data explored in section four: More than 50 CE-related interviews performed during the last two years which were used in previous projects, as well as 20 more recent interviews conducted exclusively for the purpose of this project, which were structured according to the Maturity Model.

The analysis was structured as the following: the different barriers and drivers identified were categorized into one of the eight elements of the Maturity model, and were subsequently evaluated either as basic, advanced, or strategic according with the criteria outlined in the model. A summary of the results can be found in table 5.

Vision

- The 2017 CE plan involves multiple institutions (Governmental collaboration with industry and business actors) in the elaboration and implementation.
- The collaboration between the different stakeholders is critical to achieving the success of the CE plan. However, it has been happening in silos: Lack of multi-disciplinary and multi-institutional approach in earlier CE Plans.

Stage: Advanced

Portugal has a well-defined CE action plan involving multiple institutions and relevant actors at three levels (micro, meso, and macro).

The CE plan has specific circularity goals for sectors and organisational structures. However, these goals are primarily built-in silos, lacking a horizontal approach which would allow the creation and implementation of more coherent and aligned objectives, and therefore, a more successful approach to circularity national-wide.

Leadership

- There are too many entities involved in the development and implementation of CE practices in Portugal, but no precise front figure.
- Lack of transparency.
- Lack of governmental commitment to overall responsibility.
- And consequently, there is an inefficient delegation of plans and actions to governmental bodies, leading to inadequate monitoring.
- On the positive side, there is governmental engagement with CE actions.

Stage: Basic

Regarding leadership, it became clear that there is a lack of a front figure leading the development, implementation, and monitoring of the CE plan in Portugal. Too many entities are involved, which creates a lack of transparency among them.

Although governmental entities have been starting to engage with CE actions at several levels, it lacks a governmental commitment to overall responsibility. Consequently, there is an inefficient delegation of plans and activities to governmental bodies, leading to inadequate monitoring – one of the most significant barriers identified.

Strategy

- Lack of coherence in the Portuguese CE plan, which is not aligned with the country's needs.
- Lack of alignment and concrete and realistic goals within the CE plan.
- Lack of incentive structure.
- There are plenty of funds/financing opportunities available.
- Lack of governmental support to redirect market pressure / Lack of (perceived) financial aid or communication for CE transitions.
- Lack of revised green taxation.
    - The taxation of sustainable products and practices should be decreased.
- Lack of prioritisation of sustainability KPIs over financial aspects.

Stage: Basic

The Portuguese CE plan is focused on specific key sectors, however, one of the biggest barriers identified at the strategy level has been the lack of coherence and the lack of aligned, concrete and realistic goals in the Portuguese CE Plan, which according to the interviewees are not aligned with the country needs.

Furthermore, there are several funding opportunities available for the implementation of CE, yet it was a common understanding that there is a lack of a clear incentive structure, and governmental support to redirect the market pressure. It is believed that green taxation should be revised, with a decrease in the taxation of sustainable products and practices.

Also, important to mention that in Portugal, there is still a prioritization of financial aspects over environmental and social sustainability KPIs.

Structure

- Excessive public and private entities per CE action area, and lack of alignment of supporting/promoting efforts.
- Lack of connection between governing bodies.
- Lack of aligned monitoring practices and national monitoring guidelines.
- Many bureaucratic obstacles.

Stage: Basic

In Portugal, it is clear that the successful implementation of CE in the country is a shared responsibility of the different national entities and key stakeholders, both public and private.

However, there is not a clear and logical structure about how these responsibilities should be assigned. There is an excessive number of public and private entities per CE action area which means a weak alignment between them. The different governing bodies currently working with CE are on silos instead of following a more collaborative and horizontal approach.

This leads to a creation of bureaucratic obstacles, which difficult the creation of aligned monitoring practices and national monitoring guidelines.

Culture

- Lack of understanding of CE.
- Lack of willingness/interest/capabilities of business and industry actors to commit to CE actions.
- Lack of initiative from the public sector.

Stage: Basic

The cultural aspect also plays a critical role in the success of the implementation of CE practices. In Portugal, there the understanding of CE has been perceived as low. The business and industry actors do not always have the willingness, interest, or capabilities to commit to CE actions, which also leads to the unwillingness from the public sector to adopt and improve CE practices.

Staff / Employees

- Lack of training/improving qualification of CE competences.
- Lack of human resources/competences in public authorities.
    - Lack of green public procurement, promoting transitions in market and industry

Stage: Basic

There is a lack of overall human resources/competences in public authorities regarding CE, for example, at the level of green public procurement. There is not enough training and improvement of CE competences among the public sector staff, hindering the transitions in markets and industries.

Systems

- There are several knowledge-creation practices happening.
    - However, there is a lack of promotion of CE practices/knowledge dissemination (dissemination of CE criteria, good practices, and successful implementation; training/improving qualification of CE competencies).
- Lack of national monitoring guidelines.
- Lack of reinforcement of legislation.
- Lack of CE-supporting legislation (reuse, recycling, refurbishment…).
- Lack of CE data alignment between entities.
- Lack of quantification tools (material level, emissions, or even results).
- Lack of CE structural tools to support CE actions (e.g.: technology; better sorting facilities).
- Lack of a clear waste classification system: classification of waste is too complicated to be implemented in practice.
- Expensive and time-consuming (and risky), to take on CE actions for companies and other private entities.

- Low valorisation of waste and high prices of recycled materials, hindering market drivers
- Lack of trust on recycled materials / on the waste management process

Stage: Basic

In Portugal, there are a couple of initiatives incentivizing the knowledge creation regarding CE in the country, however, the different interviewees believe that this knowledge is not properly disseminated and that there is a lack of promotion of the best CE practices, like some clear guidelines, procedures, and case examples.

There is a lack of systems supporting CE in Portugal: there are not clear national monitoring guidelines, neither proper CE supporting and reinforcement legislation. There are not the right quantification tools nor CE structural supporting tools (e.g.: a clear waste classification system).

Besides, the current systems in place can work against the CE vision. It is still risky, expensive, and time-consuming, for companies and other private entities to move towards more circular practices when compared to the traditional linear ways of doing business. The low valorisation of waste and high prices of recycled materials hinders market drivers and creates a lack of trust on recycled materials and on the waste management process.

Network

- Lack of multi-disciplinary and multi-institutional collaboration/willingness to collaborate.
- Strained relations/lack of trust
- Necessity for collaborations between entities and different stakeholders.

Stage: Advanced

As previously mentioned, the need of collaboration among the different stakeholders is one of the key principles defined in the current Portuguese CE plan, yet there are no clear guidelines about how to manage the different multi-disciplinary and multi-institutional stakeholders in a successful way.

It has been pointed out that in some cases, there are some strained relations between the different actors, leading to a lack of trust among them and the creation of sub-optimal connections between them.

Pillar	VISION	LEADERSHIP	STRATEGY	STRUCTURE	EMPLOYEES	SYSTEMS	CULTURE	NETWORK
Current stage	Advanced	Basic	Basic	Basic	Basic	Basic	Basic	Advanced

Table 5: Summary of the assessment of maturity of the Portuguese CE institutional setting

The findings show that Portugal has a well-defined Circular Economy (CE) action plan with specific goals for different sectors and organizational structures. However, the plan lacks a horizontal approach, a clear leadership, a coherent and aligned strategy, and a clear structure for assigning responsibilities. The country faces a weak understanding and commitment to CE from the public and private sector, a shortage of CE competences among public sector staff, and a lack of supportive systems and guidelines. Portugal's network of stakeholders shows a need for clear guidelines on managing multi-disciplinary and multi-institutional relationships, with some strained relationships leading to a lack of trust.

In essence, the implementation of CE practices in Portugal is at a basic stage with room for improvement in several elements.

6. IMPROVEMENT OF STRATEGIC IMPLEMENTATION OF CE

Due to the disruptive nature of a transition to a Circular Economy, to overcome the challenges previously identified and incorporate the drivers perceived as relevant, it is relevant to visualize the dynamics of transition as an iterative process of the build-up of emerging alternatives and a change of established regimes over a long period (Loorbach et al., 2017). To successfully cope with this complex transition process is essential the involvement of all relevant stakeholders (government, industry, and society) and develop the capacity to connect and create the proper collaboration and exchange patterns of knowledge and best practices (Ghisellini et al., 2016).

Taking these factors into consideration, to improve the strategic implementation of CE in Portugal two different forms of governance should be considered**: the public and the network governance** – a strategy already adopted by the Netherlands, one of the world's front runners in implementing circular economy policies (The World Bank, 2022; Cramer, 2022).

In the next section, firstly will be provided an explanation regarding the foundation of the network governance theory, while in a second stage, clear recommendations for overcoming the barriers identified will be presented, which will be based on the network governance theory principles and other EU best cases examples, such as the Netherlands, who is considered one of the European front runners when it comes to the implementation of CE at national level.

6.1 Network governance as the solution

6.1.1 Public governance

This form of governance concerns the conventional role of government as the guardian of the common good (e.g., to safeguard the environment). It is necessary to formulate a policy plan and implement relevant instruments to steer towards CE. However, it is insufficiently connected to the people expected to realise the CE policy objectives (Cramer, 2022).

Governments can enhance CE initiatives through several policy instruments (e.g.: regulatory, financial-economic, and social), but without the support of industry and overall society, these same CE initiatives cannot be sustained (Winans et al., 2017; Cramer, 2020; Cramer, 2022; The World Bank, 2022).

6.1.2 Network governance

Network governance is a complement to public governance rather than a substitute (Figure 10). It is about collaboration among actors who are willing to further a transformational change and who need each other to accomplish the CE goals. All stakeholders must redefine their roles and responsibilities to help accelerate the transition (Cramer, 2022).

The governance of sustainability transitions requires an interactive dynamic between public and network governance, or in other words, between top-down and bottom-up steering, since a transformative transition as CE will be the result of emerging co-evolutionary interactions across several sectors of the economy and society during decades (Patterson et al., 2017; Cramer, 2020).

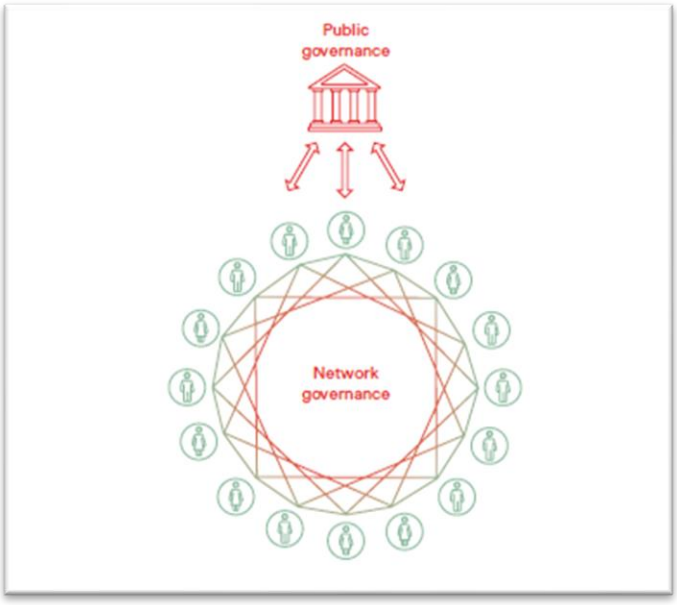


Figure 10: Relation between public & network governance (Source: Cramer J., 2020)

As stated in the World Bank report "*Squaring the Circle: Policies from Europe's Circular Economy Transition",* governments have a critical role on creating and strengthening collaborative CE communities, hubs, and networks within and across economic sectors, value chains, and regions (Figure 11).The leadership from the public sector in co-developing innovative strategies for circularity and using their convening power to facilitate cross-sectoral collaboration is another crucial aspect of a successful transition (Ddiba et al., 2020).

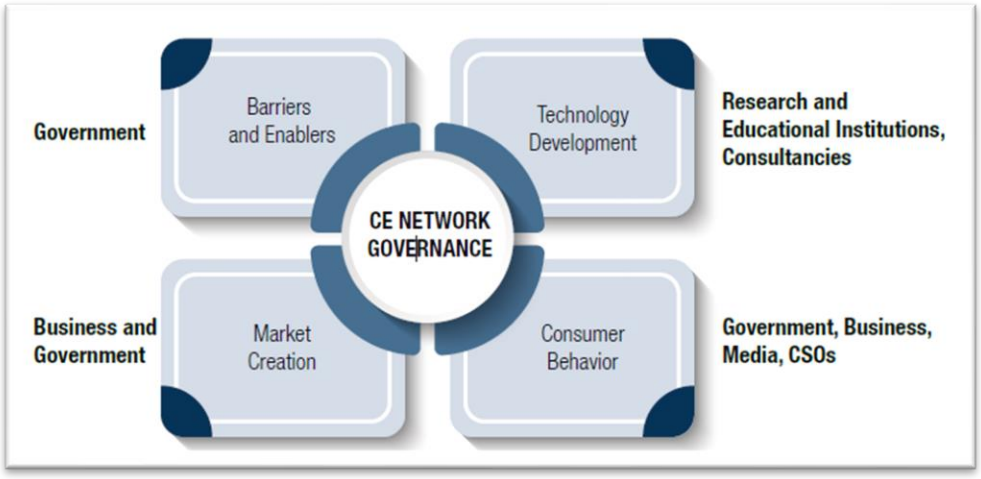


Figure 11: Actors and roles in CE (Source: The World Bank, 2022)

In order to implement CE effectively, strong leadership of the government, active involvement of different actors, and receptivity to network governance are essential (Figure 12).

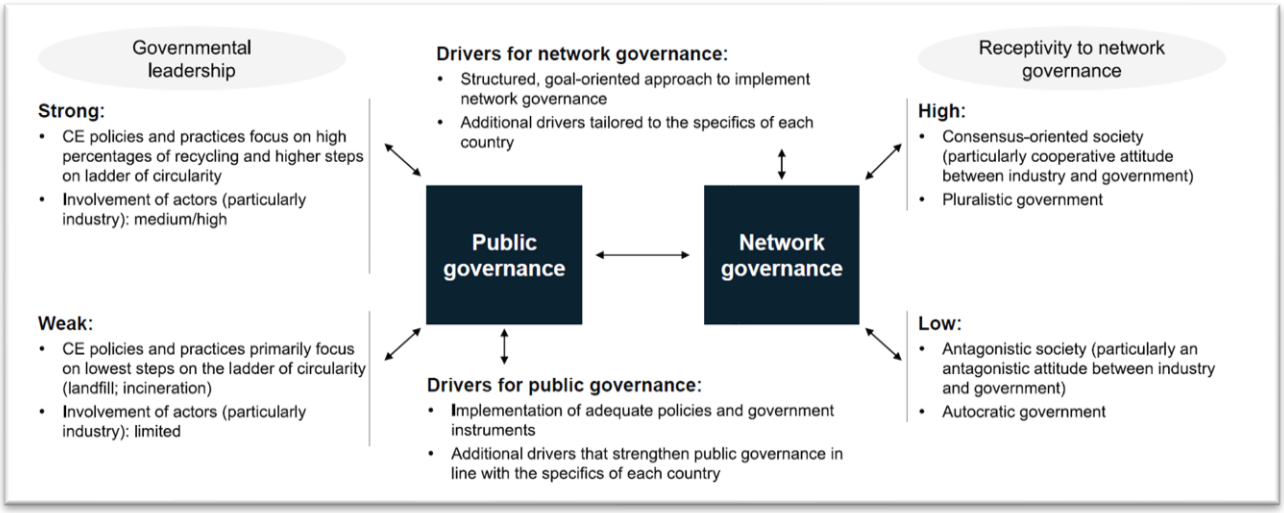


Figure 12: Effectiveness of the governance of CE (Source: Cramer J., 2022)

6.1.3 Guiding Principles for Building a CE through Network Governance

Cramer J. (2020), derived from the Dutch experience and dozens of circular initiatives and scientific research reflections, ten guiding principles for building a Circular Economy through network governance, which will be further explained in this section (Figure 13).

Sparking the transition to a circular economy
Guiding principle 1: The circular initiative starts with a shared sense of urgency
Guiding principle 2: The implementation of circular initiatives occurs in four sequential yet cyclic phases (preparing the initiative, building a joint business-case, scaling up successful initiatives and mainstreaming these initiatives)
Guiding principle 3: Tasks to be performed for each circular initiative are roughly the same, but the focus is case-specific
Guiding principle 4: Building a circular economy is a journey with a clear destination, but no predetermined path.
Context is key
Guiding principle 5: Focus on the most promising innovations
Guiding principle 6: Map the key drivers and preconditions for successful implementation
Guiding principle 7: Identify the relevant actors and assess their willingness to join forces
Successful implementation
Guiding principle 8: New circular business models should benefit all network partners
Guiding principle 9: Intermediaries ('transition brokers') can accelerate circular initiatives
Guiding principle 10: A transparent division of labour among the relevant actors is indispensable

Figure 13: 10 guiding principles for building a CE through network governance (Source: Cramer J., 2022)

Sparking the transition

The first four principles help to create a strong foundation for a successful transition from a linear to a circular system.

Guiding principle 1: The circular initiative starts with a shared sense of urgency

All the participants involved in circular initiatives should be triggered by a shared sense of urgency that incentivizes them to take collective action. This can be created by societal pressures, threats to market opportunities or a change in policy and regulations.

Guiding principle 2: The implementation of circular initiatives occurs in four sequential yet cyclic phases

The four phases for circular initiatives implementation are the following:

1. Preparing the circular initiative.
2. Building a joint business case.
3. Scaling up a successful circular initiative.
4. Mainstreaming circular initiatives.

This process has a cyclical nature instead of a linear one, since a successful transition to a CE requires several rounds of far-reaching improvements rather than a sudden radical change.

Guiding principle 3: Tasks to be performed for each circular initiative are roughly the same, but the focus is case-specific

In each of the four phases identified, there is a set of similar tasks that must be performed:

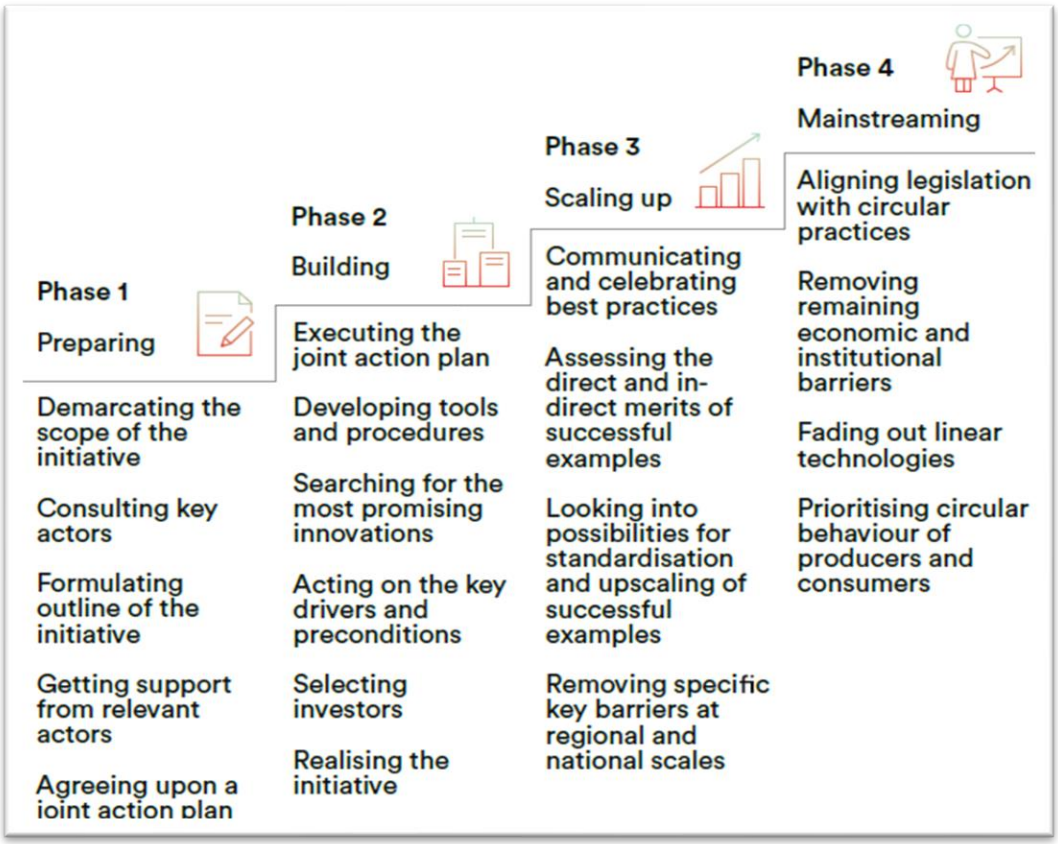


Figure 14: Tasks to be performed in circular initiatives (Source: Cramer J., 2020)

Guiding principle 4: Building a circular economy is a journey with a clear destination but no predetermined path.

An example of a step-by-step action plan would be the following:

1. Formulate a vision and mission
2. Gain insight into the current environmental, economic, and social situation and societal demands
3. Set long-term goals which guide the short-term actions
4. Draw up a strategy, including main priority points with intermediate and final targets
5. Develop the necessary tools and adapt the procedures
6. Monitor the results, evaluate the progress, and formulate the next steps
7. Implement an offline and online communication strategy

(Source: Cramer J., 2020)

This suggestion goes in line with the already formulated Portuguese Circular Economy Action Plan. It is important to keep in mind that the process of carrying out the plan requires flexibility, where participants continuously adapt, learn, and respond to new situations.

Context is key

The next three principles emphasize the importance of the context in which the transformational change is happening.

Guiding principle 5: Focus on the most promising and disrupting innovations.

Innovation is essential in a transformation towards CE. When setting a circular initative, it is important to be ambitious and innovative, and resist the pressure of the traditional market players who defend the current linear system.

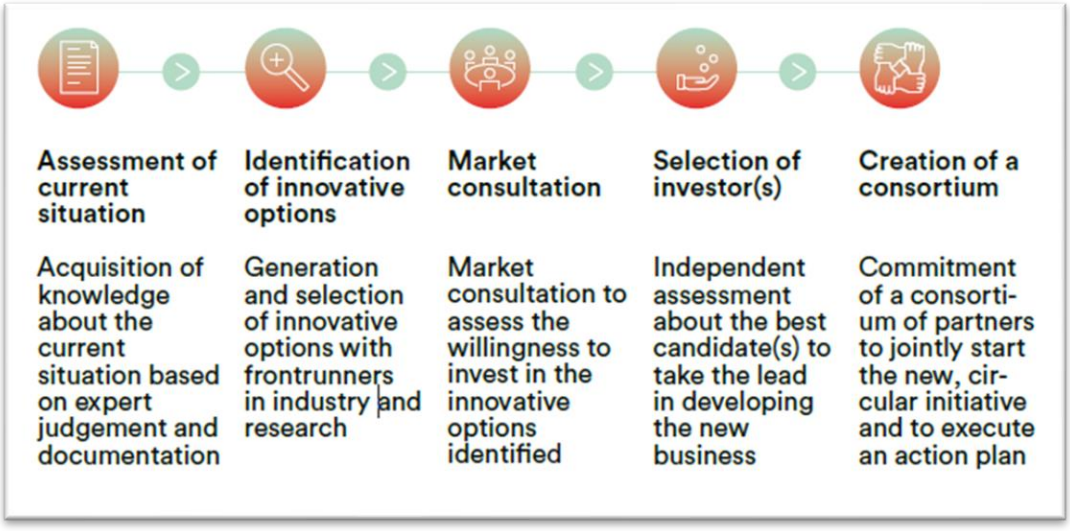


Figure 15: Generic approach for generating and selecting the most promising innovations (Source: Cramer J., 2020)

Guiding principle 6: Map the key drivers and preconditions for successful implementation

It is crucial to clearly the barriers and drivers for a successful CE implementation – which was one of the main goals of the previous section of this report. By doing this, it becomes easier to set the direction to follow and to understand where the focus of the actions should be.

Guiding principle 7: Identify the relevant actors and assess their willingness to join forces

One of the core values of the network governance theory is to build a strong network of actors who jointly are able to join forces and create choesing in building a CE. It is important to involve stakhdeolrs from several backgrounds: government, industry, academia and society.

Successful implementation

After preparing a circular initiative, the next step is its successful implementation, which is dependent on three factors represented by the last three guiding principles defined by Cramer J., (2020).

Guiding principle 8: New circular business models should benefit all network partners.

Without having a clear value defined for all partners involved in the network, it becomes incredibly challenging to successfully implement circular initiatives. Networked business models must be connected to each business model to facilitate the process of financing circular initiatives where several different partners are involved.

Guiding principle 9: Transition brokers can accelerate circular initiatives.

As emphasised in this report, to realise a circular initiative, several actors need to work together to accomplish the goal. Governments are dependent on markets, civil society, as well as on research institutes and universities to transition towards a CE. However, many of these actors work in silos, sometimes even internally, making these new forms of collaboration an extremely challenging process.

To orchestrate the networks and align all relevant stakeholders, scholars studying the governance of CE emphasise the importance of a neutral intermediary who can accelerate the transition process from a neutral position and in a goal-oriented direction - **the transition broker**.

This intermediary can be either a person or a team and should be the orchestrator of the transition process and the content of the circular transition, having the formal mandate to fulfil a servant leadership position. According to Cramer J. (2020), there are several competencies that this person/entity should fulfil:

- To be entrepreneurial, dare to leave your comfort zone, persevere, be impatient and be willing to follow up with contacts.
- To excite and inspire others to cooperate.
- To think and act from a systems perspective but at the same time to be pragmatic.
- To get the idea of circular economy accepted in various businesses and organisations, translate the desired actions into the language of other organisations and not appear threatening.
- To act in the collective interest and be professional enough to stand above the parties.
- To have comprehensive knowledge base in circular economy innovations, the business environment and political culture.
- To be open doors at all policy levels to remove barriers that need to be solved by the government.

(Source: Cramer J., 2020)

In figure 16 is possible to identify the different roles the transition broker played in the Dutch case's different circular initiatives implementation phases.

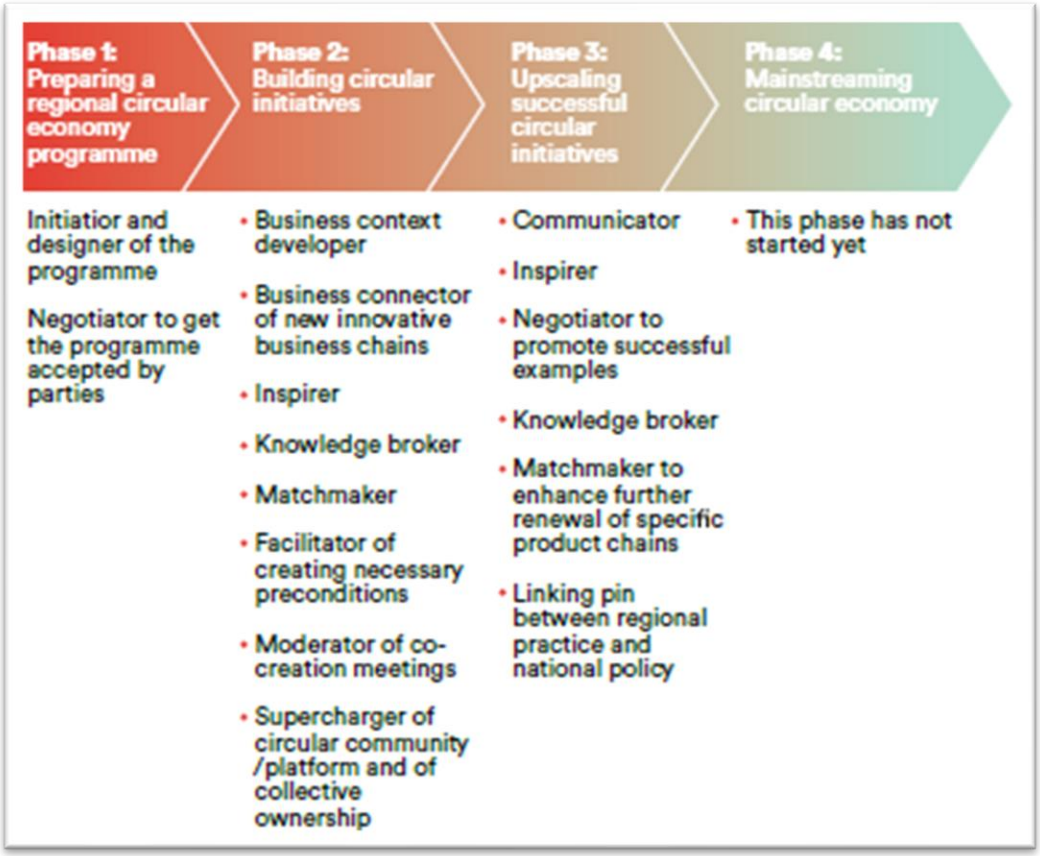


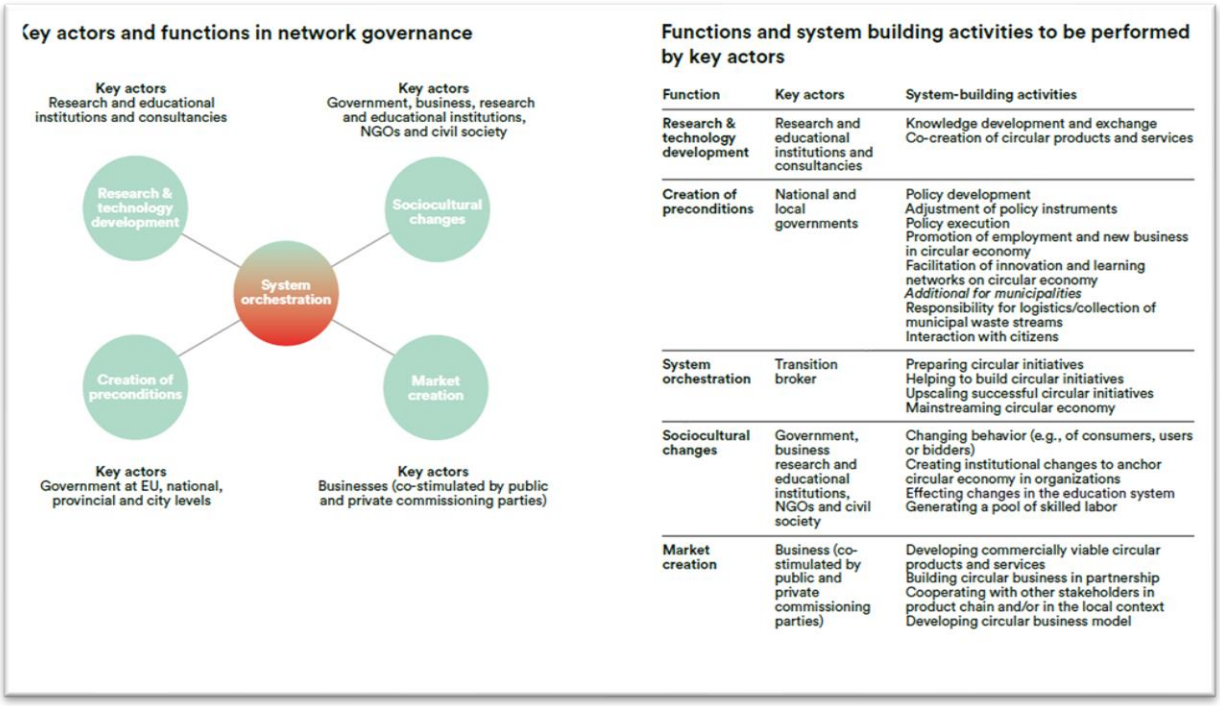
Figure 16: Roles of transition brokers in various phases (Source: Cramer J., 2020)

Guiding principle 10: A transparent division of labour among the relevant actors is indispensable.

Since all actors depend on each other for a successful implementation of the initiatives, it is crucial to have a clear division of labour agreed upon upfront at the beginning of a project, which, although it seems self-evident, is often overlooked.

Usually, each actor knows its function in a system transformation: the government is responsible for creating the proper preconditions; businesses for the provision of circular products and services; research institutions for the development and sharing of knowledge – however, how every function plays on specific situations and circular initiatives is not always clearly defined (Cramer J., 2020).

Figure 17 exemplifies how the different vital actors should interact in a network governance system, and which actions should be the responsibility of each singular actor. Once again, the importance of the system orchestration is emphasised, which is placed in the middle of the model, since it is the interlinking element between all functions in the system (Cramer J., 2020).



Functions and system building activities to be performed by key actors

Function	Key actors	System-building activities
Research & technology development	Research and educational institutions and consultancies	Knowledge development and exchange Co-creation of circular products and services
Creation of preconditions	National and local governments	Policy development Adjustment of policy instruments Policy execution Promotion of employment and new business in circular economy Facilitation of innovation and learning networks on circular economy *Additional for municipalities* Responsibility for logistics/collection of municipal waste streams Interaction with citizens
System orchestration	Transition broker	Preparing circular initiatives Helping to build circular initiatives Upscaling successful circular initiatives Mainstreaming circular economy
Sociocultural changes	Government, business research and educational institutions, NGOs and civil society	Changing behavior (e.g., of consumers, users or bidders) Creating institutional changes to anchor circular economy in organizations Effecting changes in the education system Generating a pool of skilled labor
Market creation	Business (co-stimulated by public and private commissioning parties)	Developing commercially viable circular products and services Building circular business in partnership Cooperating with other stakeholders in product chain and/or in the local context Developing circular business model

Figure 17: Key actors & system-building activities (Source: Cramer J., 2020)

6.2 Recommendations for improvement of the maturity of Portugal's CE institutional setting

When analysing the barriers and drivers identified in section 3, it became clear that the topics are all somehow interconnected, and the solutions for these problems are not mutually exclusive. The lack of a clear front figure leading the transition to a CE; the lack of a multi-disciplinary and multi-institutional approach in earlier CE Plans with a systemic collaborative approach, as well as the lack of the right instruments, policies, and monitoring indicators to successfully implement CE in the country, were among the biggest problems identified in the Portuguese CE institutional setting.

Therefore, based on the network governance theory, there are three main recommendations to address these problems:

- Using "transition brokers" as orchestrators of the CE initiatives
- Mainstreaming of CE principles, instruments, and indicators across action levels
- Setting up an effective monitoring system

6.2.1 Using "transition brokers" as orchestrators of the CE initiatives

As is emphasised in the governance theory, using transition brokers could be crucial to achieving the required coherence lacking at the governance level.

In the Portuguese case, these intermediaries should be selected both at the governance level of the PAEC (coordination group) and per the action level defined under the plan (macro, meso and micro).

Transition broker within PAEC Governance Model

Currently the governance of the PAEC is under the responsibility of the Inter-ministerial Committee for Air and Climate Change (CIAAC) and the Coordination group, which is composed solely of representatives of the different ministries. To guarantee alignment across ministries and departments, it is suggested to nominate a representative within the coordination group, someone responsible for ensuring that each Ministry has specific circular objectives in its department agenda and is aligned with the country's needs. This person (or group of people) should have the competencies mentioned in the previous section and could be a Circular Economy expert, as an academic and industry representative, and not necessarily a policy maker.

Also, it is important to ensure that each Coordination Group members has the mandate within its Ministry to enforce the CE agenda objectives.

Transition brokers for the Macro Action Level

As explained in section 3, the macro-level actions are structural in scope. They have the same focus areas as the EU´s action plan for the CE – product, consumption, waste/secondary raw materials. Under this level, the actions were categorized into seven main categories (see section "*3.4.2. Strategy per action level*"). Therefore, it could be of interest to have a clear entity responsible for the planning and monitoring of each action. This person, or group of people, should be involved in all the four phases necessary for implementing a circular initiative: its preparation; building; upscaling and mainstreaming, ensuring its enforcement across all the relevant Ministries.

Furthermore, these representatives of the different actions, should be closely connected with the PAEC coordination group to guarantee that the other actions are aligned with the country's needs and with the goals defined by the PAEC.

Transition brokers for the Meso Action Level

Regarding the meso-level currently under the PAEC, each sector was responsible for defining its own transition agenda, the PAEC's lines of action mainly guidelines that the different sectors could use. However, voluntary, and non-committal approaches will not suffice to successfully transition towards a circular economy (Kooke, M., 2021).

The suggestion here would then be, like the Netherlands case, to create circular agreements for each sector relevant to the circular transition, that should not be merely voluntary, but should instead call for some degree of binding commitment from the parties involved (Cramer J., 2020). Each agreement would then be under the supervision of a transition broker with the required competencies for its successful implementation. These intermediaries should understand the needs of each sector as well as the overall national circular goals, ensuring that both are aligned.

Transition broker for the Micro Action Level

For the micro level, Portugal has already in place regional agendas for the CE which are under the responsibility of each CCDR (Regional Coordination and Development Commissions of the Continent). These agendas are a great example of the application of some of the network governance principles since they involved the active participation of municipalities, companies, non-governmental organisations, higher education institutions and populations.

A suggestion for its improvement would be to have a representative of each CCDR responsible for the orchestration of these same agendas. These transition brokers should then be able to meet and align goals ensuring that there is not just a regional but also a cross-regional agenda in the entire country. These

would facilitate knowledge and best practices sharing, allowing for continuous improvement across regions.

6.2.2 Mainstreaming of CE principles, instruments, and indicators across action levels

As it is stated in the World Bank report *"Squaring the Circle: Policies from Europe's Circular Economy Transition*", the visibility of the CE agenda among business stakeholders and consumers tends to increase when cross-sectoral ownership exists, helping simultaneously to support greater policy coherence.

Currently, as presented in section 2.1, Portugal has very vague objectives for 2050 (a carbon-neutral economy; knowledge as an impulse; inclusive and resilient economic prosperity, a flourishing, responsible, dynamic, and inclusive society), without having the required specific policies, instruments or indicators to measure its performance.

Although there are several ministries involved in the Portuguese CE policy, their individual packages are not aligned nor focused on achieving a more circular economy. A circular economy asks for a cabinet-wide approach, where policy should cover several product chains, sectors, and spatial scales, from global to local, and from industry to product design level. It includes not only climate policy, but also policies targeting green public procurement, green fiscal reforms, making international trade more sustainable and promoting green innovations, that should be applied across all ministries (Kooke, M., 2021).

It is important to identify crosscutting themes affecting several aspects of the circular transition, and from there, understand which specific policy, instruments, and indicators to use to accelerate the transition and the collaboration across actors and sectors. Therefore, based on the barriers and drivers previously identified and used as guiding examples the Dutch Circular Economy Implementation Programme 2019-2023 and the World Bank report, there are a couple of instruments that can be used by Portugal to achieve a more successful CE:

1. The adjustment or removal of obstructive rules and regulations in favour of a circular economy
    a. Increase the use of coercive measures in CE policy (e.g.: taxation and regulation, including standardisation.)
    b. Legislation and regulations should no longer cause disadvantages for circular initiatives compared to established linear practices. New regulatory instruments such as the right to repair, recycled content mandates, product labelling and extended producer responsibility are needed.
2. Innovative market incentives & better financial arrangements
    a. Ensure that environmental damage is factored into the prices of products and services, closing the gap between linear pricing and the 'true pricing' of products, since currently externalities are not included in cost-benefit analysis.
    b. Financial support for companies that use fewer natural resources
3. Circular Procurement
    a. Gradually increase the circularity requirements in government purchasing and procurement (e.g.: include a minimum recycling rate and setting preconditions on purchasing and procurement that go beyond recycling.)
4. Knowledge development and innovation
    a. Have a multi-stakeholder approach when developing circular initiatives (e.g.: include transition brokers in the process).
    b. Creation/improvement of knowledge sharing platforms (e.g.: in addition to the ECO.NOMIA platform, to create an additional platform that will work as an accelerator program to assist companies (mostly SMEs) in becoming more circular (such as the Circular Netherlands Accelerator portal). This would be a great instrument for facilitating and scaling

up innovative circular business models, helping businesses to be compliant with the regulations and accessing financing, knowledge and an appropriate network) (Cramer J., 2020).

5. Incentivize behavioural change
    a. Influencing the demand side by improving consumer's access to information and awareness

6.2.3 Setting up an effective monitoring system

Monitoring the transition process is essential to make timely adjustments in the transition towards a circular economy (Kooke, M., 2021; Cramer J., 2020). However, due to its complexity, to set an effective monitoring system and identify the right indicators is not an as straightforward process as it seems. Although there is not a one-size fits all solution, there are already several frameworks and suggestions being developed which can be used as guidelines and examples to be followed. Some of these frameworks will be explained in the following section and will work as the basis to provide clear suggestions for the Portuguese case.

Bellagio Declaration Circular Economy Monitoring Principles

The "Bellagio Declaration" is a set of principles which were established in 2020, on how to guarantee that monitoring of the progress towards a transition to a circular economy includes all relevant aspects and involves all relevant stakeholders (Table 5). These principles should work as a guide to national and European authorities in the development of monitoring frameworks and indicators (UNECE, n.d.).

Bellagio principles	
1. Monitor the Circular Economy Transition	It needs to holistically consider all relevant initiatives – public and private - across the economy, capturing the economic, environmental and social changes happening to the material and waste flows, products over their life cycles, business models, and consumer behaviour.
2. Define indicator groups	A robust monitoring system for the CE transition should include: • Material and waste flow indicators to monitor changes throughout the material life cycle including resource efficiency dimensions. • Environmental footprint indicators to capture the impacts across the full life cycle of products and materials, so that spill-over effects are assessed, and planetary boundaries are respected. • Economic and social impact indicators to capture positive as well as negative impacts that may occur during the structural changes of the circular economy transition. • Policy, process, and behaviour indicators to capture the implementation of specific Circular Economy policy measures and initiatives, in particular for key sectors.
3. Follow indicator selection criteria (RACER)	The indicators should follow RACER criteria: Relevant, Accepted, Credible, Easy to monitor, and Robust. However, development of innovative, experimental indicators should also be encouraged, even if not all RACER criteria may initially be fulfilled.
4. Exploit a wide range of data and information sources	The data underpinning the monitoring framework may include: • Official statistics from the European Statistical System or National Statistical Offices, other data produced by EU institutions, national or local authorities, as well as from international organisations) – Exploiting and integrating official information sources. • Policy information – Tracking policy developments and implementation including qualitative assessments.

	• New data sources – Exploiting new information sources beyond official statistics, such as data from the private sector and trade associations, research models, or from new applications of digital technologies.
5. Ensure multilevel monitoring	Monitoring should capture changes happening across all levels of the economy, both public and private sector stakeholders, and different governance levels from global to local scale. A well-defined monitoring and governance structure is required to promote the development of coherent metrics that capture the multiple dimensions of the circular economy transition.
6. Allow for measuring progress towards targets	Monitoring Circular Economy implementation should help assess progress to relevant policy targets and objectives, thus helping inform if the right policies are in place and well implemented, or if corrections or new policies are needed.
7. Ensure visibility and clarity	A well-designed Circular Economy monitoring framework will inform policy makers, stakeholders and citizens. Appropriate indicators as well as user friendly methods of communication, such as dashboards, should therefore be identified. Where possible, open data principles should be followed, with data being made fully and freely available

Table 5: Bellagio Principles. Adapted from Bellagio declaration

European Circular Economy Monitoring Framework

In December 2017, the European Union developed a circular economy monitoring framework, which provides official data and indicators aiming to monitor the progress of CE implementation at the Members States' level (Avdiushchenko, A., 2018; UNECE, no date).

This framework consists of 10 indicators across four main monitoring areas: production and consumption, waste management, secondary raw materials, and innovations (Figure 18). It has a holistic approach, following the RACER criteria, however, in some areas there is still a lack of full implementation and understanding of the life cycle of products and services (UNECE, n.d.). These indicators are mainly focused on resource use, waste production and recycling, without considering other crucial aspects of the transition (e.g.: prevention, re-use and repair) (Potting, J., et al.; 2018).

This kind of framework may not be detailed enough for monitoring the effects of important CE areas such as social innovations, eco-innovations, sharing economy initiatives, the level of greening of the main economic sectors, new business models' implementation, eco-design, and architecture initiatives. The monitoring actions proposed in this framework concern only the national level, with no proposals for the other operational levels of implementation (local and regional) (Avdiushchenko, A., 2018).

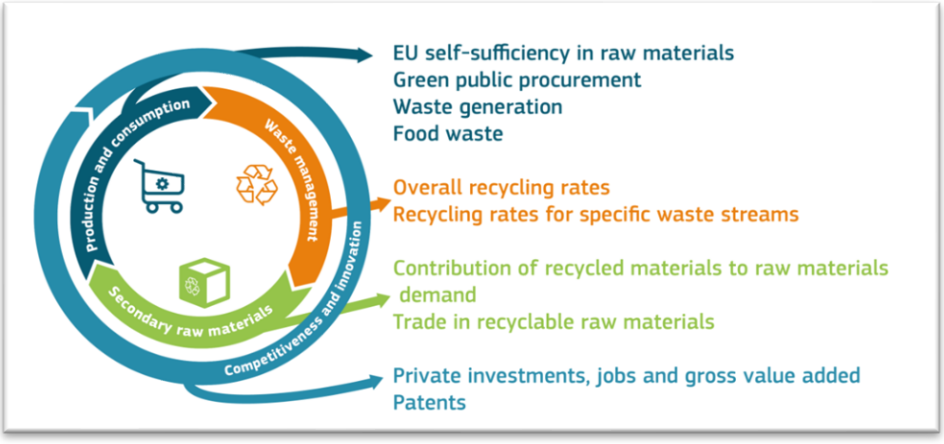


Figure 18: Circular Economy Monitoring framework indicators (Source: Eurostat, 2018)

CE-Based Regional Development Area	Evaluation Aspects
Regional CE-economic development area	economic growth innovative development (CE-based technical innovation) resource consumption level and resource efficiency level energy consumption and energy efficiency level water consumption and water usage efficiency CE products and services offered in the region SMEs with a CE business model CE-based GPP CE-based PPP CE investment projects funded CE R&D funded
Regional CE-environmental development area	waste recycling and upcycling rates landfilling rates reuse, remanufacturing, refurbishment rates air pollution rates renewable energy production/usage energy balance between conventional and renewable energy sources water reuse
Regional CE-social development area	CE-related education campaigns CE-based employment circular society initiatives social innovations life expectancy citizens' wellbeing CE-based collaboration platforms NGOs' CE-related activities
Regional CE-spatial development area	CE-based spatial planning regional industrial symbiosis systems' development urban industrial symbiosis development urbanization CE public space CE-based transport infrastructure area dissipation in a region CE cities and zones in a region
Regional CE-cultural development area	CE-based forms of art CE urban design solutions in a region

Figure 19: Circular Economy Monitoring regional framework indicators (Source: Avdiushchenko, A., 2018)

However, as Avdiushchenko, A. (2018) emphasises in his research work, the circular economy has become a strategic approach for further EU growth and sustainable development not only at the national level among the EU Members but also on local and regional scales. The current lack of CE monitoring instruments at the regional level creates barriers to CE policy's effective implementation, which could slow down the overall transition from the current linear model to a circular one. Therefore, a CE regional monitoring framework is suggested to help regional policymakers realize their regions' full CE potential, improve competitiveness, and use all relevant opportunities for intelligent and sustainable growth (Figure 19) (Avdiushchenko, A., 2018).

National tools: Netherlands Circular Economy Monitoring System (2018)

In addition to the European tools, there are further federal and private sector initiatives attempting to capture circularity for a given economic context, the Netherlands being one great example.

The entity responsible for setting up the Dutch national CE monitoring system was the Netherlands Environmental Assessment Agency (PBL) who emphasised that an effective monitoring system should not just follow the transition, but also find the adequate parameters to manage the transition (Cramer J, 2020).

PBL has formulated indicators for both the effects of the transition and the transition process itself (Figure 20 & table 6). Within the monitoring of the transition process there two components to consider: monitoring the transition dynamics and monitoring the actions. On the one hand, transition dynamics concerns what is actually taking place in specific product groups (e.g.: product design), and if the proportion of circular products is increasing. On the other hand, the action monitoring evaluates the progress being made by the actions integrated in the government-wide policy programme that are to accelerate the transition dynamic (Potting, J., et al.; 2018).

Regarding the effects to be monitored the following are considered:

- The number of resources/materials used
- The amount of GHG emissions (both direct and indirect – scope 3 emissions)
- Socio-economic effects

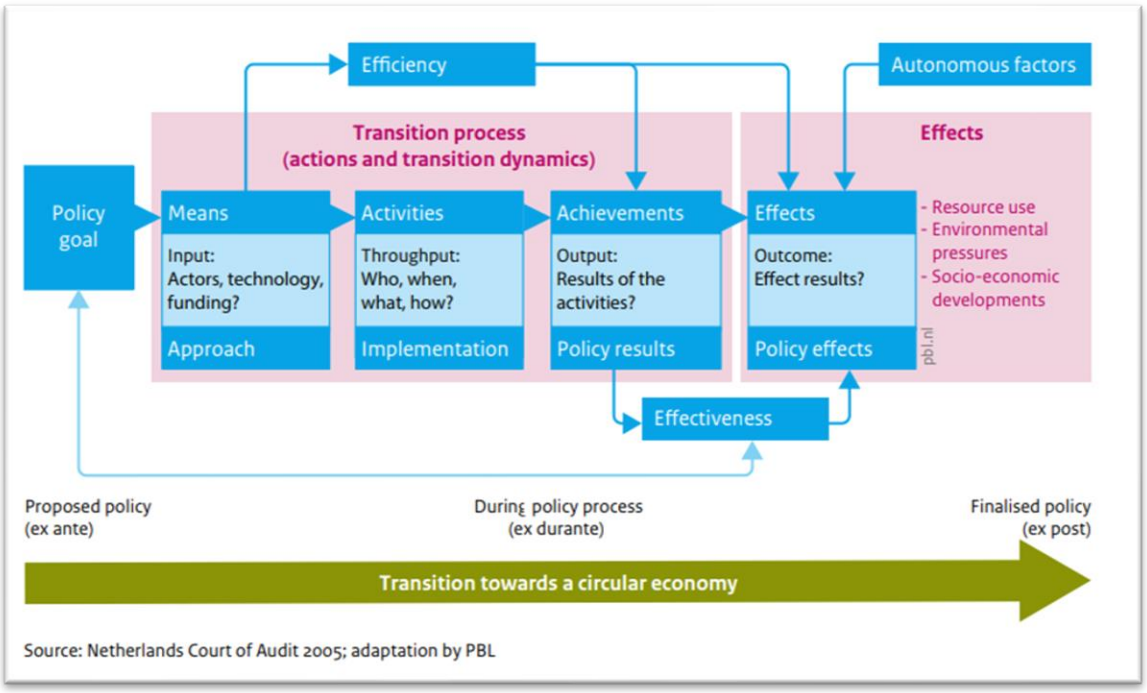


Figure 20: A policy assessment framework for measuring the progress of the transition towards a circular economy (Source: Potting, J., et al.; 2018)

According to the innovation system literature, organisations need a supportive context to be able to innovate – capacity, motivation, and permission - which is referred to as the innovation system. Therefore, when it comes to measuring the transition process PBL emphasises the need of having quantifiable indicators to measure capacity (able to), motivation (want to) and permission (allowed to), across three levels: input (means), throughput (activities) or output (achievements). Some suggested indicators are represented in table 6 which can also be used in the Portuguese case.

	Capacity (able to)	Permission (allowed to)	Motivation (want to)
Input (means)	For increasing circular knowledge and expertise, e.g.: - Number of circular economy researchers (in FTE) - Investment in research (in euros) - Circular courses	For developing circular regulations and change 'linear' regulations, e.g.: - Number of circular policy advisers (in FTE) - Number of circular advisers in branch organisations (in FTE)	For developing circular visions and transition agendas, e.g.: - Number of people actively working on this (in FTE)
Throughput (activities)	Related to knowledge and expertise, e.g.: - Number of circular innovation projects - Share of circular projects in total number of innovation projects - Number of network meetings for circular projects	Related to developing circular and changing 'linear' regulations, e.g.: - Policy process for new circular laws and regulations - Negotiations for circular standards	Related to increasing motivation for the circular economy, e.g.: - Number of vision-forming meetings - Number of awareness campaigns - Description of awareness campaigns - Development of new laws and regulations that discourage linear practices (e.g. resource tax, public circular procurement, resource passport)
Output (achievements)	Knowledge- and expertise-related activities, e.g.: - Number of publications - Number of patents (technology, product design) - Number of new revenue models - Number of new circular products - Share of circular products in total number of products - Number of circular start-ups	New and changed regulations that permit circular initiatives, e.g.: - Number of legal and regulatory barriers to the circular economy removed - Description of new standards and regulations	Results of activities that increase motivation for circular economy, e.g.: - Number and description of vision documents - Number of circular economy media reports - Consumer perception of circular economy - Market volume of public circular procurement - Number and description of new laws and regulations that discourage linear practices (e.g. resource tax, public circular procurement, resource passport)
Core achievements (core output)	Circularity strategies (Refuse; Rethink; Reduce; Reuse...): - Smarter product use and manufacture - Extend lifespan of product and its parts - Useful application of materials		

Table 6: Suggested indicators for transition dynamics monitoring for circularity initiatives in all priority themes (generic indicators) (adapted from Potting, J., et al.; 2018)

The intended effects of the transition to the circular economy concern the use of fewer natural resources, the pressure reduction on the environment and the improvement of economic growth, job opportunities and security of the supply of resources.

There are also several factors (the autonomous factors) influence resource use (and other circular economy effects) that should as well be tracked, such as economic and population growth. Changes in economic structure, such as globalisation, growth in the service economy, investment decisions and consumption patterns could also be considered (Potting, J., et al.; 2018).

The circular economy transition achievements can also be measured by using indicators such as material use or waste production. These generic indicators are influenced by the chosen circularity strategies, such as improved reuse and recycling (Potting, J., et al.; 2018).

The ultimate goal of an effect monitor is to quantify the relationship between effects, achievements, and autonomous factors. Therefore, the monitoring effects indicators suggested by the PBL are represented in table 7.

	Direct effects	**Product chain effects**
Resources • Production (input) • Consumption • Total	• *DMI (resources use; direct)	• **RMI (resources use; chain) • ***RMC (resources consumption; chain)
Environment & nature • Land use • Water use • Greenhouse gas emissions	• Direct land use • Direct water use • Direct GHG emissions	• Land footprint • Water footprint • GHG footprint
Socio-economic • Security of supply/ self-sufficiency • Circular value added • Circular jobs	• Extraction in the country for DMI (resources) • % of value added • % of jobs	
Autonomous factors • Population • Economic growth/structure	• Population, employment • Gross domestic product (GDP), globalisation measures, etc.	
Achievements <u>General</u> • Material use • Waste production • Energy consumption <u>Circularity ladder</u> • Landfill, Incineration (R9); Recycling (R8); Repurpose (R7); Remanufacture (R6); Refurbish (R5; Repair (R4); Reuse (R3); Reduce (R2); Rethink (R1); Refuse (R0)	• DMI (materials) • Waste production • % of renewable energy of the total energy produced • R2: material productivity; waste produced by kg of product produced • R8: cyclical use rate; reuse waste; value-based recycling index	

*Domestic Material Input (DMI) indicator = resources extracted in the country + imported resources that are used for production (e.g. iron ore to produce steel) and consumption (e.g. wood for consumers).
** Raw Material Input (RMI) indicator: as well as direct resource use, RMI also includes resource use for imported semi-manufactured goods and products.
*** Raw Material Consumption (RMC) indicator = resources used in the country 'consumption' whatever the origin

Table 7: Suggested indicators for effects, autonomous factors and achievements (adapted from Potting, J., et al.; 2018)

These effects and achievements can be discussed at the national level as well as by priority themes defined in a specific country (e.g.: plastics; construction; manufacturing; consumer goods, etc.), and could be applied using three different perspectives: by sector, by product or by material (Potting, J., et al.; 2018). Depending on the data availability, each monitoring entity should define which perspective is the most suitable one.

ISO TC 323 Circular Economy

In 2019 the International Organization for Standardization created a Technical Committee (TC) to produce some transversal standards related to Circular Economy – the ISO TC 323. These standards are expected to be fully published in mid-2023/beginning of 2024, and will be useful tools to develop frameworks, guidance, supporting tools and requirements for the implementation of activities of all involved organizations, to maximize the contribution to Sustainable Development (International Organization for Standardization, 2019).

This CE package aimed to facilitate implementation, dialogue, and communication between stakeholders, and have resulted in the creation of six different standards which are currently under development:

1. *ISO WD 59 004 – Circular Economy – Terminology, principles, and framework for implementation*: Gives a common understanding of Circular Economy
2. *ISO WD 59 010 – Circular Economy – Guidance on business models and value networks*: Provides a guideline to transform business models from linear to circular
3. *ISO WD 59 020 – Circular Economy – Measuring circularity*: Provides a framework to measure and assess circularity performance
4. *ISO NWP 59 040 – Circular Economy – Products circularity datasheet*: Provide further framework and toolbox for reporting circularity performance at product level
5. *ISO TR 59 031 – Circular Economy – Performance based approaches:* Provides experience feedback to make circular economy tangible and concrete
6. *ISO TR 59 032 – Circular Economy – Review of business model implementation:* Provides experience feedback to make circular economy tangible and concrete

The number of countries engaging with the standards has grown from 40 to 85, which emphasises the increasing interest in circular economy internationally and worldwide (International Organization for Standardization, 2019).

Recommendations for the Portuguese case

To conclude, it is recommended that Portugal adopts an effective circular economy monitoring system capable of tracking the efforts undertaken by the public authorities and the different sectors of the economy in circular economy as well as showing their effects. This should allow assessing of successes and failures in the transition process towards the circular economy.

This system should be structured following the principles defined in the Bellagio declaration and should be seen as a growth model that should be continuously improved in collaboration with all parties involved in the CE transition agenda.

When considering the national level and the priority themes, a good suggestion is also, like the Netherlands case, to use indicators to track the progress both at the transition process and effects level, for which the suggested indicators above mentioned could be an excellent example to follow. At the regional level, applying some of the indicators mentioned by Avdiushchenko, A., 2018 (figure 19) is suggested.

It is also recommended to follow closely the progress of the standards developed by the ISO TC 323 during 2023, since they will provide clear guidelines about CE definition and monitoring indicators.

7. CONCLUSION

In this report it was developed a full in-depth analysis of the Portuguese CE institutional setting, using both secondary and primary data as supporting tools for the analysis. The report also presented concrete recommendations for improving the institutional setting in the country.

In the first stage of the report, a comprehensive overview of the Portuguese institutional setting was provided using secondary data from various official documents, while in the second stage of the report, the institutional setting of the country was analysed through the perspectives of the Portuguese public authorities. The findings of these interviews were then presented in the report, along with a small literature review regarding the drivers and barriers for CE implementation to provide further context.

In the third stage of the report, a maturity assessment model of the Portuguese institutional setting was drawn using the information collected in the first and second stages. This model aimed to identify the gaps between what was expected to happen according to the information provided in national documents, such as the PAEC, and what should and is happening according to the personal view of the public authorities interviewed. This assessment allowed for a deeper understanding of which barriers need to be overcome and which drivers should be better explored to ensure a better CE implementation in Portugal.

The findings of the assessment of interviews in the Public Sector suggested that the most common barriers to CE are a lack of promotion and training on CE, insufficient understanding and knowledge sharing, a lack of incentives, limited supporting legislation, insufficient governmental support and market pressure, and low valorization of waste with high prices of recycled materials. On the other hand, the drivers identified included collaborations between entities and different stakeholders, knowledge-sharing between institutions, provision of the right incentives and tools to stimulate a behavioral change, creation of environmental compliance legislation and plans, and clear delegation of responsibilities.

The report concluded with specific recommendations for improvement of the Portuguese institutional setting based on the analysis made on the third section and relevant academic literature, such as the network governance theory. These recommendations included using "transition brokers" as orchestrators of the CE initiatives; mainstreaming of CE principles, instruments, and indicators across action levels; and setting up an effective monitoring system for CE practices.

In summary, the recommendations for the use of transition brokers in the Portuguese CE governance model included the following:

- Transition broker within PAEC Governance Model: A representative should be nominated within the Coordination Group to ensure that each Ministry has specific circular objectives in its department agenda and is aligned with the country's needs. This person should have the necessary competencies and could be a Circular Economy expert.
- Transition brokers for the Macro Action Level: It is suggested to have a clear entity responsible for the planning and monitoring of each macro-level action. This person, or group of people, should be involved in all the four phases necessary for implementing a circular initiative: its preparation, building, upscaling, and mainstreaming, ensuring its enforcement across all the relevant Ministries.
- Transition brokers for the Meso Action Level: Circular agreements for each sector relevant to the circular transition should be created, which should call for some degree of binding commitment from the parties involved. Each agreement would then be under the supervision of a transition broker with the required competencies for its successful implementation.

- Transition broker for the Micro Action Level: A representative of each CCDR should be responsible for the orchestration of the regional agendas for the CE. These transition brokers should be able to meet and align goals ensuring that there is not just a regional but also a cross-regional agenda in the entire country.

Regarding the second recommendation, it was emphasized that Portugal can accelerate the transition to a more circular economy and promote collaboration across different sectors and actors by implementing various instruments. Some of these instruments could be adjusting or removing obstructive regulations, increasing the use of coercive measures, creating new regulatory instruments like the right to repair and extended producer responsibility, introducing innovative market incentives and better financial arrangements, adopting circular procurement, investing in knowledge development and innovation, creating knowledge sharing platforms, and incentivizing behavioural change by improving consumer access to information and awareness.

Finally, it was pointed out that an effective circular economy monitoring system for Portugal should be capable of tracking efforts made by public authorities and different sectors of the economy, assessing successes and failures in the transition process, and showing their effects. This system should be structured following the principles defined in the Bellagio declaration and seen as a growth model that should be continuously improved in collaboration with all parties involved in the CE transition agenda. It was also mentioned that could be strategically important to have specific CE indicators at the regional level. At the national level, using indicators to track progress at the transition process as well as specific indicator to track the effects of the CE are suggested. Additionally, it is recommended to closely follow the progress of standards being developed by the ISO TC 323 in 2023, which will provide clear guidelines about CE definition and monitoring indicators.

8. BIBLIOGRAPHY

APA, DGAE, 2021. *Review of PAEC Activities and Achievements between 2018 and 2020. Available at: https://www.dgae.gov.pt/gestao-de-ficheiros-externos-dgae-ano-2022/paec_relatoriofinal_edi_21_3_2022-pdf1.aspx*

Avdiushchenko, A., 2018. *Toward a circular economy regional monitoring framework for European regions: conceptual approach*. Sustainability, 10(12), p.4398.

Cramer, J., 2020. *How network governance powers the Circular Economy. Ten guiding principles for building a Circular Economy, based on Dutch experiences*. Publication of the Amsterdam Economic Board.

Cramer, J., 2022. Effective governance of circular economies: An international comparison. Journal of Cleaner Production, 343, p.130874.

Ddiba, D., Andersson, K., Koop, S.H.A., Ekener, E., Finnveden, G., Dickin, S., 2020. *Governing the circular economy: assessing the capacity to implement resource-oriented sanitation and waste management systems in low- and middle-income countries*. Earth Syst. Govern. 4, 100063 https://doi.org/10.1016/j.esg.2020.100063.

European Commission, 2018. *Measuring circular economy - new metrics for development?.* Available at: https://ec.europa.eu/newsroom/env/items/624232/en

European Commission, 2021. European green deal: delivering on our targets, Publications Office of the European Union, 2021, https://data.europa.eu/doi/10.2775/373022

Eurostat, 2018. *How is the EU progressing towards the circular economy?*, Eurostat News Release, 2018.

Ghisellini, P., Cialani, C., Ulgiati, S., 2016. *A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems*. J. Clean. Prod. 114, 11–32. https://doi.org/10.1016/j.jclepro.2015.09.007.

Government of Portugal, 2017. *Leading the transition: a circular economy action plan for Portugal (PAEC).* Available at: https://circulareconomy.europa.eu/platform/sites/default/files/strategy_-_portuguese_action_plan_paec_en_version_3.pdf

Government of Portugal, 2022. *National budget for 2023.* Available at: https://dre.pt/dre/legislacao-consolidada/lei/2022-205695052

International Organization for Standardization, 2019. *ISO/CD 59010 - Circular Economy*

Kooke, M., 2021. *Netherlands Integral Circular Economy Report 2021 – English Summary*

Loorbach, D., Frantzeskaki, N., Avelino, F., 2017. *Sustainability transitions research: transforming science and practice for societal change*. Annu. Rev. Environ. Resour. 42, 599–626. https://doi: org./proxy.library.uu.nl/10.1146/annurev-environ-1020 14-021340

Patterson, J., Schulz, K., Vervoort, J., van der Hel, S.C., Widerberg, O.E., Adler, C., Hurlbert, M., Anderton, K., Sethi, M., Barau, A., 2017. *Exploring the governance and politics of transformations towards sustainability*. Environ. Innov. Soc. Transit. 24, 1–16. https://doi.org/10.1016/j.eist.2016.09.001.

Potting, J., Hanemaaijer, A., Delahaye, R., Ganzevles, J., Hoekstra, R. and Lijzen, J., 2018. *Circular Economy: what we want to know and can measure. Framework and baseline assessment for monitoring the progress of the circular economy in the Netherlands.* PBL Policy Report, 3217.

The World Bank., 2022. *Squaring the Circle: Policies from Europe's Circular Economy Transition - World Bank.*

UNECE (no date). *Measuring and monitoring the circular economy and the use of data for policy-making, UNECE*. Available at: https://unece.org/environment-policy/environmental-monitoring-and-assessment/measuring-and-monitoring-circular (Accessed: December 29, 2022).

Winans, K., Kendall, A., Den, H., 2017. *The history and current applications of the circular economy concept*. Renew. Sustain. Energy Rev. 68 (1), 825–833. https: //EconPapers.repec.org/RePEc:eee:rensus:v:68:y:2017:i:p1. p:825-833

Recommendations for Improved Municipal Waste Management in Portugal

Part II: The role of change management for successful waste management practices

THREE ROADS TO CIRCULAR ECONOMY: REDUCE, REUSE, RECYCLE (3R2CE)

March 2023

This project is funded by the European Union via the Structural Reform Support Programme and implemented by CLEAN in collaboration with its experts, in cooperation with the European Commission.

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The report 'Recommendations for Improved Municipal Waste Management in Portugal', consisting of 'Part I: Baseline study for preparation for reuse and increased recycling of textile waste, bulky waste, hazardous household waste and C&D waste', and 'Part II: The role of change management for successful waste management practices', is one of the three main reports resulting from project 'Three Roads to Circular Economy: Reduce, Reuse, Recycle', co-funded via the Structural Reform Support Programme.

The authors of this report would like to thank the Government of Portugal for its engagement and commitment during its preparation and the Directorate-General for Structural Reform Support (DG REFORM) of the European Commission for continuous support during its implementation.

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This report was prepared under the guidance of Maria Dominguez, Senior Project Manager at CLEAN, who drafted the content with the analytical support of Lais Valenca and Margarida Sousa Torres, project coordinators at CLEAN, and inputs and direction from Bjørn Bauer and Amalie Ploug Olsen, from Norion Consult.

EXECUTIVE SUMMARY

Portugal has requested support from the Structural Reform Support Service (SRSS) of the European Commission under Regulation (EU) 2017/825 on the establishment of the Structural Reform Support Programme ('SRSP Regulation'). The Commission has analysed the request in accordance with the criteria and principles referred to in Article 5 of the SRSP Regulation, following which the Commission has agreed to provide technical support to Portugal in the area of institutional, administrative and growth-sustaining structural reforms, with the objective to:

- to support the national authorities in enhancing their capacity to formulate, develop and implement reform policies and strategies and in pursuing an integrated approach ensuring consistency between goals and means across sectors;
- to support the efforts of national authorities to define and implement appropriate processes and methodologies by taking into account good practices and lessons learned by other countries in addressing similar situations.

The project 'Reduce – Reuse – Recycle: Three Roads to a Circular Economy – 3R2CE' had the aim of developing and presenting strategies for three key areas of the circular economy, focusing on i. material efficiency in the following industrial sectors: textile, furniture, and construction, and focusing on ii. improved municipal waste management. This report belongs to the second part. Part I of the report 'Recommendations for Improved Municipal Waste Management in Portugal' proposes strategies to support Portugal in the attainment of EU waste targets and the further development of municipal waste management in the country, within four waste streams from households: textiles, bulky waste, hazardous household waste and construction and demolition waste. In Part II, the focus is shifted to the critical role of change management in securing the successful implementation of these strategies and driving positive change in municipal waste management practices in Portugal.

This report includes an assessment of the most recent research about the role of change management to foster improvements in municipal waste systems, an assessment of drivers and barriers experienced by the Portuguese municipalities to improve urban waste systems; and an assessment of European best practices in terms of municipal change management based on the identified needs.

The contributions in this report can serve as a roadmap for municipalities to take proactive steps towards sustainable waste management.

Financing for this project has been made available as part of the Work Programme for the year 2020 for the Structural Reform Support Programme under Regulation (EU) 2017/825 as amended by Regulation (EU) 2018/1671.

TECHNICAL TERMS

Recycling	Any recovery operation in which waste materials are reprocessed into products, materials, or substances, fit new purposes or products[1]
Upcycling	The process of transforming waste or discarded materials into new products that are of higher quality, value, and environmental significance. Unlike recycling, which typically involves breaking down materials into raw materials for reuse, upcycling involves using creative methods to repurpose materials into something new and useful.[2]
PRO	Non-profit producer responsibility organisation
Civic Amenity Centres	Civic amenity sites are waste sorting facilities run by the local authorities. Citizens can deliver their household bulky waste and consult employees that are on the site to assist and assure that citizens are sorting the waste into the correct recycling fractions[3]. Civic amenity sites can either be completely open to the public or open to the citizens of the municipality only. When limited to the citizens of the municipality, individual user cards can be issued, or ID control can be performed at the civic amenity, or the control can be connected to the registration number of the car. Monitoring the users of the civic amenity centres is useful for making statistics, but also has a security purpose, as the sites can be targets for thefts and break-ins[4].
MSW	Abbreviation for Municipal Solid Waste

[1] EEA (2022a): Reaching 2030's residual municipal waste target – why recycling is not enough.
[2] Upcycle That - a website with a collection of upcycling ideas and tutorials: https://www.upcyclethat.com/
[3] URBANREC (2019): New approaches for the valorisation of Urban waste into high added value RECycled products.
[4] Waste Sweden (2021a): Återvinningscentraler.

TABLE OF CONTENTS

1 INTRODUCTION

Part I of the report 'Recommendations for Improved Municipal Waste Management in Portugal' developed under project 'Three Roads to Circular Economy: Reduce, Reuse, Recycle' (3R2CE) proposes strategies to support Portugal in the attainment of EU waste targets and the further development of municipal waste management in the country, within four waste streams from households: textiles, bulky waste, hazardous household waste and construction and demolition waste. In Part II of the report, we shift our attention to the critical role of change management in securing the successful implementation of these strategies and driving positive change in municipal waste management practices in Portugal.

Change management is a critical component of any successful waste management initiative. It is the process of planning, implementing, and managing changes in a structured and systematic way. In the context of municipal waste management, change management is essential because it helps to ensure that new policies, procedures, and technologies are implemented effectively and efficiently.

In this section, a set of recommendations will be provided so successful change management can lead to more sustainable and effective waste management systems in Portugal. These recommendations will draw on the specific drivers and barriers identified in close collaboration with local stakeholders.

2 METHODOLOGY

To identify the best change management strategies for improving municipal waste management in Portugal, a multi-step methodology was employed. The methodology consisted of four main steps: literature review, identification of needs, identification of best practices and proposed change management strategies.

Literature review

First, a comprehensive literature review was conducted to identify relevant research on change management strategies for waste management. This involved reviewing academic papers, reports, and other relevant sources to identify best practices and emerging trends in the field.

Identification of needs

Throughout the project 3R2CE, interviews were conducted with key stakeholders in the waste management sector in Portugal, consisting of municipalities, recyclers, non-governmental organizations, inter-municipal waste management services, and PROs. Iinterviews have been held with more than 80 stakeholders to map the current possibilities and barriers for improving the existing collection and separate systems, as well as to promote the reduction, reuse and recycle, of the textiles, bulky waste, hazardous household waste and construction and demolition waste from households. After this initial assessment, almost 200 stakeholders participated in four workshops tailored according to each waste stream category to discuss and validate the drivers and barriers identified throughout the interview phase. The stakeholders provided invaluable insights and inputs regarding the prioritisation of the identified barriers for each waste stream and the possibilities of overcoming these barriers.

All four workshops were opened by Ana Cristina Carrola, Member of the Board of Directors of the Portuguese Environment Agency (APA), providing an overview of the government approach to the specific topic and illustrating potential solutions, hereby contributing to the stakeholders' perception of the workshops' importance. Appreciating the challenges in actively involving participants in a workshop only using digital media, the workshops were designed using an interactive tool allowing for constant activity and feedback. Sequenced breakout rooms were facilitated by both Portuguese and English-speaking mediators with a deep understanding of the project context, enabling a constructive and knowledge-based dialogue in which individual interests could be expressed in an open atmosphere. Barriers and drivers for implementing novel solutions for improved municipal waste systems – as perceived by stakeholders – were mapped.

The input gained from the literature review, interviews, and workshops, lead to the identification of drivers and barriers. The full lists of barriers per waste flows have been presented in sections 6.1.2, 6.2.2, 6.3.2, and 6.4.2 of the report 'Baseline study for Preparation for Reuse and Increased Recycling of Textiles, Bulky waste, Hazardous Household Waste and C&D Waste', and served as a background for the development of strategies for increased reuse and recycling of each waste flow. The subsequent work on the identification of the needs specifically for change management within the municipalities benefited from an analysis of the level of the barriers (local or national), and from input gained from a collection of best practices combined with feedback from APA.

Best practices

The best practices collection was analyzed to identify successful change management strategies in waste management from other countries that could be adapted to the Portuguese context. This involved reviewing case studies from Europe to identify key success factors and lessons learned.

Finally, the findings from the literature review, stakeholders engagement, and best practices analysis were synthesized to identify the best change management strategies for improving municipal waste management in Portugal. These findings were organized into a set of recommendations for local stakeholders working in

the waste management sector in Portugal. Overall, the methodology employed in this report aimed to provide a comprehensive and evidence-based approach to identifying the best change management strategies for improving municipal waste management in Portugal. By drawing on a range of sources and perspectives, the report aims to provide actionable recommendations that can help to drive positive change in the waste management sector in the municipalities of Portugal.

3 LITERATURE REVIEW

Municipal waste management is a complex issue that requires various strategies and approaches to be effectively managed. According to Leal Filho et al. (2020), waste management is a multidisciplinary field that involves various disciplines such as environmental science, public policy, economics, and engineering.[5]

Change management is a critical aspect of municipal waste management, as it involves implementing changes to policies, procedures, and technologies to improve waste management outcomes. However, implementing change in the context of municipal waste management can be challenging, due to a range of technical, social, and economic factors (Lu et al., 2020).[6]

One important concept in change management for municipal waste management is the waste management hierarchy. The hierarchy prioritizes waste reduction, followed by reuse, recycling, recovery, and disposal (Mekonnen et al., 2021). By prioritizing waste reduction and reuse, communities can minimize the amount of waste that needs to be managed and reduce the environmental and economic impacts of waste management.

Another key concept is stakeholder engagement in the change management process. Effective stakeholder engagement is critical to building support for change, addressing concerns and objections, and ensuring that all perspectives are considered. This may involve engaging with a range of stakeholders, including government agencies, private sector companies, civil society organizations, and residents. According to Nguyen et al. (2021), involving stakeholders in the waste management process can enhance public participation, reduce conflict, and increase trust.[7]

Additionally, effective communication is critical to successful change management for municipal waste management. This may involve developing clear and concise messaging around the need for change, the benefits of proposed changes, and the impacts of existing waste management practices. It may also involve using a range of communication channels, including social media, community meetings, and public events (Khan et al., 2020).[8]

Other best practices in change management for municipal waste management include the need for strong leadership, effective monitoring and evaluation, ongoing capacity building, and overcoming ingrained habits and attitudes. According to Chowdhury et al. (2021), strong leadership is critical to providing direction and guidance throughout the change process and addressing any obstacles or challenges that arise.[9] Effective monitoring and evaluation can help to track progress towards goals, identify areas for improvement, and ensure that changes are having the desired impact. Ongoing capacity building can help to ensure that employees and stakeholders have the skills and knowledge needed to implement and sustain changes. Finally, changes to waste management culture may require significant effort to overcome ingrained habits and attitudes and may require sustained communication and engagement with stakeholders (Said et al., 2021).[10]

[5] Leal Filho, W., Wall, T., Azul, A. M., & Brandli, L. L. (2020). Waste management in the context of the circular economy: Challenges and strategies in the 21st century. International Journal of Sustainable Development & World Ecology, 27(5), 447-459.
[6] Lu, X., Cao, Y., & Li, X. (2020). Municipal solid waste management in China: A review. Journal of Environmental Management, 268, 110585.
[7] Nguyen, T. P., Tiberghien, J., & Thao Nguyen, T. P. (2021). Assessing the effectiveness of waste management policies in Vietnam: A review. Resources, Conservation and Recycling, 174, 105824.
[8] Khan, N. H., Hussain, T., Sabir, S., & Saeed, U. (2020). Municipal solid waste management: A comprehensive review. Journal of Environmental Management, 263, 110413.
[9] Chowdhury, M. K. R., Chakraborty, A., & Paul, P. (2021). Municipal solid waste management in India: A critical review. Journal of Environmental Management, 295, 113-127.
[10] Said, M., Elsayed, O. A., & Khaled, A. (2021). Towards sustainable municipal solid waste management: A review. Journal of Cleaner Production, 319, 128838.

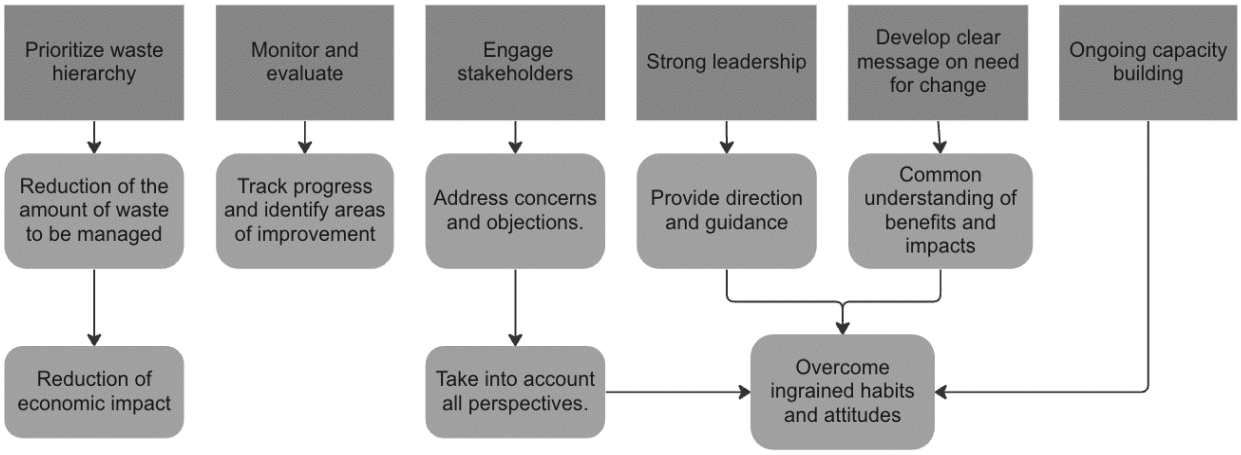

Figure 1. *Summary of suggestedchange management approaches in the context of municipal waste management based on the literature review*

Overall, effective change management is critical to ensuring that municipal waste management systems are able to adapt to new challenges and opportunities, and to meet the evolving needs of communities. By drawing on best practices and frameworks from the broader field of change management, municipal waste management practitioners and policymakers can develop effective strategies for implementing change and driving positive outcomes.

4 IDENTIFICATION OF NEEDS

To provide a more comprehensive understanding of the identified barriers hindering the implementation of novel solutions for improved municipal waste systems in Portugal, Part I of the report presents detailed tables in sections 6.1.2, 6.2.2, 6.3.2, and 6.4.2. These tables provide a more nuanced analysis of the national and local obstacles in enhancing waste management practices across the four waste streams, and served as a background for the development of a strategy to increase reuse and recycling of the four waste streams. A shortlist of these obstacles was created in consultation with the Portuguese Environment Agency (APA) and then translated into municipal needs for each waste stream.

Based on this shortlist, the table presented below outlines the identified needs that could be addressed through changes in municipalities. It provides a starting point for developing effective solutions to improve waste management practices in Portugal's municipalities, and highlights the needs for change management and recommendations that could facilitate positive change in the waste management sector.

NEEDS	Waste stream			
	Textile waste	Bulky waste	Hazardous waste	C&D waste
Improve communication & capacitation of citizens	x	x	x	x
Development of good practice guidelines for citizens	x	x	x	x
Public procurement (targeting municipalities' purchases)	x	x	x	x
Promote collection Schemes/ Inter-municipal collaboration	x	x	x	x
Equalization of municipal cost-differences		x	x	x
Rural civic amenity centres		x	x	x
Promote economic incentive structures			x	x
Educational practices for small contractors				x

Before presenting recommendations, it is important to provide further explanation on the identified needs and their relevance to municipal waste management.

4.1 Improve communication & capacitation of citizens.

Improving communication and capacitation of citizens can have a significant impact on municipal waste management. Effective communication strategies can help to raise awareness among citizens about the importance of waste reduction and recycling, and how they can contribute to more sustainable waste management practices.

By providing citizens with the necessary information and knowledge, municipalities can encourage them to adopt more responsible waste management behaviors, such as separating waste correctly, reducing waste generation, and recycling more. This can ultimately result in a reduction in the amount of waste sent to landfill, and an increase in recycling rates.

In addition, capacitation of citizens can also be beneficial for the implementation of new waste management practices or technologies. For example, when a municipality introduces a new waste separation system, it can provide training and support to citizens to ensure that they understand how to use it effectively. By doing so, the municipality can increase the likelihood of the new system being adopted and used correctly, which can lead to more effective waste management.

Overall, improving communication and capacitation of citizens can play an important role in municipal waste management by promoting more sustainable waste management practices, increasing recycling rates, and ensuring the effective implementation of new waste management initiatives.

4.2 Development of good practice guidelines for citizens

Good practice guidelines for citizens can have a significant impact on municipal waste management by providing guidance on how citizens can better manage their waste. These guidelines can cover a range of topics, including waste reduction, sorting, and disposal. By following good practice guidelines, citizens can help to reduce the amount of waste generated, improve the quality of the waste stream, and increase the effectiveness of recycling and other waste management processes.

When citizens are educated on how to properly sort and dispose of their waste, it can also reduce contamination of the waste stream. Contamination occurs when non-recyclable or improperly sorted materials are mixed in with recyclables, leading to lower quality and reduced value of the materials. Good practice guidelines can help to reduce contamination by providing clear instructions on what can and cannot be recycled, and how to properly dispose of non-recyclable materials.

Furthermore, good practice guidelines can also help to increase the participation of citizens in waste management programs. By providing clear and easy-to-follow instructions, citizens may be more willing to participate in waste reduction, sorting, and disposal programs. This can lead to increased efficiency and effectiveness of waste management processes, and ultimately contribute to a more sustainable and environmentally-friendly waste management system.

Textile waste

By providing clear and easy-to-follow guidelines for how to properly care for and dispose of textiles, citizens can be empowered to make more sustainable choices. This may include information on how to repair or repurpose clothing, how to properly sort textiles for recycling or donation, and how to dispose of textiles that cannot be recycled or donated. By following these guidelines, citizens can help to reduce the amount of textile waste that ends up in landfills and increase the number of textiles that are reused or recycled. Good practice guidelines may also include information on how to reduce overall textile consumption, such as through buying secondhand or choosing more sustainable materials.

Bulky waste

The guidelines can inform citizens on how to properly dispose of bulky items, such as furniture and appliances, through appropriate channels such as waste collection services or recycling centers. By educating citizens on how to dispose of bulky waste properly, there is a reduced risk of illegal dumping, which can lead to environmental damage and potential health hazards. Additionally, good practice guidelines can encourage citizens to consider alternatives to disposing of bulky items, such as donating or selling them, which can help extend the life cycle of the products and reduce waste generation. Furthermore, guidelines can inform citizens about the potential impacts of their consumption choices on the generation of bulky waste, encouraging them to make more sustainable choices and reducing the overall amount of bulky waste generated.

Household Hazardous Waste

By educating citizens on the proper management of household hazardous waste, the risk of improper disposal and the negative impacts on human health and the environment can be reduced. Good practice guidelines can also promote the use of safer and less toxic alternatives to household hazardous products, ultimately reducing the amount of hazardous waste generated. Additionally, guidelines can provide information on local collection points for household hazardous waste and encourage citizens to participate in disposal programs to properly manage these wastes. Overall, good practice guidelines can play a key role in improving household hazardous waste management and reducing its negative impacts on the environment and public health.

Construction and demolition waste

Citizens can be encouraged to reduce waste by planning construction projects carefully to avoid excess materials, using recycled or reclaimed materials, and donating usable materials to organizations that can reuse them. The guidelines can also promote the use of certified waste management companies to ensure that waste is properly disposed of and recycled. Additionally, guidelines can encourage citizens to engage with their local authorities and construction companies to promote sustainable construction practices and increase awareness about the importance of reducing construction and demolition waste.

4.3 Public procurement

Public procurement can play an important role in municipal waste management. It refers to the process by which public authorities, such as municipalities, purchase goods and services from suppliers. In the context of waste management, public procurement can be used to promote sustainable waste management practices by selecting suppliers that provide environmentally friendly products and services.

For example, when a municipality needs to purchase waste collection vehicles or equipment for a waste treatment plant, it can specify in the tender documents that the products must meet certain environmental criteria, such as minimum energy efficiency ratings or use of recycled materials. By doing so, the municipality can ensure that it is procuring products that have a lower environmental impact and contribute to more sustainable waste management.

In addition, public procurement can be used to promote circular economy principles by selecting suppliers that provide services related to repair, refurbishment, or reuse of products. This can help to reduce waste and increase the lifespan of products, contributing to a more sustainable use of resources.

Overall, public procurement can be a powerful tool for municipalities to promote sustainable waste management practices and contribute to the achievement of waste reduction and recycling targets.

4.4 Inter-municipal collaboration

Inter-municipal collaboration can play a crucial role in municipal waste management. It involves cooperation and coordination between different municipalities in a region or area to jointly tackle waste management challenges. By sharing resources, expertise, and best practices, the municipalities can achieve economies of scale and optimize their waste management systems. Inter-municipal collaboration can help in setting up common facilities for waste collection, sorting, and disposal, which can be more efficient and cost-effective than individual facilities for each municipality. It can also help in promoting sustainable waste management practices and increasing recycling rates through joint campaigns and awareness-raising initiatives. Additionally, inter-municipal collaboration can facilitate the implementation of extended producer responsibility (EPR) schemes and other waste reduction initiatives that require coordination among multiple stakeholders. Overall, inter-municipal collaboration can help municipalities improve their waste management practices and achieve their waste reduction targets in a more effective and sustainable manner.

4.5 Equalization of municipal cost-differences

The equalization of municipal cost-differences can have a significant impact on municipal waste management. In many cases, waste management costs can vary significantly between municipalities, which can result in disparities in the quality and availability of waste management services. This can lead to issues such as illegal dumping and poor waste management practices, which can have negative impacts on the environment and public health.

By equalizing the costs of waste management services across municipalities, it can help ensure that all citizens have access to high-quality waste management services, regardless of their location or economic situation. This can encourage more sustainable waste management practices and reduce the incidence of illegal dumping and other forms of environmental harm.

Additionally, the equalization of costs can help incentivize municipalities to adopt more sustainable waste management practices, such as recycling and composting. When the costs of waste management are spread more evenly across municipalities, it can create a level playing field for waste management providers and encourage the adoption of more environmentally sustainable practices.

In summary, the equalization of municipal cost-differences can promote more equitable and sustainable municipal waste management practices, and can help reduce the negative environmental and health impacts of poor waste management.

4.6 Rural civic amenity centres

Rural civic amenity centres can play an important role in municipal waste management, particularly in rural areas where access to waste management facilities may be limited. These centres provide a place for residents to bring their waste, such as bulky items, hazardous materials, and other items that cannot be disposed of in regular household bins. By providing access to these facilities, rural civic amenity centres can help to reduce illegal dumping and promote proper disposal of waste. Additionally, these centres can serve as a hub for educational and awareness-raising activities, such as workshops on waste reduction and recycling, which can further promote sustainable waste management practices in rural communities.

4.7 Economic incentive structures

Economic incentive structures can play a crucial role in shaping the behavior of both individuals and organizations in the realm of waste management. In the context of municipal waste management, economic incentives can take many forms, including fees for waste disposal, taxes on waste generation, and financial rewards for waste reduction or recycling. Such structures can create a financial motivation for individuals and organizations to reduce the amount of waste they generate and dispose of. For example, if a municipality charges residents for every unit of waste they dispose of, individuals may be incentivized to reduce their waste generation or to recycle more in order to save money. Similarly, if a company is subject to a tax on the waste it generates, it may be incentivized to reduce its waste generation in order to avoid the tax. Economic incentive structures can also help to offset the costs associated with implementing and maintaining effective waste management practices. For example, revenue generated from waste disposal fees can be used to fund recycling programs, while taxes on waste generation can be used to finance waste reduction initiatives.

Regarding the management of household hazardous waste (HHW), many households may not properly dispose of HHW because of the perceived inconvenience or cost associated with the disposal process. Incentives, such as financial incentives, can encourage households to properly dispose of HHW. For example, some municipalities offer HHW collection events where residents can dispose of HHW free of charge or for a reduced fee. Additionally, municipalities can consider offering financial incentives to residents who properly dispose of HHW throughout the year, such as through a rebate or discount program. Economic incentives can also encourage HHW reduction, reuse, and recycling by providing financial benefits for these actions. Overall, economic incentive structures can help increase the proper management of HHW, leading to a safer environment and protecting public health.

With regards to construction and demolition waste (CDW), some countries have introduced levies or taxes on the disposal of construction and demolition waste in landfills, which can create an economic incentive for companies to recycle and reuse these materials. In addition, some municipalities have implemented policies that require a certain percentage of recycled materials to be used in construction projects. By creating economic incentives to reduce the amount of construction and demolition waste sent to landfills and increase recycling, these policies can contribute to more sustainable waste management practices.

In both cases, economic incentives can encourage a shift towards sustainable waste management practices, while also potentially providing cost savings for waste producers. However, effective communication and enforcement mechanisms are necessary to ensure compliance and prevent abuse of the system.

4.8 Educational practices for small contractors

Educational practices for small contractors can help to reduce the amount of waste going to landfill in several ways. Firstly, by educating contractors on the importance of waste reduction, reuse, and recycling, they can be encouraged to adopt more sustainable practices in their work. This could include strategies such as source reduction, where waste is minimized at the outset by reducing the number of materials used or by reusing materials where possible.

Secondly, contractors can be taught to properly sort and separate waste materials at the source, which can increase the amount of material that is diverted from landfill and sent for recycling or reuse. This can be achieved through training on the different types of waste and how to properly separate them, as well as the use of color-coded bins and other visual aids to help with identification and sorting.

Thirdly, educational practices can help to promote circular economy principles among small contractors. This involves designing waste out of the system and encouraging the reuse of materials and products at the end of their lifecycle. By providing information and resources on circular economy practices, small contractors can be encouraged to adopt these principles in their work, leading to a reduction in waste going to landfills.

Finally, educational practices can also help to promote awareness among small contractors of the economic benefits of waste reduction and recycling. By highlighting the potential cost savings associated with these practices, contractors may be more likely to adopt them as part of their business model, leading to a reduction in waste going to landfill.

It is important to note that identifying the needs for change management is only the first step towards driving positive change in waste management practices within municipalities. While the shortlist of identified needs provides a solid foundation, it is crucial to go beyond identifying the needs and to take action to address them. In the next section of the report, best practices in waste management will be explored, and examples of successful implementation will be highlighted to help guide Portuguese municipalities towards sustainable waste management practices. By combining the insights gained from identifying needs with the implementation of best practices, municipalities can make significant progress towards achieving their waste management objectives.

5 BEST PRACTICES

With a solid understanding of the identified needs for change management within municipalities, the next step towards achieving sustainable waste management practices is to explore best practices that have been successfully implemented in other contexts. By studying best practices in waste management, municipalities can gain valuable insights into effective strategies for addressing the identified needs and improving their waste management systems.

This section will examine examples of successful waste management practices from Europe, with a focus on approaches that are relevant to the Portuguese context. Weheras some of the examples were identified through litterature review, most examples drawn from the most relevant cases presented during the two-days event arranged on the 7th and 9th March 2023 by the Technical Assistance and Information Exchange instrument (TAIEX) of the European Commission, in Porto and Lisbon, in the context of project Three Roads to Circular Economy: Reduce, Reuse, Recycle.

Management of Hazardous waste from households – practices and lessons learned in Finland

In Finland, municipalities have been obligated to organize the reception and treatment of hazardous waste generated in housing since 1979. This includes waste such as batteries, fluorescent lamps, paint, pesticides, and electronic equipment. The goal is to ensure that hazardous waste is handled safely and disposed of properly to protect both human health and the environment.

Household hazardous waste is usually collected at dedicated collection points or special events organized by municipalities. These collection points are typically located at waste management facilities, recycling centers, or other designated locations. Some municipalities also offer a home collection service for larger quantities of hazardous waste.

Once collected, the hazardous waste is transported to specialized treatment facilities where it is either recycled, recovered, or disposed of safely. For example, batteries and fluorescent lamps are usually recycled, while hazardous chemicals and paints may be treated or incinerated to minimize their impact on the environment.

Furthermore, several hazardous waste fractions of municipal solid waste are extended producer responsibility fractions (EPRs). Manufactures and importers of certain product types must bear the responsibility for the management of their products when they become waste, and EPR organisations and municipalities are cooperating to maintain a good service level for households as well, and several EPR fractions are also hazardous waste, e.g.: cellphones, batteries, refrigerators, old cars, fluorescents lights. Also, EPR organisations cover part of the costs for municipalities that organize the collection.

In addition to the collection and disposal of household hazardous waste, municipalities in Finland also provide information and education to residents on how to handle and dispose of hazardous waste safely. This includes guidance on how to reduce hazardous waste generation, how to store hazardous waste safely, and how to dispose of it properly.

Managing Household Hazardous Waste with a Mobile Collection Unit: The Oslo Case

The city of Oslo, Norway has implemented a program to manage household hazardous waste through its 'Hazardous Waste Mobile Collection Unit'. The program provides residents with a convenient way to dispose of household hazardous waste such as batteries, electronics, and chemicals. The mobile unit travels to

different neighborhoods throughout the city on a regular schedule, making it easier for residents to dispose of their hazardous waste properly.[11]

The initiative was launched in 2012 and has faced challenges such as increasing public awareness about hazardous waste and ensuring proper disposal of items. However, the program has been successful in reducing the amount of hazardous waste that is illegally dumped and has improved public health by reducing exposure to harmful chemicals.

The Hazardous Waste Mobile Collection Unit also promotes waste reduction and encourages sustainable practices. For example, the unit offers advice and information on how to reduce the amount of hazardous waste generated in households, and they provide free replacement batteries for rechargeable devices. The program has been well received by residents, with over 12,000 visits to the mobile unit each year.

The success of the Hazardous Waste Mobile Collection Unit program in Oslo has led to its replication in other cities in Norway and Europe. The initiative demonstrates the importance of proper management of hazardous waste and the benefits of providing convenient and accessible disposal services to residents.

Best practices in Intermunicipal Collaboration: The pictogram system for waste sorting in Denmark

The Danish Waste Association, an association of 60 municipalities and waste companies, has developed a harmonized pictograms system for waste sorting and citizen involvement. This system works as a link between waste and the bins, and has the purpose of making waste sorting easier for citizens and corporations. Today close to all of the 98 municipalities in Denmark are using the pictogram system.[12]

***Figure 2**. The 91 pictograms for waste sorting (Source: https://danskaffaldsforening.dk/)*

[11] Oslo Kommune. (2021). Hazardous Waste Mobile Collection Unit. https://www.oslo.kommune.no/avfall-og-gjenvinning/husavfall-og-groenntare/helse-og-miljo/hazardous-waste-mobile-collection-unit/.

[12] https://danskaffaldsforening.dk/the-danish-pictograms-waste-sorting

This system is a combination of the most effective elements of pre-existing waste sorting systems from various regions in Denmark. Its creation was informed by a series of meetings, workshops, interviews, and surveys involving waste management experts from municipalities and waste plants, as well as citizens from different parts of the country.

The primary objective of the Danish pictogram system is to ensure that individuals can easily identify and use the same pictograms consistently, regardless of when or where they are disposing of their waste in Denmark, for both household waste and waste collected at recycling centers. They are currently in use by almost all 98 municipalities in Denmark, various corporations and organizations, private individuals, and at different events and on packaging.

Furthermore, the system considers the entire value chain. Putting pictograms on packaging has been a gateway to discuss packaging design with the Danish producers and retailers, allowing for improving consumers' awareness.

Currently, besides Denmark, Sweden, Norway, Iceland, Latvia, Lithuania, Faroe Islands and Åland Islands are also using the pictograms system, while in Finland, Estonia and Greenland the pictograms are underway to be implemented. Other EU countries have shown interest, and as part of the packaging directive revision, the EU Commission are looking into extending the use across the EU.[13]

Citizens and their waste behaviour: Dutch approach of communication around waste and littering

The Netherlands is known for its efficient waste management system, and communication plays an important role in shaping citizens' waste behavior. The Dutch approach to communication around waste and littering is focused on education, engagement, and empowerment.

One of the key strategies used in the Netherlands is to provide citizens with clear and simple information on how to properly dispose of their waste. This includes information on which materials are recyclable and which should be disposed of in the trash, as well as information on where to find recycling facilities and what to do with hazardous waste. Citizens are also encouraged to reduce waste by using reusable products and avoiding single-use items.[14]

Another important aspect of the Dutch approach is engagement with citizens. This involves working with local communities and organizations to promote sustainable waste practices and reduce littering. For example, many municipalities in the Netherlands organize cleanup events where citizens can come together to collect litter from public spaces. These events help raise awareness about the impact of littering on the environment and encourage citizens to take action to reduce waste.[15]

Empowering citizens to take responsibility for their waste is another key strategy used in the Netherlands. This includes providing citizens with the tools and resources they need to properly dispose of their waste, such as recycling bins and composting facilities. It also involves encouraging citizens to report littering and illegal dumping to local authorities, which helps to identify problem areas and address them more effectively.

The Dutch approach to communication around waste and littering has been successful in shaping citizens' waste behavior. Through education, engagement, and empowerment, the Netherlands has been able to achieve high rates of recycling and minimize littering. This approach can serve as a model for other countries looking to improve their waste management systems and reduce the impact of waste on the environment.

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[13] European Commission. (2021, July 14). Q&A: Packaging and Packaging Waste Directive. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_7157.

[14] Rijkswaterstaat. (2021). The Dutch Waste Management Chain. Retrieved from https://www.rijkswaterstaat.nl/english/topics/water-quality-waste-management/waste-management/dutch-waste-management-chain/index.aspx

[15] Van den Berg, M., & Spaargaren, G. (2019). Sustainable waste management in the Netherlands: The role of citizen engagement. Waste Management, 87, 756-766.

Antwerp's Diftar System: Encouraging Citizen Contribution to Better Waste Management

The city of Antwerp, Belgium, is a good example of European municipality that has successfully improved citizens' contribution to better waste management.[16]

In 2018, the city introduced a new waste management system called 'Diftar' which stands for 'Different Tariffs'. Under this system, households are charged a fee based on the volume of non-recyclable waste they produce. The more waste a household produces, the higher the fee they pay. Conversely, households that produce less waste pay a lower fee.

To support this new system, the city has implemented several initiatives to encourage residents to recycle more and produce less waste. For example, the city provides free recycling bags for residents and has expanded its recycling infrastructure with new recycling centers and more recycling points in public spaces. The city has also launched educational campaigns to raise awareness about the importance of recycling and reducing waste.

The Diftar system has faced challenges, including initial resistance from some residents who felt that the new fees were unfair. However, the system has been successful in reducing the amount of non-recyclable waste produced in the city and increasing recycling rates.[17]

As a result of the Diftar system and accompanying initiatives, Antwerp has become a leader in sustainable waste management practices and serves as a model for other European municipalities looking to improve citizens' contribution to better waste management.

Rotterdam's Waste Pays Card Program: Incentivizing Bulky Waste Management and Promoting Sustainability

The 'Waste Pays Card' program in Rotterdam, Netherlands, is a creative solution to the issue of bulky waste management. The program was launched in 2012 by Afval Loont, the municipal waste management company, with the goal of incentivizing residents to properly dispose of bulky waste items and reduce the amount of waste sent to landfills.[18] However, the program faced initial challenges in engaging residents and encouraging them to participate in the program.[19]

Despite these challenges, the Waste Pays Card program has been successful in promoting a culture of sustainability in Rotterdam. As of 2021, the program had over 300,000 registered participants who brought in more than 10,000 tonnes of bulky waste annually. In addition, the program has increased participation in bulky waste collection, reducing the amount of bulky waste sent to landfills by 30% since its inception.

The rewards system has been praised for its effectiveness in motivating residents to dispose of bulky waste responsibly, while also providing benefits for local businesses. Rotterdam's Waste Pays Card program has inspired similar initiatives in other municipalities in the Netherlands, demonstrating the potential for innovative solutions to address waste management challenges.

Reuse Centre on Wheels: A Mobile Solution for Sustainable Waste Management in Ljubljana's Zero Waste Initiative'

[16] City of Antwerp. (2021). Waste Management: Diftar. https://www.antwerpen.be/en/overzicht/dienst/afval-en-reiniging/diftar.
[17] Eunomia Research & Consulting Ltd. (2021). Municipal Waste Management in European Countries: A review of Best Practices. https://www.eunomia.co.uk/reports-tools/municipal-waste-management-in-european-countries-a-review-of-best-practices/
[18] Afval Loont Pas zorgt voor afvalscheiding in Rotterdam" (in Dutch), VNG Realisatie website: https://www.vngrealisatie.nl/nieuws/afval-loont-pas-zorgt-voor-afvalscheiding-rotterdam
[19] "Rotterdam's 'Waste Pays' scheme turns rubbish into rewards," The Guardian website: https://www.theguardian.com/sustainable-business/2015/jan/19/rotterdam-waste-pays-scheme-turns-rubbish-rewards

Ljubljana's waste management practices have been recognized internationally, and the city has received numerous awards for its efforts. In 2018, Ljubljana was awarded the United Nations' World Tourism Organization's Award for Innovation in Sustainable Tourism, and in 2019, the city was named the European Green Capital (The Guardian). These accolades demonstrate the success of Ljubljana's waste management practices and serve as an example for other cities around the world. The Reuse Centre on Wheels is one of Ljubljana's zero waste initiatives implemented as part of the city's effort to reduce 75% of the waste sent to landfills by 2035, with the ultimate goal of achieving zero waste and promote circular economy.[20]

The Reuse Centre on Wheels involves a mobile unit that travels around the city collecting unwanted items that are still in good condition, such as furniture, clothing, and household items. These items are then brought to a central location, where they are repaired and prepared for resale (City of Ljubljana).[21] This project was launched in 2012 and has been successful in diverting large amounts of waste from landfills. In 2020 alone, the project collected over 74,000 items and prevented more than 370 tons of waste from being sent to landfills (City of Ljubljana). The project not only reduces waste, but also provides affordable items for those in need and promotes the circular economy by encouraging the reuse of materials.[22]

The Reuse Centre on Wheels is just one example of Ljubljana's commitment to sustainable waste management practices. The city's comprehensive waste management system, which includes separate collection of biodegradable waste, recycling programs, and a pay-as-you-throw system, has resulted in impressive recycling rates and a significant reduction in waste sent to landfills.

The Swap Shop: Fostering Community Engagement and Sustainable Consumption in Gothenburg's Waste Reduction Efforts

The Swap Shop initiative in Gothenburg, Sweden is a unique approach to waste reduction that encourages residents to exchange items they no longer need for items they do. The project involves a physical location where residents can bring unwanted items such as clothes, electronics, and books and trade them for other items that are of interest to them. The project's goal is to reduce waste and promote reuse while providing residents with an opportunity to socialize and build community connections[23].

The Swap Shop was launched in 2017 and has faced some challenges such as space constraints and logistics of managing inventory. However, the initiative has been well-received by the community and has been successful in diverting waste from landfills. According to a report by the City of Gothenburg, the Swap Shop has helped to save over 24 tons of items from being discarded and has prevented an estimated 45 tons of carbon dioxide emissions from entering the atmosphere.[24]

In addition to reducing waste, the Swap Shop has also provided social benefits for the community. The project has become a popular gathering place for residents, where they can meet and socialize while also contributing to a more sustainable future. The Swap Shop has also provided opportunities for education and awareness-raising around waste reduction and sustainable consumption.

The Swap Shop initiative in Gothenburg demonstrates the importance of community engagement in waste reduction efforts. By providing a physical space for residents to exchange items, the project has successfully fostered a culture of reuse and encouraged more sustainable consumption patterns.

[20] City of Ljubljana. (n.d.). Zero Waste. https://www.ljubljana.si/en/ljubljana-for-you/sustainable-ljubljana/zero-waste/
[21] City of Ljubljana. (n.d.). Reuse Centre on Wheels. https://www.ljubljana.si/en/municipality/projects/reuse-centre-on-wheels/
[22] City of Ljubljana. (2021). Annual Report 2020. https://www.ljubljana.si/file/1170102/Annual-report-2020.pdf
[23] City of Gothenburg. (n.d.). The Swap Shop - Sustainable Consumption. https://goteborg.se/wps/portal/start
[24] City of Gothenburg. (2021). Annual Report on Sustainable Gothenburg 2020. https://goteborg.se/wps/wcm/connect/2c3e3692-e7d4-4f77-86e2-53b3fdbf0d31/City+of+Gothenburg+Annual+Report+2021.pdf?MOD=AJPERES

Promoting Sustainable Consumption and Waste Reduction through the ReUse Centre in Aarhus, Denmark

The ReUse Centre in Aarhus, Denmark is an innovative waste management initiative that aims to reduce waste and promote sustainable consumption. The centre provides a physical space where residents can donate and purchase second-hand items such as furniture, clothing, and electronics. Additionally, the centre features a workshop component, providing a space for repairing and upcycling items, as well as educating the public on the benefits of waste reduction and sustainable consumption (ReUse Aarhus).[25]

The project's goal is to extend the lifespan of products and promote circular economy principles by reducing waste and minimizing resource consumption. The ReUse Centre was launched in 2016 and has faced challenges such as managing inventory and maintaining a high level of quality control for donated items. However, the project has been successful in diverting waste from landfills and promoting sustainable consumption. According to ReUse Aarhus, the centre has helped to save over 400 tons of items from being discarded and has provided opportunities for employment and volunteer work in the community.

In addition to providing a physical space for reuse, the ReUse Centre has also implemented innovative solutions such as a digital platform for exchanging and sharing items. The platform, called 'Genbrug Aarhus,' allows residents to connect with each other and exchange items that they no longer need, further promoting a culture of reuse and sustainable consumption.[26]

The ReUse Centre in Aarhus has become a model for waste reduction and sustainable consumption in Denmark and beyond. The project demonstrates the importance of collaboration between government, businesses, and community organizations in achieving sustainable waste management goals.

Circular Procurement: The ProCirc Project

Public procurement accounts for 14% of GDP in the European Union.[27] Therefore, circular public procurement practices can play a crucial role in advancing a circular economy. By prioritizing the use of products and services that have been designed for circularity, public procurement can help reduce waste, conserve resources, and promote sustainable production and consumption patterns.

Circular procurement can also create market demand for circular products and services, which can drive innovation and investment in sustainable business models. This can lead to job creation and economic growth in industries that prioritize sustainability.

The ProCirc project has started in December of 2018 and is expected to finish in June of 2023. It conducts and supports 30 pilots to demonstrate procurement opportunities, and is set up to experiment, implement and learn how circular economy and procurement can benefit the North Sea Region. In addition to the pilot case studies which have supported the creation and expansion of circular business models, there are other results coming from the project such the publication of eight professional articles, the creation of a circular procurement toolbox, the development of a circular procurement framework guidance, the provision of organisational change guidance, as well as the development of a permanent platform, the C-PRONE, for exchange and connection to establish a one stop starting point for everybody engaged in projects and networks about circular procurement.[28]

This section highlights best practices and initiatives in waste management from different countries such as UK, Finland, Italy, Denmark, Catalonia, and the Netherlands, which can be used as example to the Portuguese

[25] ReUse Aarhus. (n.d.). Om ReUse. https://www.reuseaarhus.dk/om-reuse/

[26] KredsLob. (2021). Reuse. https://www.kredslob.dk/produkter-og-services/genbrug-og-affald/reuse

[27] European Commission. (n.d.). Public Procurement. Retrieved from https://ec.europa.eu/growth/single-market/public-procurement_en.

[28] ProCirc: Fostering circular procurement in European municipalities": European Commission, CORDIS: https://cordis.europa.eu/article/id/418108-procirc-fostering-circular-procurement-in-european-municipalities/en

context. Portugal can benefit from successful change management strategies that include effective stakeholder engagement, clear communication, a shared vision for the future of waste management, and better circular public procurement strategies. Thus, in the following section it will be given specific examples of strategies to be used in the Portuguese case.

6 CHANGE MANAGEMENT STRATEGIES

In this section, we present some strategies and recommendations for successful change management in Portuguese municipalities to lead to more sustainable and effective waste management systems. These strategies and recommendations are based on best practices and lessons learned from successful waste management initiatives implemented in other European municipalities. By adopting these strategies and recommendations, Portuguese municipalities can overcome the challenges they face and achieve their waste management targets.

Overall objective and long-term goal: Successful change management, within the Portuguese municipalities, lead to more sustainable and effective waste management systems.		
Strategy element	**Indicator**	**Means of verification**
Objective 1: Citizens have developed a culture of sustainability and responsibility and know where to dispose their waste	Percentage of waste that is correctly sorted and disposed of in designated waste bins by citizens. Frequency of illegal dumping or littering in public spaces	Waste audits or monitoring waste collection trucks to identify the level of contamination in the different waste streams. Regular inspections of public spaces and areas prone to illegal dumping
Output 1.1 Improved communication from municipalities	Citizen participation in waste management initiatives, such as recycling programs or community clean-up events.	Surveys or focus groups with citizens to gather feedback on the effectiveness of communication efforts and the level of participation in waste management initiatives.
	Frequency of communication and engagement activities implemented by municipalities (ex: town hall meetings, social media posts, or educational campaigns).	Track the number of communication and engagement activities conducted over a set period of time, such as per month or per year, and reach of activities.
Output 1.2 Development of good practice guidelines for citizens	Percentage of citizens who report increased awareness and knowledge of waste reduction, reuse, and recycling practices after the implementation of the guidelines.	Surveys, focus groups, or other forms of direct feedback from citizens.
	Level of citizen engagement in waste management activities	Monitor the number of citizens participating in waste management activities (e.g. recycling, composting) and collect feedback on their experience with the guidelines.
	Reduction in waste generation and/or increase in recycling rates	Track the amount of waste generated and the amount of waste recycled before and after the implementation of the guidelines, and compare the data to assess the impact of the guidelines on waste reduction and recycling rates.
Output 1.3 Educational practices for small contractors	Number of contractors who have completed training or certification programs related to waste management and construction waste.	List of participants & surveys to evaluate knowledge of waste disposal practices.

Specific examples under Objective 1 : Citizens have developed a culture of sustainability and responsibility and know where to dispose their waste		
Iniative	**Strategic partners & platforms**	**Objective**

Create municipality guidelines for waste separation and collection to be placed near households.	Condominiums, town hall, post office, mailbox.	It can help to standardize the waste separation and collection process, ensuring that all citizens are aware of what waste items can be recycled or disposed of properly. This can reduce confusion and errors in waste disposal, leading to a more efficient and effective waste management system. Placing the guidelines near households can serve as a reminder for citizens to properly separate and dispose of their waste, increasing compliance with waste management regulations and reducing contamination of recyclable materials. It can also promote a culture of environmental responsibility among citizens, encouraging them to take an active role in waste reduction and resource conservation.
Cleanups organized by municipality	Community places: town hall, local school, church, community center, library, hospital/health center, youth center, senior center, sports facility.	Raise awareness about the issue of waste management and encourage community involvement in keeping public spaces clean.
Development of communication and outreach materials through digital campaigns, to educate the public on waste management practices and promote community engagement.	Municipality website, social media, and local influencers.	Reach out to a broader range of citizens
Development of communication and outreach materials, such as brochures, and flyers, to educate the public on waste management practices and promote community engagement.	Community places: pharmacy, grocery, town hall, local school, church, community center, library, hospital/health center, youth center, senior center, sports facility.	Convenience: People can take the materials with them and refer to them later, making it easier to remember and follow the information provided. Targeted distribution: Physical materials can be targeted to specific areas or demographics, making them more effective in reaching the intended audience. Local relevance: Materials can be customized to reflect the specific waste management practices and needs of a particular community, making them more relevant and useful for local residents. Increased visibility: Physical materials can be displayed in public spaces such as community centres, libraries, or schools, increasing their visibility and reach beyond just online channels.
Feed information in WasteApp (wasteapp.pt)	Ecocentres, amenity center, and any collectors of waste streams with activities or collection points within the municipality.	Save time, resources, and effort. By using an existing app, the municipality can avoid the cost and time associated with developing a new one from scratch, including design, programming, testing, and implementation. Additionally, an existing app may already have a user base, which means that citizens may be more likely to use it, as they may already be familiar with it. This can increase the effectiveness of the waste management program by making it easier for citizens to find information on how to dispose of their waste properly. Finally, using and promoting an existing app may also allow for better integration with other municipal services, such as public transportation, parking, or city events, creating a more comprehensive user experience.
Provide a list of certified small contractors who have demonstrated their ability to manage waste responsibly.	Local technical school Local small contractors	Promote responsible waste management practices in the community. Ensure compliance with regulations by supporting work with contractors who are knowledgeable about waste

		management regulations and who have experience implementing them. Encourage competition among contractors and help to ensure that they are getting the best value for their money. This can help to keep costs down while still ensuring that waste is managed responsibly. Build trust with the community and demonstrate their commitment to sustainability and environmental stewardship.

Strategy element	Indicator	Means of verification
Objective 2: Improved municipal coordination and cooperation to foster better waste systems	Establishment of cross-functional teams or task forces within the municipality dedicated to waste management initiatives.	Documentation of the establishment of cross-functional teams or task forces, as well as the development and implementation of joint waste management plans or agreements, which can demonstrate a commitment to working together towards a common goal of improving waste management in the region.
Output 2.1 Identification of common needs	Number and frequency of inter-municipal meetings or workshops focused on waste management.	Records of the meetings or workshops, including the number of participants, the topics discussed, and the agreements or actions resulting from the meetings.
Output 2.2 Establishment of working group with representatives from different municipalities	Development and implementation of joint waste management plans or projects between municipalities, the establishment of inter-municipal waste management associations or networks, and the adoption of similar waste management initiatives, policies or regulations across municipalities (eg: common communication plan).	These indicators could be verified through official documents, such as the joint plans or policies, or through records of the activities and decisions of the associations or networks. Surveys or interviews with municipal officials could also provide information on the level of collaboration and the identification of common needs between municipalities
Output 2.3 Engage in regional public procurement for better waste management systems	Number of joint public procurements with environmental criteria.	The solutions proposed tackle the different municipalities needs, and enable economies of scale for the municipalities.
Specific examples under Objective 2: Improved municipal coordination and cooperation to foster better waste systems		
Initiative	**Strategic partners & platforms**	**Objective**
Training municipality staff on public procurement, public procurement for innovation, and green public procurement.	• Compras Públicas de Inovação – CPI (Portuguese Competence Center in Public Procurement of Innovation)[29] • Innovation Procurement Platform[30]	• Enhance the staff knowledge and skills on the procurement process, procedures, and regulations related to municipal waste management. This training can help ensure that the procurement process is carried out in a transparent, fair, and competitive manner. It can also help staff identify and address potential risks and challenges related to procurement, such as conflicts of interest, collusion, or lack of competition. By improving staff's knowledge and skills in public procurement, the municipality can achieve better value for money,

29 https://www.compraspublicasinovacao.pt/
30 https://innovation-procurement.org/

		reduce procurement-related risks, and increase the efficiency and effectiveness of its waste management services.

Strategy element	Indicator	Means of verification
Objective 3: Incentivizing sustainable waste management practices	Percentage increase in the use of sustainable waste management practices, such as recycling, composting, or reducing waste generation.	Data collected from waste management programs, such as recycling rates and waste diversion rates. Surveys and interviews with households and businesses could also provide feedback on their participation in sustainable waste management practices and their attitudes towards waste reduction.
Output 3.1 Promote economic incentives	The number of businesses or individuals participating in incentive programs (e.g., reduced waste disposal fees for those who recycle or compost). The amount of money saved through reduced waste disposal costs. The amount of revenue generated. through the sale of recyclable materials. The level of participation in education and outreach programs related to waste reduction and management.	Waste audits, surveys, and program participation data. Tracking the amount of waste that is diverted from landfills over time and comparing it to previous years or to other municipalities
Output 3.2 Innovative and attractive rural civic amenity centres	Increase in the number of visitors and the amount of waste properly disposed of at the centres.	Tracking the number of visitors to the centres before and after the improvements are made, as well as by monitoring the amount of waste collected and properly disposed of. Surveys can be conducted to gather feedback from users on their satisfaction with the amenities and services provided at the centres.

Specific examples under Objective 3: Incentivizing sustainable waste management practices		
Initiative	Strategic partners & platforms	Objective
Provide workshops for repairing and upcycling items, at local community place, or near eco-centre and/or amenity centre.	Ecocentre Amenity Centre • Community places: Community center, Library, Youth center, Sports facility.	Promotes a circular economy. Foster a sense of community and encourage social interactions. Citizens can share skills and knowledge, collaborate on projects, and form connections with other like-minded individuals. This can lead to the creation of a supportive network that extends beyond the workshop and can have a positive impact on the community as a whole. Provide educational opportunities for citizens, especially for younger generations. Workshops can offer classes or training on repairing and upcycling techniques, which can increase awareness of the benefits of waste reduction and promote sustainable practices. This education can empower citizens to take responsibility for their waste and motivate them to make more informed choices about their consumption patterns.
Promote and advertise local stores to fix and repair items.	Local repair stores.	Help reduce the amount of waste generated by encouraging residents to repair items instead of disposing of them. This, in turn, can lead to a reduction in the amount of waste

		that needs to be collected and processed by the municipality. Support local businesses and the local economy, which can have a positive impact on the community as a whole. Shift cultural attitudes towards waste and consumption by emphasizing the value of repairing and reusing items rather than constantly buying new ones.

Now that some of the key strategies that municipalities can use to improve waste management have been outlined, it's important to consider the skills and knowledge that municipal staff involved in waste management should possess in order to effectively implement these measures. Effective waste management requires staff to possess a range of technical competencies, such as knowledge of waste collection and treatment processes, environmental legislation and regulations, and data analysis and management (de Brito et al., 2020; Ribeiro et al., 2018). However, waste management is a complex and multifaceted issue, and staff should also possess soft skills such as teamwork, communication, problem-solving, and decision-making (de Brito et al., 2020; Ribeiro et al., 2018). Familiarity with public funding and financial management is also crucial, as waste management projects often require significant funding and resources (de Brito et al., 2020; Ribeiro et al., 2018).

Less hierarchy and more decision-making power can facilitate the implementation of waste management measures, as it allows for greater collaboration and co-creation between staff and different departments within the municipality (Ribeiro et al., 2018). This can lead to more innovative and effective solutions to waste management challenges (Kumar et al., 2017). Furthermore, staff should be able to take ownership and responsibility for waste management initiatives and have a strong understanding of the importance of sustainability and environmental stewardship (Kumar et al., 2017). This can foster a culture of continuous improvement and innovation in waste management practices.

Strategy element	Indicator	Means of verification
Objective 4: Municipalities have the competencies to drive changes fostering better waste management systems	Number of municipal staff who have undergone waste management training programs. Number of staff members who have achieved waste management certification or accreditation Number of waste management projects initiated and successfully completed by the municipality	Records of training attendance and completion certificates Waste management project reports and evaluations Staff performance reviews and assessments to evaluate their waste management competencies
Output 4.1 Development of training programs for municipal staff involved in waste management to be familiar with public funding and financial management.	Number of municipal staff trained in waste management. Percentage of trained staff who reported an improvement in technical competencies, soft skills, and familiarity with public funding and financial management. Number of waste management projects successfully implemented after the training programs were introduced. Increase in efficiency and effectiveness of waste management measures after the training programs were introduced.	Records of staff training attendance and completion. Pre- and post-training surveys to measure improvement in technical competencies, soft skills, and familiarity with public funding and financial management. Documentation of waste management projects and their successful implementation. Analysis of waste management data and reports to measure the effectiveness of the training programs in improving waste management measures.

Output 4.2 Implementation of workshops and capacity building activities to promote collaborative innovation and co-creation between staff and different departments within the municipality.	• Number of workshops and capacity building activities held. • Number of staff members participating in the workshops and capacity building activities. • Level of participation and engagement of staff members in the workshops and activities. • Number of cross-departmental projects initiated or completed as a result of the workshops and activities.	Attendance sheets and sign-in logs for workshops and activities. Feedback surveys from staff members regarding the effectiveness and usefulness of the workshops and activities. Progress reports and documentation of cross-departmental projects initiated or completed as a result of the workshops and activities.
Output 4.3 Establishment of mechanisms to facilitate ownership and responsibility for waste management initiatives, such as regular monitoring and evaluation of waste management practices.	• Number of mechanisms established to facilitate ownership and responsibility for waste management initiatives. • Percentage increase in staff involvement in waste management initiatives. • Frequency of monitoring and evaluation of waste management practices.	• Records of established mechanisms, such as regular staff meetings or designated staff responsible for waste management initiatives. • Staff surveys to assess their involvement in waste management initiatives. • Documentation of the frequency and results of monitoring and evaluation of waste management practices, such as reports or data on waste diversion rates.
Output 4.4 Development of communication and outreach materials, such as brochures, flyers, and videos, to educate the public on waste management practices and promote community engagement.	• Number of communication and outreach materials developed. • Reach of communication and outreach materials (e.g. number of downloads, views, or shares). • Feedback from the public on the effectiveness of the materials in promoting behavior change towards waste management practices.	• Records of the number and type of communication and outreach materials developed. • Analytics data from online platforms hosting the materials (e.g. number of downloads, views, or shares). • Surveys or focus groups with the public to assess the impact of the materials on their knowledge and behavior towards waste management practices.
Output 4.5 Collaboration with regional and national organizations and institutions to share best practices and promote knowledge transfer in the field of waste management.	• Number of regional and national organizations and institutions that the municipality collaborates with for knowledge sharing and best practices in waste management. • Number of knowledge-sharing activities and events organized with regional and national organizations and institutions. • Number of best practices shared and implemented in the municipality as a result of the	• Records of collaboration with regional and national organizations and institutions, such as signed agreements or memorandums of understanding (MOUs). • Attendance records and feedback from participants of knowledge-sharing activities and events. • Documentation and reports of best practices

	collaboration with regional and national organizations and institutions.	implemented in the municipality as a result of the collaboration with regional and national organizations and institutions.

7 CONCLUSION

After conducting a comprehensive literature review and analyzing best practices from European municipalities, 'Part II - The role of change management for successful waste management practices', presents several key recommendations for change management in Portuguese municipalities to improve their waste management systems. These recommendations were developed in collaboration with local stakeholders, considering the specific drivers and barriers present in Portugal.

It was highlighted the importance of citizen involvement and education, incentivizing sustainable waste management practices, improved municipal coordination and cooperation, development of staff competencies, and collaboration with regional and national organizations to promote knowledge transfer. To effectively implement these recommendations, municipalities should focus on developing clear and measurable goals, building a competent team, engaging stakeholders and the public through communication and outreach, and establishing mechanisms to facilitate ownership and responsibility for waste management initiatives.

Moreover, municipalities should develop training programs for their staff, promote collaborative innovation and co-creation, and collaborate with regional and national organizations and institutions to facilitate effective change management. Municipal staff involved in waste management should possess technical competencies, soft skills, familiarity with public funding and financial management, and a strong understanding of sustainability and environmental stewardship.

Implementing these recommendations can improve waste management systems in Portuguese municipalities, leading to more sustainable and effective practices that benefit both the environment and the community. The recommendations can serve as a roadmap for municipalities to take proactive steps towards sustainable waste management.

In conclusion, effective waste management is crucial for sustainable development in Portugal. The recommendations are based on best practices and lessons learned from successful waste management initiatives in other European municipalities. By working together towards a common goal, Portuguese municipalities can achieve a more sustainable and effective waste management system that benefits the environment, the economy, and society. Successful change management in waste management systems requires a long-term commitment from all stakeholders involved, including the government, private sector, civil society, and citizens.

8 BIBLIOGRAPHY

- "Afval Loont Pas zorgt voor afvalscheiding in Rotterdam" (in Dutch), VNG Realisatie website: https://www.vngrealisatie.nl/nieuws/afval-loont-pas-zorgt-voor-afvalscheiding-rotterdam
- Aslam, A., & Qamar, U. (2021). A Review of Municipal Solid Waste Management (MSWM) Practices and Challenges in Urban Areas: A Way Forward. Journal of Environmental Management, 291, 112604.
- Chowdhury, M. K. R., Chakraborty, A., & Paul, P. (2021). Municipal solid waste management in India: A critical review. Journal of Environmental Management, 295, 113-127.
- City of Antwerp. (2021). Waste Management: Diftar. https://www.antwerpen.be/en/overzicht/dienst/afval-en-reiniging/diftar
- City of Gothenburg. (2021). Annual Report on Sustainable Gothenburg 2020. https://www.goteborg.se/wps/wcm/connect/7eaae1f2-7c54-4fc2-930b-7aee4231f138/Sustainable+Gothenburg+Annual+Report+2020.pdf?MOD=AJPERES&CVID=mX.yftd
- City of Gothenburg. (n.d.). The Swap Shop - Sustainable Consumption. https://goteborg.se/wps/portal/enhetssida/the-swap-shop
- City of Ljubljana. (2021). Annual Report 2020. https://www.ljubljana.si/file/1170102/Annual-report-2020.pdf
- City of Ljubljana. (2021). Zero Waste - Zero Hazard. https://www.ljubljana.si/en/living-in-ljubljana/sustainable-development/zero-waste-zero-hazard/
- City of Ljubljana. (n.d.). Reuse Centre on Wheels. https://www.ljubljana.si/en/municipality/projects/reuse-centre-on-wheels/
- City of Ljubljana. (n.d.). Zero Waste. https://www.ljubljana.si/en/ljubljana-for-you/sustainable-ljubljana/zero-waste/
- Conference paper: Rezaei, R., & Azar, A. (2019). An investigation into the importance of change management in municipal solid waste management (MSWM). In International Conference on Environmental Science and Technology (pp. 1-5). IEEE.
- de Brito, J., Alves, H., & Vaz, M. (2020). Municipal solid waste management in Portugal: current state, challenges, and perspectives. Journal of Environmental Management, 270, 110887.
- Eunomia Research & Consulting Ltd. (2021). Municipal Waste Management in European Countries: A review of Best Practices. https://www.eunomia.co.uk/reports-tools/municipal-waste-management-in-european-countries-a-review-of-best-practices/
- European Commission. (2018). Municipal Waste Management in the EU. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php/Municipal_waste_statistics
- European Commission. (n.d.). Ljubljana, Slovenia – European Green Capital 2016. https://ec.europa.eu/environment/europeangreencapital/winning-cities/2016-ljubljana-slovenia/
- European Environment Agency. (2018). Waste hierarchy. https://www.eea.europa.eu/airs/2018/resource-efficiency-and-waste/waste-hierarchy
- European Environment Agency. (2020). Waste Prevention in Europe: Policies, Statuses and Trends in Reuse in 2019. https://www.eea.europa.eu/publications/waste-prevention-in-europe-2020.
- Ferronato, N., & Torretta, V. (2020). Waste Management in Italy at a Time of Crisis: Environmental and Health Impacts of Inadequate System Performance. Sustainability, 12(11), 4627.
- Gómez-Navarro, T., Ferrer-Balas, D., & Martínez-Blanco, J. (2021). Key Drivers for Circular Economy in Municipal Solid Waste Management Systems: Insights from the Catalan Case. Resources, Conservation and Recycling, 171, 105660.
- "Hoe werkt de Afval Loont Pas?" (in Dutch), Afval Loont website: https://www.afvalloont.nl/afval-loont-pas/hoe-werkt-de-afval-loont-pas/

- Journal article: De Feo, G., & De Gisi, S. (2016). The role of waste management in achieving a circular economy in Europe. Waste Management, 49, 1-2.
- Khan, N. H., Hussain, T., Sabir, S., & Saeed, U. (2020). Municipal solid waste management: A comprehensive review. Journal of Environmental Management, 263, 110413.
- KredsLob. (2021). Reuse. https://www.kredslob.dk/produkter-og-services/genbrug-og-affald/reuse
- Kumar, A., Samadder, S. R., & Muthu, S. S. (2017). Municipal solid waste management in India: From waste disposal to recovery of resources? Resources, Conservation and Recycling, 124, 1-3.
- Leal Filho, W., Wall, T., Azul, A. M., & Brandli, L. L. (2020). Waste management in the context of the circular economy: Challenges and strategies in the 21st century. International Journal of Sustainable Development & World Ecology, 27(5), 447-459.
- Lu, X., Cao, Y., & Li, X. (2020). Municipal solid waste management in China: A review. Journal of Environmental Management, 268, 110585.
- Ludwig, C., & Bogumil, J. (2018). Municipal Waste Management: Strategies and Technologies for Sustainable Solutions. Springer.
- Mekonnen, M. M., Hoekstra, A. Y., & Chapagain, A. K. (2021). The blue and grey water footprint of global municipal solid waste management. Science of The Total Environment, 750, 141511. https://doi.org/10.1016/j.scitotenv.2020.141511
- Nguyen, T. P., Tiberghien, J., & Thao Nguyen, T. P. (2021). Assessing the effectiveness of waste management policies in Vietnam: A review. Resources, Conservation and Recycling, 174, 105824.
- Oslo Kommune. (2021). Hazardous Waste Mobile Collection Unit. https://www.oslo.kommune.no/avfall-og-gjenvinning/husavfall-og-groenntare/helse-og-miljo/hazardous-waste-mobile-collection-unit/
- ReUse Aarhus. (n.d.). Om ReUse. https://www.reuseaarhus.dk/om-reuse/
- Ribeiro, S., Sá, A., Coutinho-Rodrigues, J., & Marques, R. C. (2018). A maturity model for waste management systems. Journal of Cleaner Production, 195, 209-222.
- "Rotterdam's Waste Pays Card," The Circular website: https://thecircular.org/rotterdams-waste-pays-card/
- "Rotterdam's 'Waste Pays' scheme turns rubbish into rewards," The Guardian website: https://www.theguardian.com/sustainable-business/2015/jan/19/rotterdam-waste-pays-scheme-turns-rubbish-rewards
- Said, M., Elsayed, O. A., & Khaled, A. (2021). Towards sustainable municipal solid waste management: A review. Journal of Cleaner Production, 319, 128838.
- Snaga. (n.d.). Pay-As-You-Throw System. https://www.snaga.si/en/pay-as-you-throw-system/
- Snaga. (n.d.). Waste Collection. https://www.snaga.si/en/waste-collection/
- Stad Antwerpen. (2021). Afval. https://www.antwerpen.be/nl/info/57a7032b6a35d316708b4778/afval
- The Guardian. (2014, June 25). Ljubljana wins title of European Green Capital 2016. https://www.theguardian.com/environment/2014/jun/25/ljubljana-wins-title-european-green-capital-2016
- United Nations Environment Programme. (2015). Global Waste Management Outlook. Retrieved from https://www.unenvironment.org/resources/report/global-waste-management-outlook
- Waste Reduction World. (n.d.). ReUse Centre, Aarhus, Denmark. https://wastereductionworld.com/centre/reuse-centre-aarhus-denmark/
- Website: United Nations Environment Programme. (2019). Waste Management. Retrieved from https://www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/waste-management
- World Bank. (2012). What a Waste: A Global Review of Solid Waste Management. Retrieved from https://openknowledge.worldbank.org/handle/10986/17
- World Bank. (2018). What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050.