This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690182

GOOD AND BEST PRACTICE *Handbook*

FOR THE COLLECTION OF PAPER AND BOARD FOR RECYCLING

IMPACTPAPEREC

Boosting separate paper collection

GOOD AND BEST PRACTICE HANDBOOK FOR THE COLLECTION OF PAPER AND BOARD FOR RECYCLING

VERSION 3.0

November 2017

Edited by ITENE (Packaging, Transport and Logistics Research Centre)

With the assistance of:
Association of Cities and Regions for Sustainable Resource Management (ACR+), Confederation of European Industries (CEPI), SAICA, HAMBURGUER RECYCLING, STORA ENSO, CITEO, PTS, PROPAKMA, S.C. TEGA S.A, C.C. CARREFOUR, German Institute for Standardisation (DIN), European Environmental Bureau (EEB), FENIX DUPNICA, SFANTU GHEORGHE MUNICIPALITY (Romania), MIHAI VITEAZU MUNICIPALITY (Romania), DUPNITSA MUNICIPALITY (Bulgaria), MEZDRA MUNICIPALITY (Bulgaria) and TRIVALIS MUNICIPALITY (France)

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Abbreviations

BE	Belgium
BG	Bulgaria
BSI	British Standards Institution
BP	Best Practice
BPWG	Best Practice Working Groups
CEN	European Committee for Standardisation
CEN/TS	European Technical Specifications
CEN/TR	European Technical Reports
CENELEC	European Committee for Electrotechnical Standardisation
CWA	CEN Workshop Agreements
DE	Germany
DIN	German Institute for Standardisation
D-t-D	Door to door
EC	European Commission
EN	European Standard
EPR	Extended Producer Responsibility
ES	Spain
ESC	External Support Committee
ETSI	European Telecommunication Standards Institute
GP	Good Practice
IEC	International Electrotechnical Commission
ISO	International Organisation for Standardisation
ITU	International Telecommunications Union
KPI	Key Performance Indicator
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
NEN	Netherlands Standardisation Institute
PfR	Paper (and board) for recycling
PO	Poland
RO	Romania
SL	Slovenia
UK	United Kingdom
WFD	Waste Framework Directive

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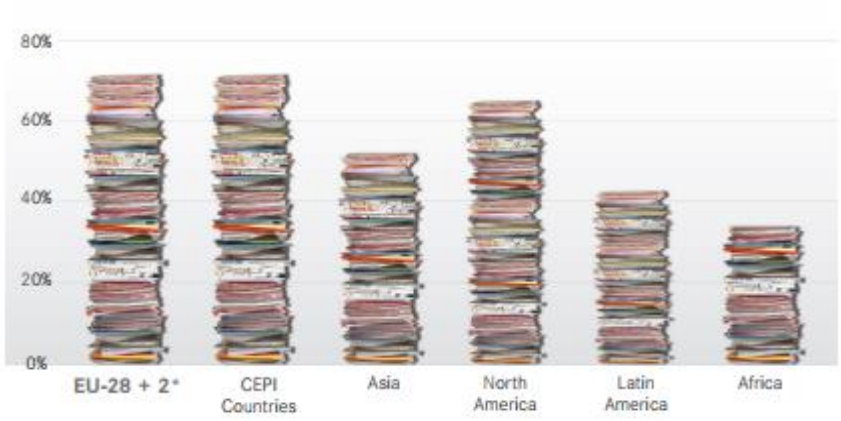
1. INTRODUCTION

Background

Current production of paper and board in the EU stands at 91 million tonnes per year. In 2015, consumption of paper and board stood at 82.5 million tonnes. 71.5% of all paper consumed in Europe, i.e. 59 million tonnes, was recycled after its collection from households, businesses, industry and offices. The paper recycling rate is therefore 71.5% (1). The contribution of PfR to the raw material mix of the European paper industry has increased over the last few years from 25 million tonnes in 1991 to 47.7 million tonnes in 2015. (1)

However, this increase in the availability of Paper for Recycling (PfR) has not taken place in all EU states, and this is especially true in central and eastern European countries. Moreover, the quality of the collected material does not always meet paper recycling requirements. These two factors imply that the recent increases in the collection of PfR achieved over the last few years will be difficult to sustain without additional measures.

This project therefore focuses on countries where paper and board still largely ends up in residual waste or where the predominant collection scheme is commingled (i.e. paper is separated from residual waste but is still mixed with other recyclables such as metals and plastics). The countries focused on here are Bulgaria, Poland and Romania from the first category and France and the UK from the second (2).



*Note: EU-28 +2: *EU-28 + Norway and Switzerland*

Figure 1. Paper recycling rates in world regions in 2015 (Source: CEPI and RISI).

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The project

IMPACTPapeRec is a European project to boost the Circular Economy by further increasing separate collection of paper and board and promoting appropriate schemes to avoid landfilling and incineration. It comes under the topic "Waste-4d-2015 Raw materials partnerships".

IMPACTPapeRec is a consortium of 19 partners from eight countries; Austria, Belgium, Bulgaria, France, Germany, Poland, Romania and Spain. The innovative approach of the defined participatory strategies on separate paper collection for efficient recycling is based on the commitment of the entire paper value chain: Municipalities (Sfantu Gheorghe, Mihai Viteazu, Dupnitsa, Mezdra, Trivalis), large paper companies (SAICA, Hamburger Recycling, Stora Enso), a large waste management company (TEGA), an international network of cities and regions (ACR+), an eNGO (EEB), research organisations (ITENE and PTS), a European retailer (C.C Carrefour Spain), representative SME groups (PROPAKMA, Fenix Dupnica), the German Institute for Standardisation (DIN), an EPR scheme (CITEO[1]) and the European paper sector organisation (CEPI). They represent a balanced view of the entire value chain.

Figure 2. Partners in the IMPACTPapeRec project

[1] Previously ECOFOLIO. Eco-Emballages and Ecofolio merged in 2017 to become CITEO, which was set up by businesses to limit the environmental impact of packaging and paper.

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IMPACTPapeRec acts as a common European information point for the collection of paper and board for recycling in European municipalities by pooling and disseminating information and bringing together stakeholders from the value chain to exchange results, findings and experiences. In order to improve the development and promotion of GOOD and BEST PRACTICES in paper collection, there is a need to establish common evaluation and benchmarking methodologies.

The main outcome of the work carried out by the IMPACTPapeRec project is a GOOD and BEST PRACTICE HANDBOOK, containing an analysis of the PRACTICES used for the collection of paper and board. The aim of the handbook is to support the different European regions in the implementation of best collection procedures.

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1.1 Definitions[2]

Source

HOUSEHOLD

Private end-user.

BUSINESS

Small Business: Small shops and offices in household-assimilated waste collection.

Big Business: Big business such as big shops, supermarkets, shopping malls, logistics and distribution centres and big office buildings.

End user

CONSUMER

Private end-user. Different building structures (detached house, town house, apartment building). Source: households.

RETAIL

Shops selling consumer goods, such as food, clothing, cosmetics, electronics and books. Household assimilated waste collection. These tipically have service contracts with PfR trading or container service companies and do not participate in the municipal collection system, specially large retailers. Source: small and big businesses.

OFFICES

Big and small offices of large companies, life insurance agencies, insurance broker, estate agents, banks, lawyers, freelancers, medical practice, consultants, etc. The big offices of large companies tipically have service contracts with PfR trading or container service companies and do not participate in the municipal collection system.

Source: big/small businesses

RESTAURANTS

Business that provides a food service, such as restaurants, pubs, cafés and fast food. Material: mixed paper & board, packaging, special paper products. Source: small and big businesses (household assimilated collection possible).

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Type of collection unit

BAG

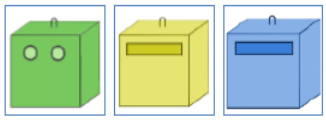
Receptacle for (normally plastic bags) with different capacities (60-120 litres) for depositing waste and recyclables. Collection system: Door-to-Door/ bring banks (Sees section 3).

BIN

Receptable for waste and recyclables; equipped with a lid and often on wheels; usually emptied into the collection vehicle. There are different capacities available (for example, small bin: 6-240 litre capacity, large bin: 660-1100 litre capacity, etc.). Collection system: bring banks and Door-to-Door (See section 3).

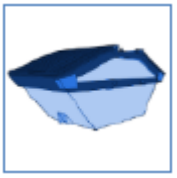
BUNDLE

Number of items, like newspapers or cardboard, fastened together with yarn or the like.



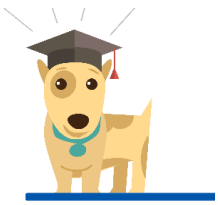
CONTAINER

Receptacle for recyclable with a capacity of 1500-4000 litres; often used for collection of recyclables at a bring bank; usually emptied into the collection vehicle. Collection system: bring bank (See section 3)



LARGE CONTAINER

Receptacle for waste and recyclables with different capacities; often used for commercial and industrial collection and at recycling yards. Collection system: Recycling yards (See section 3).



[2] **N.B.:** For further information, see "*Deliverable 3.1. Current collection models in the cities under study*" (34)

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Material characteristics **(waste & recyclable streams and sorted fractions)**

RECYCLABLES

Materials that can be reprocessed into feedstock for new products. Common examples are paper, cardboard, glass, aluminium and plastic.

GRAPHIC PAPER

Paper made for printing text or images (newspapers, magazines, office paper, etc). The sorted stream ´graphic paper´corresponds to paper for recycling grade 1.11.00 (according to the European List of Standard Grades of Paper and Board for Recycling EN 643)

CARDBOARD

Board (paperboard): The generic term applied to certain types of paper frequently characterized by their relatively high rigidity. The primary distinction between paper and board is normally based on thickness or "grammage" (the basis weight), though, in some instances, the distinction is based on the characteristics and/or end use. For example, some materials of lower grammage, such as certain grades of folding boxboard and corrugated raw materials, are generally referred to as "board", while other materials of higher grammage, such as certain grades of blotting, felt or drawing paper, are generally referred to as "paper".

Packaging paper: The type of high-strength paper used for wrapping and packing after conversion to packaging (boxes, bags). This covers both paper and board.

The sorted stream 'cardboard' corresponds to PfR grades 1.04.xx and 1.05.xx.

COMMINGLED

Dry mixed recyclables that are collected together (single-stream).

NON-PAPER COMPONENTS

According to EN 643, a non-paper component is any foreign matter included in the paper and board fraction for recycling which is not a constituent part of the product and can be separated by dry sorting, such as metal, plastic, glass, textiles, wood, sand, building materials and synthetic materials"

PAPER AND BOARD (p&b)

Any product based on paper and/or board, printed and/or converted to fulfil its designated purpose.

PAPER FOR RECYCLING (PfR) (recovered paper)

Paper and board material collected separately at source for intended use a secondary raw material only. Paper and board material collected with other recyclables is also called Paper for Recycling after sorting and when intended for use as a secondary raw material for recycling (Note: in this document PfR means PfR separately collected at source unless specifically mentioned otherwise).

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Collection systems

COLLECTION

The process of picking up waste from households, businesses, or a collection point, loading them into a vehicle, and transporting them to a processing, transfer, or disposal site. (See section 3)

SEPARATE COLLECTION

Setting aside recyclable materials from the waste stream before they are collected with other municipal solid waste, to facilitate recycling. In addition, separate collection of compostable materials, to facilitate composting. (See section 3)

SELECTIVE COLLECTION

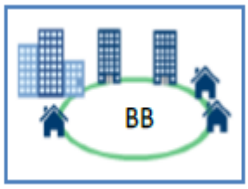
For the purpose of this project the term selective collection is used to characterize separate collection into graphic paper and packaging cardboard. (See section 3)

DOOR TO DOOR (kerbside collection- pick up system)

Direct collection of materials from individual households (or shops), either from front door or kerb. (See section 3)

DROP-OFF SYSTEM

The waste generator takes accumulated waste by foot or by car to a central location and drops it there into containers. It can be a bring bank or a recycling yard.



BRING BANK (DROP-OFF SYSTEM)

Collection of waste and recyclables in separate containers, above ground or underground, in close proximity to the end user (usually max. distance 100-200 m) and spread in sufficient numbers across residential areas. (See section 3)

RECYCLING YARD (DROP-OFF SYSTEM)

Centralised site authorised by the authorities for the separate collection of domestic waste and recyclables. Usually qualified staff available. (See section 3)

COLLECTION SHOPS

Special "shops for secondary raw materials" where residents receive a small financial compensation.

COMMINGLED COLLECTION

Paper and board collected together with other recyclables such as metal, plastics and glass in a different stream from residual waste. Also called multi-material collection. (See section 3)

INFORMAL SECTOR

Existence of scavengers and waste pickers, picking up recyclables, in urban settlements and landfills.

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Processing

PROCESSING

Preparing municipal waste and recyclable materials for subsequent use or management, using processes such as manual processes, baling, magnetic separation, crushing and shredding. The term is also used for separation of mixed waste streams.

SORTING STATION

The sorting plant consists of one or more mechanical separation stages (e.g. screen, magnetic separator) and might be even equipped with optical sorting units (VIS and NIR), in most cases combined with manual sorting. If manual sorting mainly serves a quality control purpose, them it is termed automated sorting.

MATERIALS RECOVERY FACILITY (MRF)

Waste processing facility that combines mechanical sorting with a form of biological treatment such as composting, biodrying or anaerobic digestion. It usually treats mixed waste

Recovery and disposal

RECYCLING

The process of transforming materials into raw materials for manufacturing new products, which may or may not be similar to the original product

RECYCLING PLANT

Industrial plant, using secondary raw materials, such as glass, plastics, cardboard, paper, metals for production of new products.

LANDFILL

Controlled dump

A planned landfill that incorporates to some extent some of the features of a sanitary landfill: siting with respect to hydrogeological suitability, grading, compaction in some cases, leachate control, partial gas management, regular (not usually daily) cover, access control, basic record-keeping, and controlled waste picking.

Sanitary landfill

An engineered method of disposing of solid waste on land, in a manner that meets most of the standard specifications, including sound siting, extensive site preparation, proper leachate and gas management and monitoring, compaction, daily and final cover, complete access control, and record-keeping.

Uncontroled/Illegal landfill

The dumping of waste and recyclables illegally instead of using an authorised method such as kerbside collection or using an authorised rubbish dump. It is the illegal deposit of any waste onto land, including waste and reyclebles dumped or tipped on a site with no licence to accept mixed waste.

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PAPER AND BOARD PLANT

Special recycling plant, using paper for recycling as the raw material for the production of paper, board or moulded fibre products.

Other terms and definitions

BEST PRACTICE (BP)

In the context of IMPACTPapeRec, a BP is an essential practice that should be implemented everywhere; it has a positive impact and is crucial to success.

GOOD PRACTICE (GP)

In the context of IMPACTPapeRec, a GP can be defined as a practice that brings better results but might not be feasible to implement everywhere; brings a positive impact only under certain conditions and/or is crucial under specific circumstances.

MUNICIPAL SOLID WASTE

Waste collected eighter on behalf of municipality authorities or directly by the private sector (business or private non-profit institutions) not on behalf of municipalities. The bulk of the waste stream originates from households, although similar waste from sources such as businesses, offices, public institutions and selected municipal services are also included. It also includes bulky waste but excludes waste from municipal sewage networks, end-of-life vehicles and municipal construction and demolition waste.

Domestic waste / household waste: Waste and recyclables originating from households (regardless of wthether they are collected door to door, in bring banks or recycling yards).

MUNICIPAL RECYCLING RATE (Paper recycling rate)

Recycling rate = % (Tonnage of municipal waste recycled / Tonnage of total municipal waste generated). Recycling generally includes material recycling, composting and anaerobic digestion.

For paper and board the recycling rate is calculated as a percentage with the DREC methodology: Tonnage of paper & cardboard recycled/ Tonnage of total paper & cardboard in municipal waste (unless mentioned otherwise). Contrary to the general definition, composting and anaerobic digestion are excluded from the paper & board recycling rate.

(Note: Total amount of municipal waste does not include waste that is not collected (litter, house fires, etc.)

PRODUCER RESPONSIBILITY ORGANISATION

A Producer Responsibility Organisation is an entity set up in collective EPR schemes to implement the EPR principle in the name of all the adhering companies.

RESIDUAL WASTE

Waste that is not separately collected, also called refuse or mixed waste.

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1.2 Current situation in different European regions

59 millions tonnes of PfR were collected from households, business, industry and offices in 2015

The pulp and paper industry in Europe has undergone continuous growth over the last few years, which has increased the amount of Paper for Recycling (PfR) available as well as the amount of paper consumed, reaching 59 million tonnes in 2015 (1). Demand for PfR in Asia has increased even more. 10 million of the 59 million tonnes collected, were exported to Asia.

In this global context, the availability of European PfR as a raw material has forced industry and government to boost actions to ensure its constant and sustainable procurement. All the PfR collected is currently recycled, with the PfR collection rate equal to the PfR recycling rate, with the exception of cases in which the quality of the collected materials does not meet industrial requirements (i.e. high wet content, presence of contaminants). These cases have also been tackled in the IMPACTPapeRec Project. All this considered, current EU paper-recycling rates reached 71.5% in 2015 (1), as has already been mentioned above. This project focuses on countries with low and medium average paper recycling rates in order to boost their recycling performance.

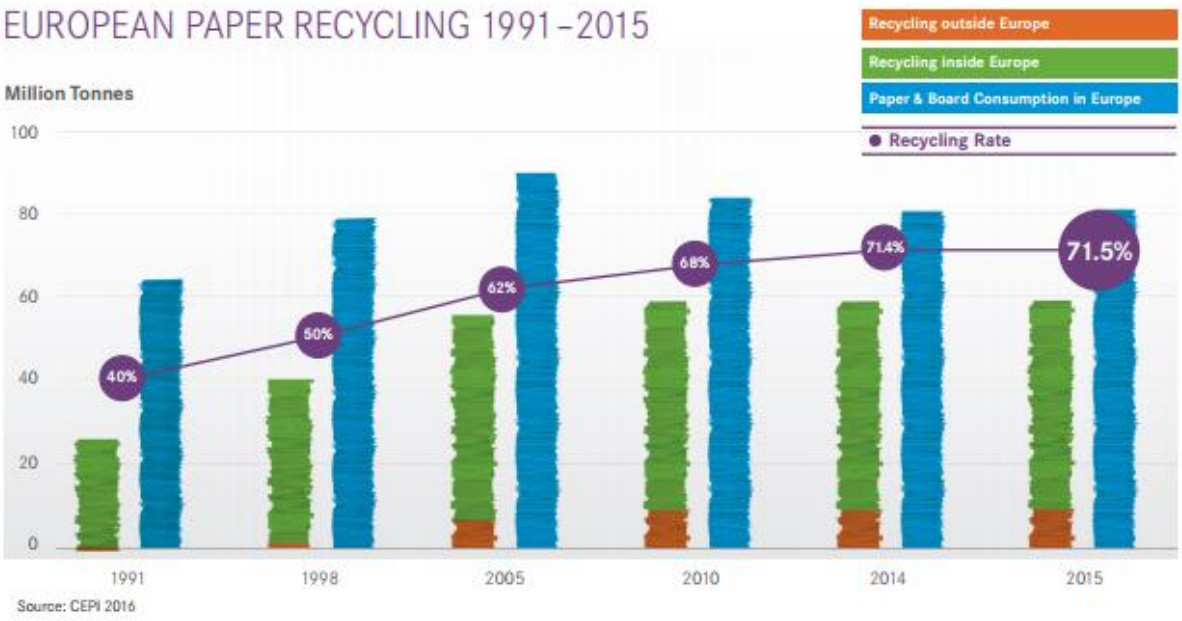

Figure 3. European paper recycling rates 1991 – 2015 (1) (Source: CEPI)

Despite the high collection and recycling ratio (almost 90%) (1) of paper and board from commerce and industry (applied in different industrial uses; i.e. corrugated boxes, office paper), as a result of the implementation of specific industrial PfR collection systems, there

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is still considerable room for improvement in municipal PfR collection and recycling rates. Theoretically, 80% of household paper is recoverable (the remaining 20% is not recoverable due to its characteristics; i.e. toilet paper, wallpaper, tissue) (1). Moreover, policy trends have established the need for a progressive increase in recovery rates as well as prioritising recycling and recovery, in this order, and avoiding elimination via landfill[3].

When EU paper and board collection and recycling rates are analysed (Figure 4 shows representative countries from north, south, east and central Europe), there is a notable gap between the different collection systems used in Europe. Three different systems are employed, depending on the different regions: ① Door-to-Door: Separate collection of paper and board from other waste streams, ② Bring Bank sites: Paper and board are separated from other waste streams, ③ Together with other recyclables like glass and plastic.

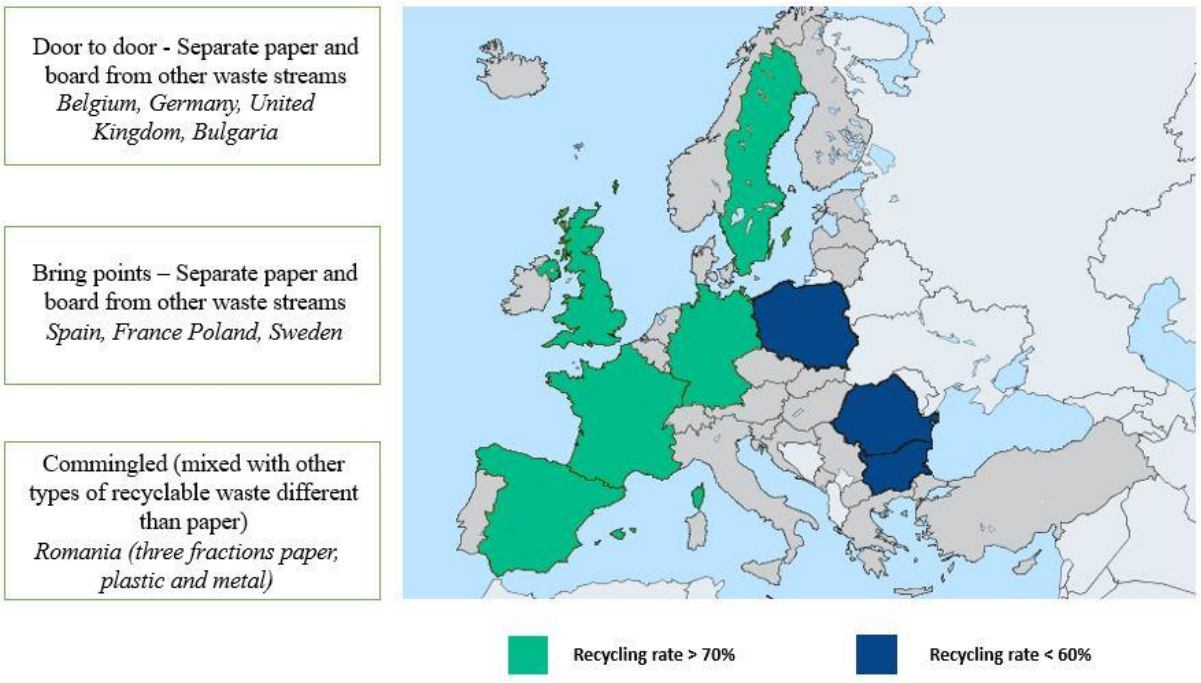

Figure 4. Paper recycling rate in 2015. Data from different collection systems in European regions (3)

[3] Waste Framework Directive 2008/98/EC: http://ec.europa.eu/environment/waste/framework/

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As shown in Figure 4, recycling rates in central, southern and northern European countries (Belgium, Germany, Sweden, Spain, France and UK) exceeded 70% in 2015, whilst these rates in eastern European countries (Poland, Romania, Bulgaria) were below 60%.

Figure 5. National recycling rates in Europe in 2015 (Source: CEPI) (1)

In general terms and according to CEPI's "*Final Monitoring Report of the 2011-2015 period*", 15 European countries exceeded the 70% recycling rate whilst 10 European countries were below 60% in 2015. (1)

Some of the issues that may cause the low rates in some countries include scarce authority knowledge and engagement, low citizen-awareness, poor management skills, and a non-restrictive legal framework, among others.

In this sense, **both quantity and quality are key aspects to be considered for efficient paper and board recycling.** Even in countries with high collection rates, poor quality of the PfR collected could risk progress in increasing recycling rates, and especially in the manufacturing of added value recovered-paper products. Hence, there are still quality issues to be addressed while maintaining the high levels achieved in the best-in-class collection systems.

Countries with separate collection schemes reach **higher recycling rates** with better quality of the PfR collected.

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1.3 Description of the handbook and its objectives

As the main outcome of the work carried out by the IMPACTPapeRec project, this "GOOD and BEST PRACTICE HANDBOOK" contains valuable information that aims to assist the different European regions in increasing the amount of paper collected for recycling, and supporting them in the implementation of best collection procedures and of practices which bring greater results.

To ensure that this handbook address key aspects and are easy to use, the partners involved in the project have been asked for regular feedback and validation of the content.

To improve the development and promotion of GOOD and BEST PRACTICES in paper collection there is a need to implement common evaluation and benchmarking methodologies. This methodology is completely described in Deliverable 2.2. of the project (2). This handbook therefore includes valuable information for the collection of PfR, which has been validated in the five countries that have been the focus of the project (Bulgaria, France, Poland, Romania and the UK). This integrated approach has led to the present handbook, which provides:

i. A knowledge database on current strategies, concepts and activities in best performing municipalities and European regions.
ii. A synthesis of good and best practices in the collection of paper for recycling.
iii. Conclusions and recommendations for the creation and implementation of good and best practices.
iv. Contacts for further information.

This "GOOD and BEST PRACTICE HANDBOOK" could serve as a guide for policy-makers and municipalities to develop and implement innovative solutions for the collection of PfR.

The purpose of distinguishing between GOOD PRACTICE (GP) and BEST PRACTICE (BP) is as follows: instead of aiming to reach an abstract ideal state, the user is inspired by existing practices that are already up and running in another location.

Additionally, "The GOOD and BEST PRACTICE HANDBOOK" comes in two forms: a paper form to download, and a web version (http://impactpaperec.eu/) which includes an interactive tool to ensure accessibility for users in different European countries. It is also a

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living document which will be updated until January 2018. From that time on, no updates will take place.

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2. LEGISLATION, STANDARDISATION, INCENTIVES & POLICY MEASURES

2.1 Relevant European legislation and obligations for Member States

About 72% of paper is recycled in Europe.

IMPACTPapeRec is completely aligned with European policy objectives regarding the prioritisation of recycling and recovery instead of landfilling, as defined by current European and national legislation on waste, such as the **Waste Framework Directive**, and the proposal of the European Commission for a **Circular Economy**, stressing the importance of separate collection.

IMPACTPapeRec is also related to emerging European initiatives whose objectives include the reuse of by-products and waste fractions in alternative production processes to prevent landfilling, such as the European Innovation Partnership on Raw Materials "IMPACT – Introduction and Improvement of Separate Paper Collection to avoid landfilling and incineration".

EU policy on waste management is set out in the Community Strategy for Waste Management and is embodied in the **Waste Framework Directive (2008/98/EC)**[4]. The EU's approach to waste management is based on the "**waste hierarchy**", which sets a priority order when shaping waste policy and managing waste at operational level. Prevention is the best option, followed by preparing for re-use, recycling and other forms of recovery. Disposal such as landfilling and incineration without energy recovery are to be considered as a last resort (Figure 7).

Figure 6. Paper and board recycling rates in Europe in 2015 (2) (Source: CEPI)

[4] http://ec.europa.eu/environment/waste/framework/

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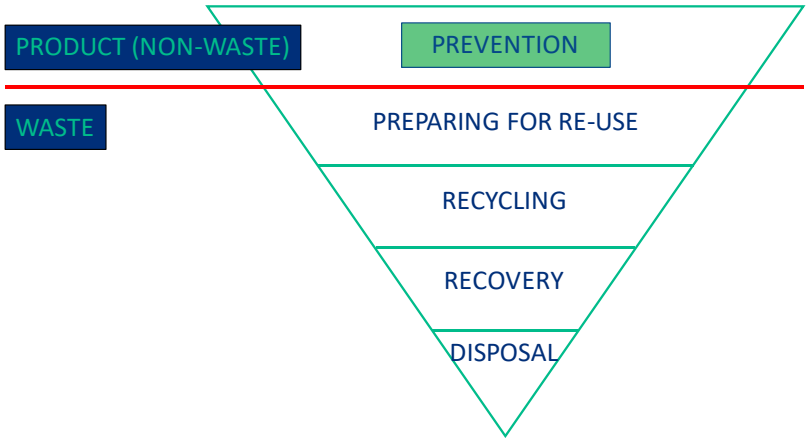

Figure 7. Waste Management Hierarchy (WFD). (Source: European Commission)

Article 10 of the WFD sets out the general requirement for separate collection and obliges Member States to set up separate collection systems for at least paper and board, metal, plastic and glass by 2015.

The Circular Economy Action Plan comprises specific targets for creating an ambitious long-term roadmap for waste management and recycling in Europe. The three quantitative targets, in which paper and board are included, are set out below:

- A binding landfill target to reduce landfill to a maximum of 10% of municipal waste by 2030.
- A target to prepare 65% per cent of municipal waste for re-use and recycling by 2030.
- A target to prepare 75% of packaging waste for re-use and recycling by 2030 (with supplementary targets for specific packaging materials).

The EU recognises seven overarching principles for waste management, which are described in the box below (4).

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Table 1. Seven principles for waste management in the EU's policy on waste management (Source: EC) (4)

Principles for Waste Management and Priorities for Implementing Waste Management Legislation
Waste management hierarchy: Waste management strategies must aim primarily to prevent the generation of waste and to reduce its harmfulness. Where this is not possible, waste materials should be reused, recycled or recovered, or used as a source of energy. As a final resort, waste should be disposed of safely (e.g. by incineration or in landfill sites).
Self-sufficiency at Community and, if possible, at Member State level. Member States need to establish, in co-operation with other Member States, an integrated and adequate network of waste disposal facilities.
Best available technique not entailing excessive cost (BATNEEC): Emissions from installations to the environment should be reduced as much as possible and in the most economically efficient way.
Proximity: Wastes should be disposed of as close to the source as possible.
Precautionary principle: The lack of full scientific certainty should not be used as an excuse for failing to act. Where there is a credible risk to the environment or human health from acting or not acting with regard to waste fractions, that which serve to provide a cost-effective response to the risk identified should be pursued.
Producer responsibility: Economic operators, and particularly manufacturers of products, have to be involved in the objective to close the life cycle of substances, components and products from their production throughout their useful life until they become waste.
Polluter pays: Those responsible for generating or for the generation of waste, and consequent adverse effects on the environment, should be required to pay the costs of avoiding or alleviating those adverse consequences. A clear example can be seen in the Landfill Directive 99/31/EC, Article 10.

EU waste legislation aims to move waste management up the waste hierarchy, turning waste into a resource, and thus achieving the EU vision for a circular economy (5).

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2.2 Objective and benefits of European standardisation

International and European standards provide a common technical language for trade partners throughout the world. For globally active businesses, international standards are important criteria for assessing the suitability of potential business partners and suppliers. They also ensure the compatibility and quality of products and services. In Europe, standardisation is a fundamental aspect of the Internal Market. The ensemble of harmonised European standards ensures free trade within the Internal Market and strengthens the competitiveness of businesses that are active in the EU. Standardisation is thus an essential instrument for success in global markets.

At European and international level, there is a variety of technical committees within the scope of paper and board for recycling. These include:

- CEN/TC 172 – Pulp, paper and board
- CEN/TC 172/WG 2 – Paper and board for recycling
- ISO/TC 6 – Paper, board and pulps

Besides standards produced by the international, European and national standards organisations, other standards are produced by a number of other types of organisation, e.g. sector associations and industry consortia. These types of standards are particularly relevant when they either contain supplementary requirements, in cases where particular groups of users have requirements that are in some way more stringent than those of European standards, or when they contain important local or application-specific requirements that are not written into the more general standards. Examples of these types of standards are the CEPI Guidelines, developed by the Confederation of European Paper Industries and the INGEDE Methods, developed by the International Association of the Deinking Industry (6).

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2.3 Incentives and policy measures for paper collection and recycling

Inspired by literature research, as well as a number of well-known practical examples, the different incentives and policy measures taken into account in the IMPACTPapeRec project can be grouped into three categories: legal and economic; social and communicative; technical and operational (7)[5].

INCENTIVES

An incentive is something that motivates or encourages someone to (not) act in a certain way. An incentive for paper and board recycling is a measure that motivates or encourages a target audience to improve its performance in paper and board sorting and collection.

Encouraging a specific audience can take various forms and can include anything from the provision of information, ensuring the audience is well aware of what it should (not) do (e.g. sorting guidelines), providing adapted equipment to enable the desired behaviour (e.g. waste collection bins); through to applying measures directly rewarding or punishing a certain behaviour (e.g. fines for non-compliance with sorting instructions).

Incentives generally work in either a positive or negative way. Positive incentives seek to motivate actors to do certain actions by promising a reward, whereas negative incentives aim to motivate actions by threatening a punishment. Examples of positive incentives are subsidies for waste reduction technologies. Examples of negative incentives are applying different taxes for generating large amounts of waste. Sometimes it is only a matter of presentation (e.g. the pay-as-you-throw scheme could be seen as a penalty for those producing more waste or as a reward for those with better performance). It can also be a combination of the two options. For instance, when a landfill tax is set, the incomes from it can be used to invest in recycling equipment and/or be used to reward the ones doing the right thing.

As mentioned above, the different incentives considered in the IMPACTPapeRec project can be grouped into three categories: legal and economic; social and communicative; technical and operational.

[5] The Deliverable 3.4_Recommendations on policy measures and incentives will be published within the next few months in http://impactpaperec.eu/

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In addition, the target audience for the various incentives may either be (local) public authorities or waste holders (individual citizens, households, small businesses, government). Table 2, Table 3 and Table 4 provide an overview of the different classifications and give examples of the incentives identified for each category.

1. Legal and economic incentives

Available literature suggests that economic incentives are an effective tool to increase waste sorting and recycling (8).

Table 2. Classification of legal and economic incentives identified in the IMPACTPapeRec project

Incentive category	Incentives	Target audience	
		Public authorities	Waste holders
Legal and economic: Regulatory measures having a legal basis and/or financial implications; mandatory	Legal obligations: - Mandatory separate collection for different waste streams (incl. paper) - High collection/recycling targets	√ √	√
	Bans and restrictions: - Ban/ restriction on landfilling - Ban/ restriction on incineration - Ban on house fires (burning paper for heating)	√ √	√
	Economic: - Landfill taxes or fees - Incineration taxes or fees - Pay-As-You-Throw schemes - Discount on waste tax for separate collection of recyclables - Penalties for non-compliance with mandatory separate collection - Separate waste bill linked to the quantity/separate collection rate - Financing EPR schemes for specific streams.	√ √ √	√ √ √ √

2. Social and communicative incentives

Effective communication and awareness-raising activities can improve the chances that recycling information will be taken on board and acted upon. Communication intervention

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is usually closely related to the legal/political framework and to technical/ infrastructure-based solutions. Therefore, it is complementary and enhances the other two aspects.

Table 3. Classification of the social and communicative incentives identified in the IMPACTPapeRec project

Incentive category	Incentives	Target audience	
		Public authorities	Waste holders
Social and communicative: Measures aiming to provide information and raise awareness; mainly on a voluntary basis	Communication campaigns and information channels: - Awareness-raising campaigns - Provision of complete information about waste collection and recycling - Open days in recycling facilities/paper mills - Promotion of GPs and BPs - Use of Eco labels and certifications	√ √ √	√ √ √ √
	Awards and competitions: - Competitions with prizes for most collected/recycled quantities	√	√

3. Technical and operational incentives

Separate collection by waste holders requires the use of resources on their behalf (such as time, space, effort). Therefore, making the action of separate collection more convenient (minimising distances to collection points, collection frequency, number of materials collected, etc.) should increase their participation. A number of studies confirm that convenience is a key determinant for separate waste collection (9).

Table 4. Classification of the technical and operational incentives identified in the IMPACTPapeRec project

Incentive category	Incentives	Target audience	
		Public authorities	Waste holders
Technical and operational: Material infrastructure and equipment, organisational and logistics measures and expertise	Collection infrastructure: - Convenience and sufficiency of collection infrastructure - Provision of collection infrastructure through EPR schemes	 √	√ √
	Organisation and logistics: - Consultancy and adapted solutions by EPR schemes - Convenient and frequent service - Less convenient collection for residual waste relative to separated/ Chip to open the residual waste bin (with limitations on disposal and easy to enter paper)	√	 √ √

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Policy measures

It would be unrealistic and even incorrect to say that the formulation of policy follows a clear and consistent pathway or route. Policy development is actually an involved and sometimes haphazard process that differs widely depending upon the concern being addressed. Sometimes it is a long and winding road with lots of detours and stops along the way. Despite the variations in policy process, there are some general steps (described below) that are common to its development. These are:

- Selecting the desired objective.
- Identifying the goal of the objective.
- Determining the pathway required to reach that objective.
- Designing the specific programme or measure required to reach that goal.
- Implementing the measure and assessing its impact.

Costing of future key measures

According to literature, there are two main approaches to estimating adaptation costs. The top-down approach evaluates total climate change impacts and the optimal adaptation level. However, it neglects the specific characteristics of actual adaptation measures, which are important for evaluating the impacts of real adaptation policy. Furthermore, the top-down-approach can rarely distinguish between private and public adaptation – a question of major relevance for designing adaptation policies at EU level. The other stream of economic evaluation is bottom-up-literature, often focusing on specific adaptation options in a specific period and location, and a certain political, societal and natural context. The costing exercise in this project relied extensively on this kind of literature, since only bottom-up studies allow sufficiently detailed insights into the cost drivers of adaptation measures.

Current legislative status – Waste Directive

The present legislation on paper for recycling defines general requirements. No specific environmental obligations apply to paper products. The packaging waste directive gives reference to the EN packaging standards which provide guidelines on how to implement essential packaging requirements across the board (see section2.1.). When paper enters the waste stream, the general rules covered in the Waste Framework Directive apply, as they do for all other materials. Regulation concerning collection, sorting and the use of paper for recycling is generally acceptable. Overregulation that could become a barrier to

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development should be avoided. Nevertheless, there are obstacles and weaknesses in the present regulation that need to be improved. Separate collection is widely interpreted.

Policy guidelines related to the Waste Framework Directive

- Legislation is lacking comprehensiveness. Therefore, more emphasis on closed loop re-cycling management is needed to clearly define the responsibilities of all the actors involved.
- Recycling is adequately placed in the waste hierarchy of the Waste Framework Directive, but clear definitions and quality standards for determining recyclability, including certification methods and guidelines, are needed at EU level.
- The priority should be ensuring implementation of existing legislation in all countries, and consistency between EU, national and regional regulations. Greater transparency is needed to facilitate implementation.
- Legislation improvements are essential, but greater awareness of recyclability issues is even more important. More investment in education, awareness-raising and promotion of good practice in paper recycling among all the actors involved is necessary, including enhanced general knowledge about the definitions of the entire paper loop (i.e. the difference between recyclability, recycling and recycled paper) and the most important pre-conditions for the quality of paper for recycling. Support for technological development should also be enforced.
- A "life-cycle thinking" approach should be applied, promoting compliance with sustainability targets among all actors in the chain; eco-design for the paper value chain to improve and move production towards products that are more recyclable, and for waste management to ensure higher collection levels, proper sorting and access to quality paper for recycling.
- Policy measures must be strengthened to stimulate actors in the paper loop for more efficient recycling, such as rewarding tax and fee incentives, stimulating investment in developing technology, and strengthening market development initiatives (i.e. GPP).

The different policy measures considered in the IMPACTPapeRec project can also be grouped into three categories: legal and economic; social and communicative; technical and operational, just like the incentives.

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1. Legal and economic policy measures

Table 5. Legal and economic policy measures identified in the IMPACTPapeRec project

Legal obligations
- Establish criteria for recyclability - Establish regional as well as national-level targets - Increase recycling targets - Establishment of waste management plans: regularly and at different levels (national, regional, local; but also for companies and industries) - Separate targets for the recovery of material quotas from industries and from citizens - Internal policies on recycling and separate collection in companies - Separate collection obligation at EU level - Green public procurement criteria for all public documents (Ex: Ecolabel) - Simplify Annex VII procedures[6] - Implement 5.01 in municipal tenders[7]
Bans and restrictions
- Avoid overcapacity of residual waste treatment - Landfill ban for recyclable paper
Economic
- Pay-As-You-Throw schemes - Incineration taxes or fees - Increase taxes for landfilling paper waste from municipal collection - Boost local recycling/recovery companies which are authorised to work near the areas where the waste is generated (as long as this measure is in line with market interests) - Fines for citizens that do not comply with rules - Funding for the compilation of necessary data and information

[6] Annex VII (of the European Waste Directive) requires waste exporters to fill in details of exactly what kind of material is being shipped, where it originated and the facility overseas that the material is being shipped to. http://ec.europa.eu/environment/waste/framework/

[7] Grade 5.01 is one of the grades defining paper purity (for recycling) contained in the European Standard EN643. 5.01 is the only grade with a maximum level of over 1.5% of non-paper components. This is due to the fact that these materials do not often undergo additional sorting between collection and the paper mill. Grade 5.01 includes mixed recovered paper and board; and unsorted paper and board, separated at source.

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2. Social and communicative policy measures

Table 6. Social and communicative policy measures identified in the IMPACTPapeRec project

Communication campaigns and information channels
- Better communication, cooperation and transparency between stakeholders - Platforms for discussion and exchange of good practices - Guidelines and handbooks for municipalities, ministries and businesses - Terminology for collection systems in different languages (dictionary) - Inclusion of social groups (non-profit organisations) to legalise collectors - Awareness-raising and education on PfR

3. Technical and operational policy measures

Table 7. Technical and operational policy measures identified in the IMPACTPapeRec project

Technical
- Coordinated local solutions and policies will improve collection rates - Measurements methods for PfR quality - Traceability of material - Enhanced technology development for separating different waste fractions - Making the paper value chain more transparent
Operational
- Stopping commingled collection

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3. COLLECTION SYSTEMS

In the European Union, several types of collection systems for PfR have been merged. A description of the most relevant collection systems is shown below: bring banks, door-to-door, separate collection, selective collection and recycling yards. The degree of separation of these collection systems is also explained for each system.

3.1 COLLECTION SYSTEM

3.1.1 Bring recycling sites

According to WRAP (the UK Waste and Resources Action Programme) (10), bring recycling sites are defined as areas in car parks and on streets, at which local authorities or third parties, provide containers ("banks") for the public to deposit recyclable materials.

WRAP[8] has published a guide for local authorities to help them improve the performance of bring recycling sites. The guide describes how to review current bring recycling provision, including performance monitoring, to make better informed decisions in the future about bring recycling, as part of the overall service provided to residents (10). This guide should be used as a step-by-step reference guide and a conceptual directive.

3.1.1.1 Bring banks

Bring banks are permanent recycling facilities that allow citizens to bring their dry recyclable materials for recycling whenever they want to. In some cases, such as Germany where a schedule is established for using bring banks in residential areas to avoid noise pollution for citizens living nearby.

Figure 8. Bring bank site in Szczecin (Poland) (11). (Source: IMPACTPapeRec Project)

[8] WRAP is the UK's Waste & Resources Action Programme, It must be taken into account that there are differences in the UK from European collection systems.

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Bring banks are usually positioned in easily accessible locations with good roadside parking to make recycling as convenient as possible.

Bring bank collection systems enable the collection of waste and recyclables in separate containers, above ground or underground, in close proximity to the end user (usually max. distance of 100-200 m) and in sufficient numbers across residential areas (11).

The advantage of bring bank systems over door-to-door (D-t-D) collection is that citizens can recycle when it suits them, rather than having to wait for fixed collection days and times (12).

3.1.1.2 Recycling yards

Centralised site authorised by the authorities for the separate collection of domestic waste and recyclables.

Figure 9. HWRC (household waste recycling centre) recycling yard. Merthyr Tydfil (UK). (Source: IMPACTPapeRec Project)

They are public facilities with free, open access for citizens in which urban waste, recyclables, hazardous waste and large-volume waste that must not be deposited in standard street containers are collected and sorted. They usually have opening hours.

They are especially aimed at catering for waste whose components can be firstly treated and then reused as raw materials when manufacturing new products (13). These kinds of facilities usually require qualified staff to be on hand (11).

Figure 10. HWRC (household waste recycling centre) recycling yard. Merthyr Tydfil (UK). (Source: IMPACTPapeRec Project)

The kind of materials that are accepted in these recycling yards varies according to the site. This means it is important to publish the location, opening hours and type of material collected on the corresponding municipal website. The following list shows the materials that are typically accepted in recycling yards.

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Table 8. Commonly accepted waste in recycling yards (13)

COMMONLY ACCEPTED WASTE[9]
Paints, varnishes, glues, paint strippers, synthetic turpentine, dyes, wood protectors
Batteries and accumulators
Vehicle batteries
Fluorescent or special lamps (halogen)
Chemicals and packaging containing dangerous products such as pesticides, cleaning products and disinfectants
Aerosol sprays
Bulky waste
Electrical and electronic waste
White goods
Used oil
Green waste
Waste from refurbishing

**N.B.: Materials will vary according to each site*

3.1.2 Door-to-door collection (D-t-D)

Figure 11. D-t-D collection of recyclables – plastic & metal packaging and cardboard in Merthyr Tydfil *(UK) (11). (Source: IMPACTPapeRec project).*

D-t-D collection (also called kerbside collection) consists of the direct collection of materials from individual households (or shops), either directly from their doors or from the kerbside. Almost any domestic waste stream can be collected by a D-t-D system: residual waste, bio-waste, packaging, paper, cardboard and glass.

The results of D-t-D collection achieved in municipalities could be better in some cases, both in terms of the amounts collected and of the quality of separation. For example, in areas with D-t-D collection, separate collection rates are between 60-85% of total MSW generation, whereas the rates achieved by other systems range from 20% to 50%, at the most (14).

[9] All waste fractions and recyclables that cannot be collected in conventional urban collection systems (bring banks, D-t-D, etc.)

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The philosophy behind D-t-D is to turn separation at source into the most convenient option and discourage the delivery of large amounts of residual waste.

Implementation of D-t-D collection has proved very successful in areas with lower population densities, where it is easier to identify the origin of the waste and recyclables. D-t-D collection systems require a change of citizens' habits, which can be achieved by suitable communication campaigns.

D-t-D collection models enable the identification of waste generators and therefore bring with them the implementation of fairer payment systems, such as PAYT (payment for generation, e.g. payment per bag or payment per bin), (14) (15).

3.2 COLLECTED MATERIAL

3.2.1 Separate collection

The Waste Framework Directive (WFD) defines separate collection in Article 3 (3) as follows: 'separate collection' means "the collection where a waste stream is kept separately by type and nature to facilitate a specific treatment". In other words, ´separate collection´ sets aside recyclable materials from the waste stream before they are collected with other municipal solid waste, to facilitate recycling. In addition, separate collection of compostable materials also exists, to facilitate composting (11).

In this sense, separate collection of individual waste fractions is a pre-condition for fostering high-quality recycling and high recycling rates. Thus, Article 10 of the WFD sets out the general requirement for separate collection and obliges Member States to set up separate collection systems for at least paper, metal, plastic and glass by 2015 (3).

Figure 12. Separate collection of plastic and metal in Merthyr Tydfil (UK) (11). (Source: IMPACTPapeRec project)

Separate waste collection facilitates the recycling of this waste, which, in turn, leads to (16):

1. Decreased consumption of raw materials
2. Water and energy savings
3. Reduced greenhouse gas emissions
4. Increased useful life of landfills

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In this kind of collection, citizens play a key role in the separation of waste in households, markets, offices and services, placing urban waste in different containers.

3.2.2 Selective collection

´Selective collection´ consists of the introduction of a new container (in the bring bank collection system) or new bag (in D-t-D collection) to separate graphic paper from packaging cardboard[10]. This enables separation at source of two different paper fractions, thus decreasing (or even potentially eliminating) the need for subsequent technical sorting: 1. graphic paper and 2. non-graphic paper (mainly packaging cardboard).

Graphic paper and copy paper play an important role in the range of paper grades produced and in worldwide need for paper. This stream corresponds to paper for recycling, grade 1.11.00 (17). Separation of graphic paper from the rest of paper and board in the collection phase increases its market value due to the reduction of sorting costs.

As a rule, mass products and newspapers are produced with a large percentage of recovered paper. By contrast, magazines normally use fresh fibres due to the demanding requirements made by consumers in terms of appearance and tactile feel. Nevertheless, even the magazine sector is starting to use recovered paper now (18).

3.2.3 Commingled collection

Figure 13. Commingled collection of recyclables in Merthyr Tydfil (UK). (11) (Source: IMPACTPapeRec Project)

Commingled collection is the traditional waste system in which all recyclables are collected together. The main drawback of this system is the difficulty in the subsequent treatment of the materials collected due to their low quality derived from cross contamination.

In commingled collection, paper and board are collected together with other recyclables such as metal, plastics and glass in a different stream from residual waste. It is also called multi-material collection.

Commingled collections face quality problems from two sources: cross contamination and the technical and physical capacity of MRFs in separating materials in the volumes delivered to them (19).

[10] For the purpose of this project, the term selective collection is used to describe the separate collection of graphic paper and packaging cardboard.

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A simple example of quality issues is paper and board. If paper and board are stored separately from other waste streams and kept dry they can be recycled. If paper and board are contaminated with food this can cause odour problems in the finished product and bacterial activity may decrease their strength.

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4. GOOD AND BEST PRACTICES FOR THE COLLECTION OF PfR

The goal of using best practice (BP) is as follows: instead of aiming to reach an abstract ideal state, the user is inspired by existing practices that are already up and running in another location (2). After analysing the "practices" identified in the project, a clear distinction was made between good practice (GP) and best practice (BP) according to three criteria that are described below.

There is no common definition for GP or BP either in the academic literature, or among practitioners. In the case of BP, the most widely accepted and broadly used definition focuses on its "functional" orientation (20).

In this sense, from a bibliographic perspective, a BP can be defined as: *a practice that is not only good, but also that has been proven to work well and produce good results, and is therefore recommended as a model*. Therefore, it is a successful experience which has been tested and validated, in the broadest sense. Furthermore, it has been repeated and deserves to be shared so that more people can adopt it (21).

In the IMPACTPapeRec context, the distinction between GP and BP is dependent on three conditions. Best practice is defined as follows:

a) It can be implemented everywhere
b) It brings a positive impact
c) It is crucial to success

Hence, to create BPs, all three conditions should necessarily apply. Conversely, a practice is classified as GP if this is not the case or if one or more conditions apply.

Accordingly, a GP can be defined as a practice that brings better results but might not be feasible to implement everywhere; brings a positive impact only under certain conditions and/or is crucial to success under specific circumstances.

And as stated before, a BP is an essential practice that should be implemented everywhere; it has a positive impact and is crucial to success.

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How to identify Good Practice or Best Practice for your municipality?

For a municipality, the methodology to identify GP and BP to boost paper collections for efficient recycling consists mainly of two steps (22):

Identify the municipality´s requirements

- In order to be as effective as possible, it is vital to identify the specific *needs of your municipality* as well as the *needs of the citizens* and the community you serve. This step involves not only considering immediate needs, but also anticipating future needs.

Identify applicable GPs and BPs

- After areas of need have been identified, potential practices need to be bechmarked to address them. This can be done by identifying existing practices that the project has validated to meet the criteria of a best, promising, or innovative practice while meeting the needs of *citizens* and municipality targets.

To help with the identification of GPs and BPs, the IMPACTPapeRec Project has launched an online tool entitled **"The Selection Tree"**: Selection Tree Tool

The selection tree guides the user through a step-by-step process that will help them to determine which solutions are best for their municipality. Further explanation of this tool is available in Annex III.

4.1 List of Good Practices and Best Practices

In the IMPACTPapeRec context, 34 good and best practices have been identified and grouped into four categories:

- Operational aspects
- Policy, legislation and economic aspects
- Monitoring and control aspects
- Information and communication aspects

The following table shows the list and classification of GPs and BPs:

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Table 9. List and classification of BPs and GPs identified in theIMPACTPapeRec project

GOOD PRACTICES		BEST PRACTICES	
Operational aspects			
1.3	Constant technological innovation in paper and board collection	1.1	Specific collection system adapted to real needs
1.5	Volunteer collection of paper and board	1.2	Separate collection system for paper and board
1.6	Selective collection system for graphic paper	1.4	User-friendly collection containers
1.7	Underground containers in higher population density areas	1.9	Container-opening systems adapted to paper and board
1.8	Compacting collection trucks		
Policy, legislation and economic aspects			
2.2	Cluster of municipalities	2.1	Ambitious strategy and targets
2.3	Pay-as-you-throw	2.5	Ordinance on separate paper and board collection in public institutions
2.4	Tender for waste and recyclables collection service		
Monitoring and control aspects			
3.3	Control measures to prevent paper theft	3.1	Data collection and monitoring of PfR quality parameters
3.4	Optimisation of collection routes	3.2	Monitoring and control of the composition of residual waste and paper and board in other recyclable streams
3.5	Filling level control for containers		
3.6	Publication of paper collection KPIs		
Information and communication aspects			
4.3	Include citizens actively in the information loop (making citizens actors)	4.1.	Information on containers and bags
4.4	Waste ambassadors	4.2	Choice of a comprehensive and functional communication package
4.5	Website on paper and board recycling	4.7	Monitoring of communication campaigns
4.6	Roadshows, events and workshops	4.13	Targeted communication campaigns
4.8	Publication of stimulating news on paper and board recycling		
4.9	Competitions rewarding best performance in recycling		
4.10	Educational areas on paper and board collection and recycling		
4.11	Dissemination of the environmental and economic benefits of paper recycling		
4.12	Involvement of celebrities in awareness campaigns		
4.14	Associations of citizens providing direct feedback to municipalities		

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4.2 Factsheets

Each GP and BP has been described in an individual factsheet. These factsheets contain introductory information which municipalities can use to implement these practices. The objective of the factsheets is to be a starting point to help municipalities with the implementation of potential solutions for their municipalities. Each factsheet contains the following information.

1. **Background**

   This section provides the reader with the essential context needed to understand the issue at hand and its significance. The content of the background varies depending on the GP or BP so that it is truly relevant to the practice being explained. It can describe the state of the art of technology, collection system, or relevant information that provides the municipalities with a basic understanding of the problem.

2. **Action**

   Clear and concise description of the practice. Basic instructions to let the municipality know what it needs to do to implement the GP or BP.

3. **Examples of locations where the practice has already been implemented**

   Each GP and BP includes real examples so that the user can visualise how it has been implemented in other municipalities/centres. Whenever possible, the impacts and outcomes of implementation have also been included. These examples include illustrative pictures and elements to facilitate the understanding of the GPs and BPs.

4. **Keep in mind that…**

   In this section, municipalities are provided with a description of the main conditions required for the application of each GP and BP, as well as potential issues that are important to the success of the implementation.

5. **How to start?**

   This section includes tips to help users to implement each GP and BP. The objective of this section is to act as a starting point for the implementation of GPs and BPs in the municipalities. Should this occur, some GPs and BPs will require the input of further information from professionals and experts.

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6. Potential benefits

According to the nature of each GP and BP, the potential benefits that can be achieved with their implementation have been divided into economic (), environmental () and social () benefits.

7. References

The sources of the information included in the factsheets.

The factsheets for each GP and BP are included in

Annex I. Factsheets

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5. EVALUATION OF PERFORMANCE IN PfR COLLECTION

To evaluate paper & board collection performance, performance indicators are a useful tool. Measurement through KPIs helps to monitor performance of GP/BP application and can also serve to benchmark against other territories or over time.

An Excel tool has been developed for evaluation and comparison purposes, based on a total of 10 performance indicators, divided into four categories of KPIs (Key Performance Indicators):

- Operational
- Economic
- Social
- Environmental

Link: Evaluation of performance in paper for recycling collection

See Annex II. USER MANUAL: The evaluation tool

5.1 Introduction to the KPI evaluation methodology

KPIs help us to measure how well companies, business units, projects or individuals are performing compared to their strategic goals and objectives. Well-designed KPIs provide the vital navigation instruments that give us a clear understanding of current levels of performance in paper and board recycling in a municipality. Effective decision-makers and managers understand that they need information on the key dimensions of performance and that this can be achieved by distilling them into these vital KPIs.

The most effective KPIs in a municipality are closely tied to strategic objectives and help to answer the most critical business questions and to identify the problems concerning the collection of paper and board. A good starting point is therefore to identify the questions that decision-makers, managers or external stakeholders (citizens included) need to answer. One or two so-called Key Performance Questions (KPQs) should be identified for each strategic objective.

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Once the most important business questions have been articulated, companies will then be able to select or develop the right KPIs to best answer them. Thus, all the KPIs will be strategic, relevant and meaningful. (23)

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6. SELECTION TREE

Planning means making a sequence of decisions. The choices made at the initial stage of the planning process determine the set of alternatives in the subsequent steps. Thus, the planning process consists of interdependent decisions, leading progressively to the final project plan (24).

In this scenario, the selection tree method is a suitable tool to be used. It assumes that the decision process consists of a finite number of stages, at which various decisions are made. For each decision, a finite, and usually relatively small, number of options are defined. This means that there is a sequence of questions and choices that drives the selection through the "branches" of a tree in order to reach the "tips" where the solutions for the problem are laid out. The applications of selection trees in project decisions and resource allocation have been demonstrated in multiple projects (25), (26), (27), (28), (29), (30).

In the IMPACTPapeRec project, a selection tree has been designed with three different levels of multiple-choice selection options, ending with the GPs and BPs that have been proposed to solve or address the problems under study.

Link: Selection tree tool

See Annex III. USER MANUAL: The Selection Tree

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7. BACKGROUND AND FURTHER INFORMATION

7.1 Methodology

The methodology used to identify GPs and BPs is thoroughly explained in Deliverable 2.2_ *Methodology for IMPACTPapeRec Best Practice and Working Instructions* (2) as mentioned on numerous occasions in this document. Moreover, the methodology for the analysis of GPs and BPs is completely explained in the Deliverable 3.2_*Innovative models and best practices to be implemented in cities under study* (31).

7.2 Contact list

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Bibliography

1. **CEPI.** European Declaration on Paper Recycling. 2011- 2015 period. [Online] 2016. http://www.cepi.org/system/files/public/documents/publications/recycling/2016/FinalMonitoringReport2015.pdf.

2. **ACR+_IMPACTPapeRec Project.** D2.2._Methodology for IMPACTPapeRec best practice and working instructions. [Online] 2016. http://impactpaperec.eu/wp-content/uploads/2016/12/D2.2-Methodology-for-IMPACTPapeRec-Deliverable-Report_V20161028.pdf.

3. **European Comission.** Assessment of separate collection schemes in 28 capitals of EU. [Online] 2015. http://ec.europa.eu/environment/waste/studies/pdf/Separate%20collection_Final%20Report.pdf.

4. **European Commission.** Handbook on the Implementation of EC Environmental Legislation_Section 4: Waste Management Legislation. [Online] 2016. http://ec.europa.eu/environment/archives/enlarg/handbook/waste.pdf.

5. **European Commission.** EU Waste Legislation. [Online] 2017. http://ec.europa.eu/environment/waste/legislation/.

6. **DIN_IMPACTPapeRec Project.** *D3.5_Analysis of existing standards and future development recommendations.* 2017.

7. **CEPI_ IMPACTPapeRec Project.** *D3.4_Recommendations on policy activites and incentives.* 2017.

8. **Bucciol, A., Montinari, N. & Piovesan, M.** Do not trash the incentive! Monetary incentives and waste sorting. *The Scandinavian Journal of Economics ,117 (4), 730-737.* 2015.

9. **Domina, T. & Koch, K.** Convenience and Frequency of Recycling . *Environment and Behaviour, 34(2), 2016-238.* 2002.

10. **WRAP.** Guide: Bring recycling site. [Online] 2013. http://www.wrap.org.uk/sites/files/wrap/Bring%20Site%20Draft%20Report%20v5%20JB%20amends_0.pdf.

11. **PTS_IMPACTPapeRec Project.** D3.1_Current collection models in cities under study. [Online] 2016. http://impactpaperec.eu/wp-content/uploads/2016/11/IMPACTPapeRec-D3.1_public-version.pdf.

12. **Palm Recycling.** How we collect materials using bring banks. [Online] 2017. http://www.palmrecycling.co.uk/materials-recycling/bring-bank-collections/.

13. **Ecovitrium.** Transforming waste in resources. [Online] N/A. http://www.ecovitrum.eu/ver/146/Qu%C3%A9-es--punto-limpioecoparque-.html.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 690182

14. **Regions for Recycling.** European project: Good Practices: Door-to-door collection. [Online] http://www.regions4recycling.eu/upload/public/Good-Practices/GP_ARC_door2door-collection.pdf.

15. **ZERO WASTE_ European Commission.** Low Cost Zero WASTE Municipality. [Online] N/A. http://www.med-zerowaste.eu/deliverables/DST_Final/index.files/Page1712.htm.

16. **Junta de Extremadura.** Recogida selectiva de residuos domésticos. [Online] http://extremambiente.gobex.es/index.php?option=com_content&task=view&id=377&Itemid=578.

17. **CEPI.** European List of Standard Grades of Paper and Board for Recycling EN 643. [Online] http://www.cepi.org/system/files/public/documents/publications/recycling/2013/CEPI_EN%20643_brochure_FINAL_0.pdf.

18. **VOITH.** Graphic papers. [Online] http://www.voith.com/en/markets-industries/industries/paper/paper-grades/graphic-papers--12786.html.

19. **Cowleys.** What does commingling mean? [Online] http://cawleys.co.uk/uncategorized/what-does-commingling-mean/.

20. **Veselý, A.** *Theory and methodology of the best practice research: a critical review of the current state. Central European Journal of Public Policy, Vol. 5 (2), pp. 98-117.* 2011.

21. **FAO.** Good Practices Template. [Online] 2014. http://www.fao.org/docrep/019/as547e/as547e.pdf.

22. **The Compassion Capital Fund (CCF).** Identifying and Promoting Effective Practices. [Online] 2010. http://strengtheningnonprofits.org/resources/guidebooks/Identifying%20and%20Promoting%20Effective%20Practices.pdf.

23. **Bernard Marr & Co.** What are Key Performance Indicators (KPIs)? [Online] https://www.ap-institute.com/what-is-a-key-performance-indicator.

24. **Nowak, M. Nowak, B.** *An application of the multiple criteria decision tree in project planning. Procedia Technology 9, pp. 826 – 835.* 2013.

25. **Gear, T.E., Chiu, L.** *An application and case history of a dynamic R&D portfolio selection model. IEEE Transactions in Engineering Management 26, pp. 2-7.* 1979.

26. **Lockett, A.G., Gear,T.E.** *A dynamic model of some multistage aspects of research and development portfolios. IEEE Transactions in Engineering Management 20, pp. 22-29.* 1973.

27. **Zuckerman, D., Granot, D.** *Optimal sequencing and resource allocation in research and development projects. Management Science 37, pp. 140-156.* 1991.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 690182

28. **Hess, S.W.** *Swinging on the branch of a tree: project selection applications. Interfaces 23, pp. 5-12.* 1993.

29. **Kirkwood, C.W., Stonebraker,J.S.** *Formulating and solving sequential decision analysis models with continuous variables. IEEE Transactions in Engineering Management 44, pp. 43-53.* 1997.

30. **Thomas, H.** *Decision analysis and strategic management of research and development: a comparison between applications in electronics and ethical pharmaceuticals. R&D Management 15, pp. 3-22.* 1985.

31. **Hamburguer Recycling_IMPACTPapeRec Project.** D3.2_Innovative models and best practices to be implemented in cities under study. [Online] 2017. http://impactpaperec.eu/wp-content/uploads/2017/02/D3.2_final.pdf.

32. **European Commission.** [Online] 2017.

33. **Ayuntamiento de Barcelona.** Barcelona City Council: Ecology, Urban Planning and Mobility. [Online] 2017. http://ajuntament.barcelona.cat/ecologiaurbana/en/services/the-city-works/maintenance-of-public-areas/waste-management-and-cleaning-services/household-waste-collection.

34. **PTS_ IMPACTPapeRec Project.** http://impactpaperec.eu/wp-content/uploads/2016/11/IMPACTPapeRec-D3.1_public-version.pdf. [Online] 2016.

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Annex I. Factsheets

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Annex II. USER MANUAL: The evaluation tool

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The evaluation tool

Ten performance indicators were selected to perform the analysis in this tool, six of which were considered as KPIs. The KPIs used were those analysed in-depth in Deliverable 2.2 of the IMPACTPapeRec project (2). The tool aims to provide municipalities and regions with a self-assessment instrument in paper & board management, based on their own data. The tool is available to download from the IMPACTPapeRec project website (Evaluation of your performance in PfR collection)

This tool is divided into three different main sections:

a) KPI calculation

This is the main section, focused on the calculation of each KPI based on the municipality's own data. It is divided into four main subsections according to the KPIs identified. The KPIs cover all of the operational, economic, social and environmental aspects. The list of the KPIs to be calculated is included for each of the subsections:

1. Operational
   - 1.1. Paper and board separate collection rate
   - 1.2. Impurities
   - 1.3. Moisture content
   - 1.4. Services for citizens
2. Economic
   - 2.1. Cost coverage
   - 2.2. Structure of cost coverage
   - 2.3. Costs incurred and costs avoided for the municipality
   - 2.4. Revenues for the municipality
3. Social
   - 3.1. Citizen satisfaction
4. Environmental
   - 4.1. Paper and board recycling rate

b) Chronological overview

This section enables the evolution of the indicators to be monitored over time. The period covered is 2015-2030. This section enables a comparison of situations in different periods of time or when a change in the management system is made.

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c) Performance comparison

The last section allows the municipality to be compared with other real municipalities analysed during the duration of the IMPACTPapeRec project. To comply with the confidentiality issues in the municipalities, their real names have been changed to *"Municipality A, Municipality B… Municipality J"*. In order to provide basic information about the cities, some general details have been provided:

- Region in which they are located:
  - North Europe
  - East Europe
  - West Europe
  - South Europe
- Population (inhabitants):
  - <10,000
  - 10,000 – 100,000
  - 100,000 – 500,000
  - > 500,000
- Density (inh/km^2):
  - <100
  - 100 – 1,000
  - > 1000
- Type of territory:
  - Project territory
  - Best performing territory

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How to use the tool

To start to use the tool, the user must go to the '*KPI calculation*' sheet in the excel file. This sheet will act as the main menu to check the information and surf between the different menus.

The first step to start with the assessment process is for the user to input the name of the municipality and the year to be analysed. After that, they must select the group of KPIs to be evaluated by clicking on the corresponding picture.

Figure 14: KPI tool - First step

For each group of KPIs, the user will be redirected to a specific menu. In this menu, the user can select the specific KPI to be calculated or move between the different sections.

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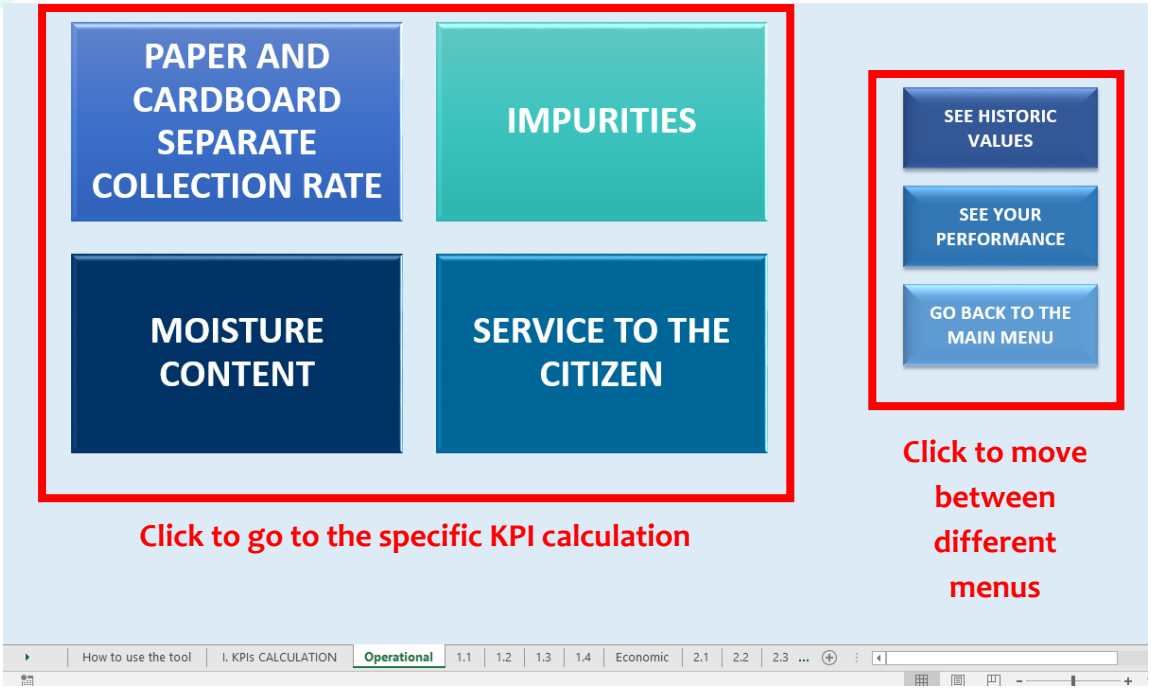

Figure 15: KPI tool - Second step

For each specific KPI sheet, the user must follow the instructions included on the left. All of the required information must be completed for an accurate calculation. After completing this information, go to the menu on the right. In this menu, a first button to calculate the value of this KPI appears, based on the data introduced. After calculating the value, the user can save it in the historical series area, by clicking on the *'Add value to historics'* button If the user wants to check their municipality performance in comparison with other municipalities, they can press the *'Compare your performance'* button. Finally, if they wish to return to the main menu they need to click on the button at the bottom.

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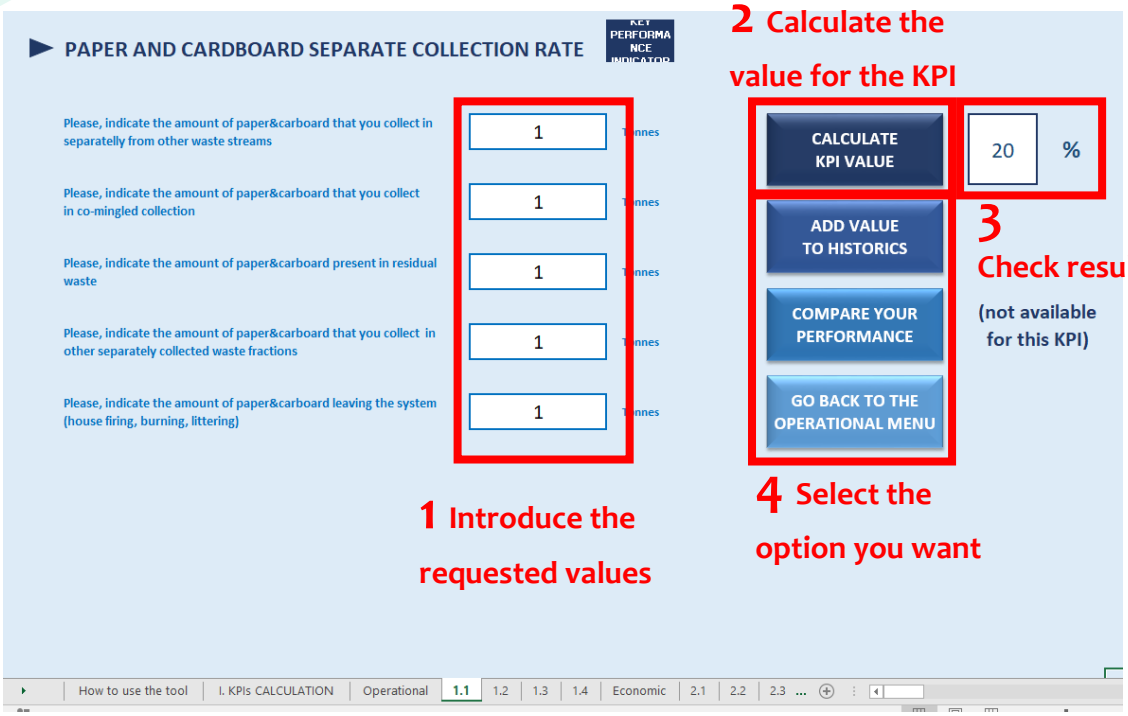

Figure 16: KPI tool - Third step

The '*Historics*' shows the main information previously sent from the KPI calculation. This information gives an overview of the evolution of each KPI during the target period. Information can be recorded from 2015 to 2030.

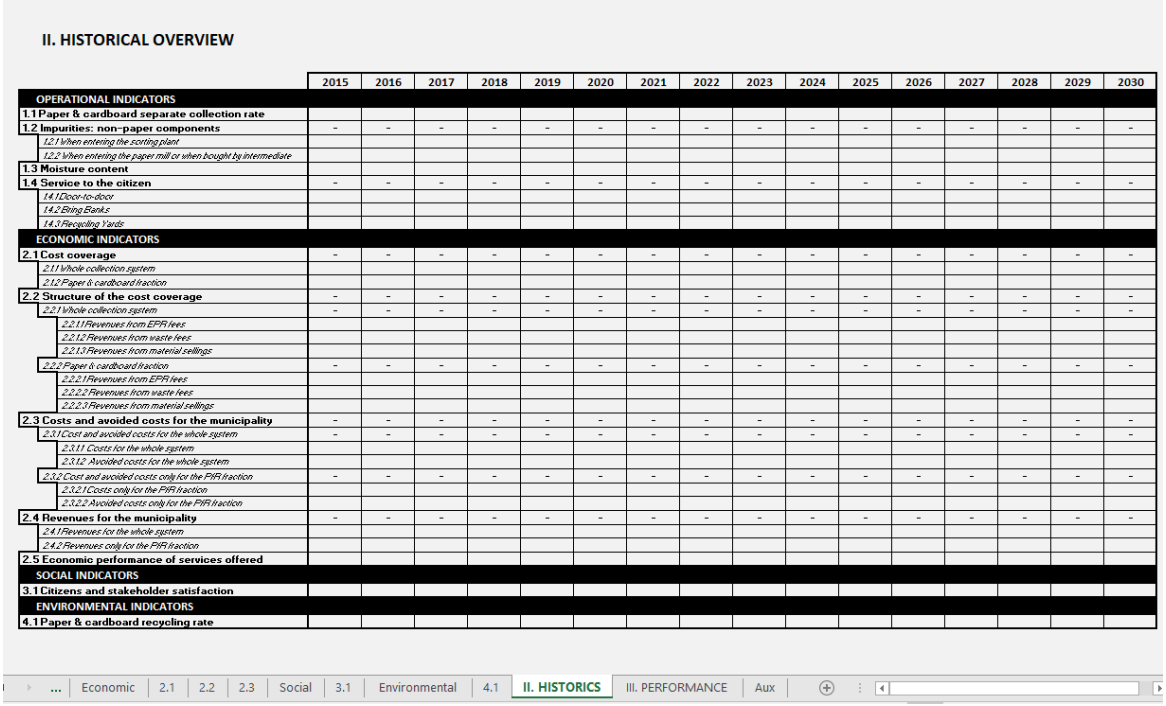

Figure 17: Municipal historical series sheet in the KPI tool

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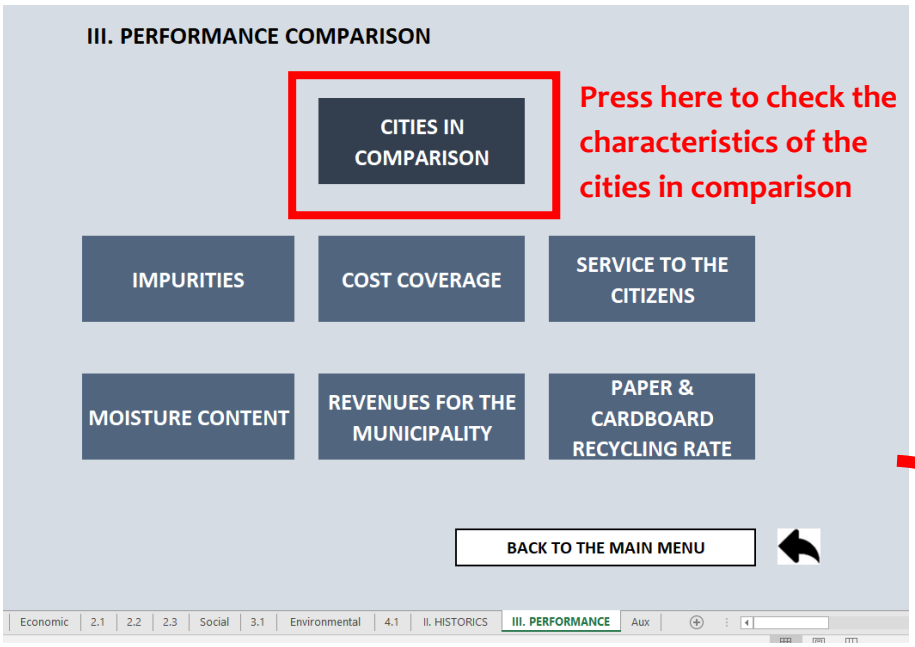
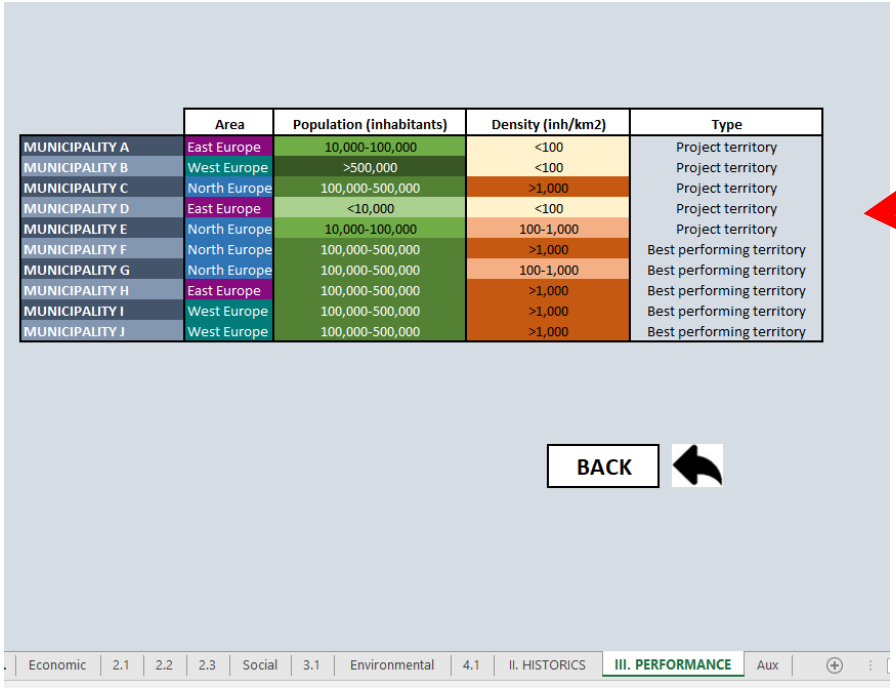
Finally, the '*Performance*' sheet shows a main menu in which to check the information. The '*Cities in comparison*' button shows a table including the main characteristics of each municipality as an example. The other buttons below redirect the user to different graphs showing information about the indicated KPIs. The user can go back to the main '*Performance menu*' or even to the main menu in this tool at any time.





	Area	Population (inhabitants)	Density (inh/km2)	Type
MUNICIPALITY A	East Europe	10,000-100,000	<100	Project territory
MUNICIPALITY B	West Europe	>500,000	<100	Project territory
MUNICIPALITY C	North Europe	100,000-500,000	>1,000	Project territory
MUNICIPALITY D	East Europe	<10,000	<100	Project territory
MUNICIPALITY E	North Europe	10,000-100,000	100-1,000	Project territory
MUNICIPALITY F	North Europe	100,000-500,000	>1,000	Best performing territory
MUNICIPALITY G	North Europe	100,000-500,000	100-1,000	Best performing territory
MUNICIPALITY H	East Europe	100,000-500,000	>1,000	Best performing territory
MUNICIPALITY I	West Europe	100,000-500,000	>1,000	Best performing territory
MUNICIPALITY J	West Europe	100,000-500,000	>1,000	Best performing territory

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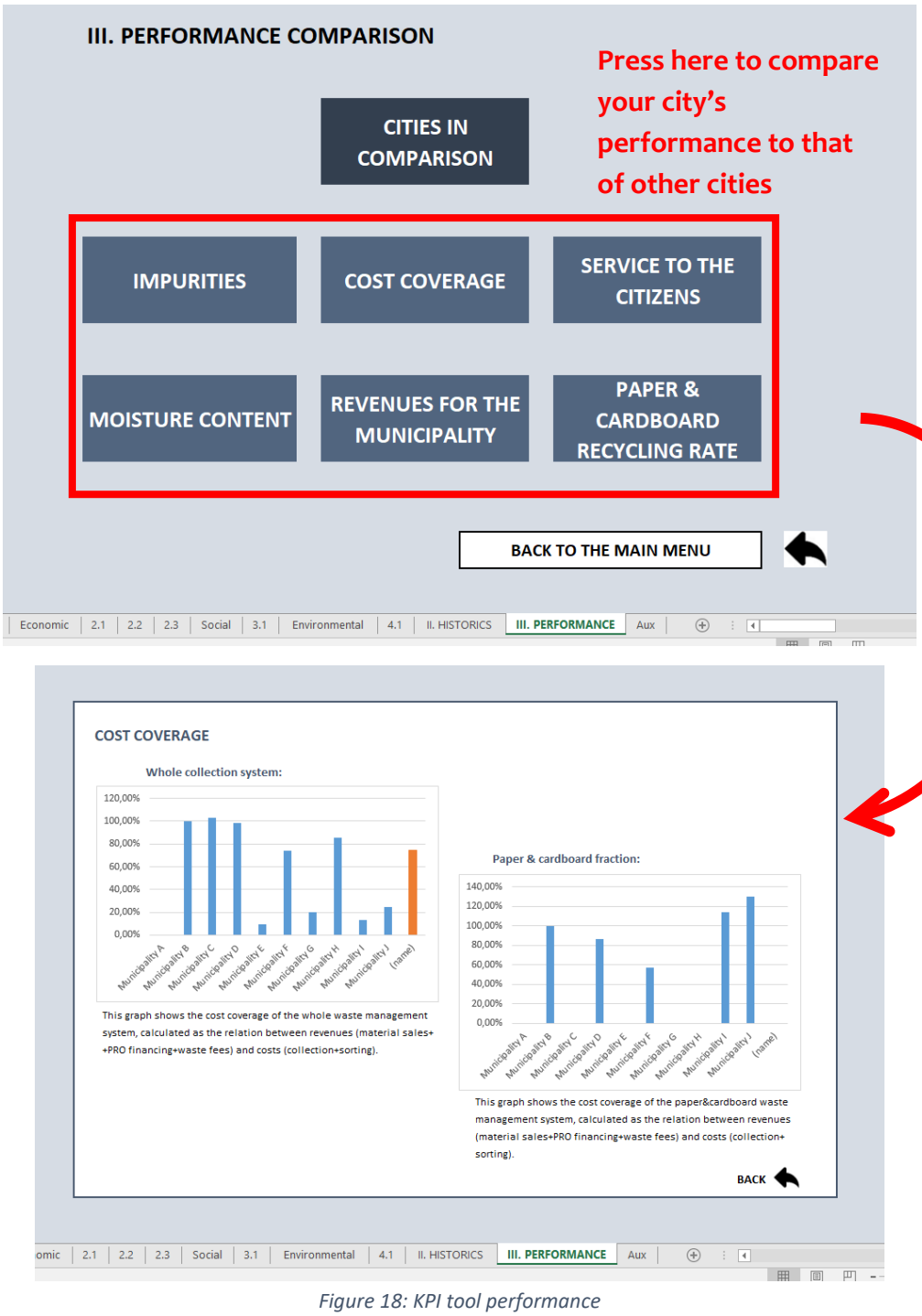

Figure 18: KPI tool performance

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Annex III. USER MANUAL: The Selection Tree

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The selection tree

LINK: Selection Tree Tool

In the IMPACTPapeRec project, a selection tree has been designed with three different levels of multiple-choice selection options ending with the GPs and BPs that have been proposed to solve or address the problems under study.

First level: NEEDS

The first level is based on the NEEDS (31) that municipalities may have. At this stage, the user should choose which of these NEEDS may constitute potential areas of improvement in paper and board collection and recycling in the municipality. At this level, the question that the user has to answer is "*Select which of the following aspects you would like to focus your efforts on or you would like to improve*". The selection tree allows the user to select one or more options at each level. In order to facilitate decision-making at this level, further explanatory comments have been included in the icon " ⓘ " in the selection tree to help the user understand each of the defined NEEDS better (see coloured text boxes in the figure below).

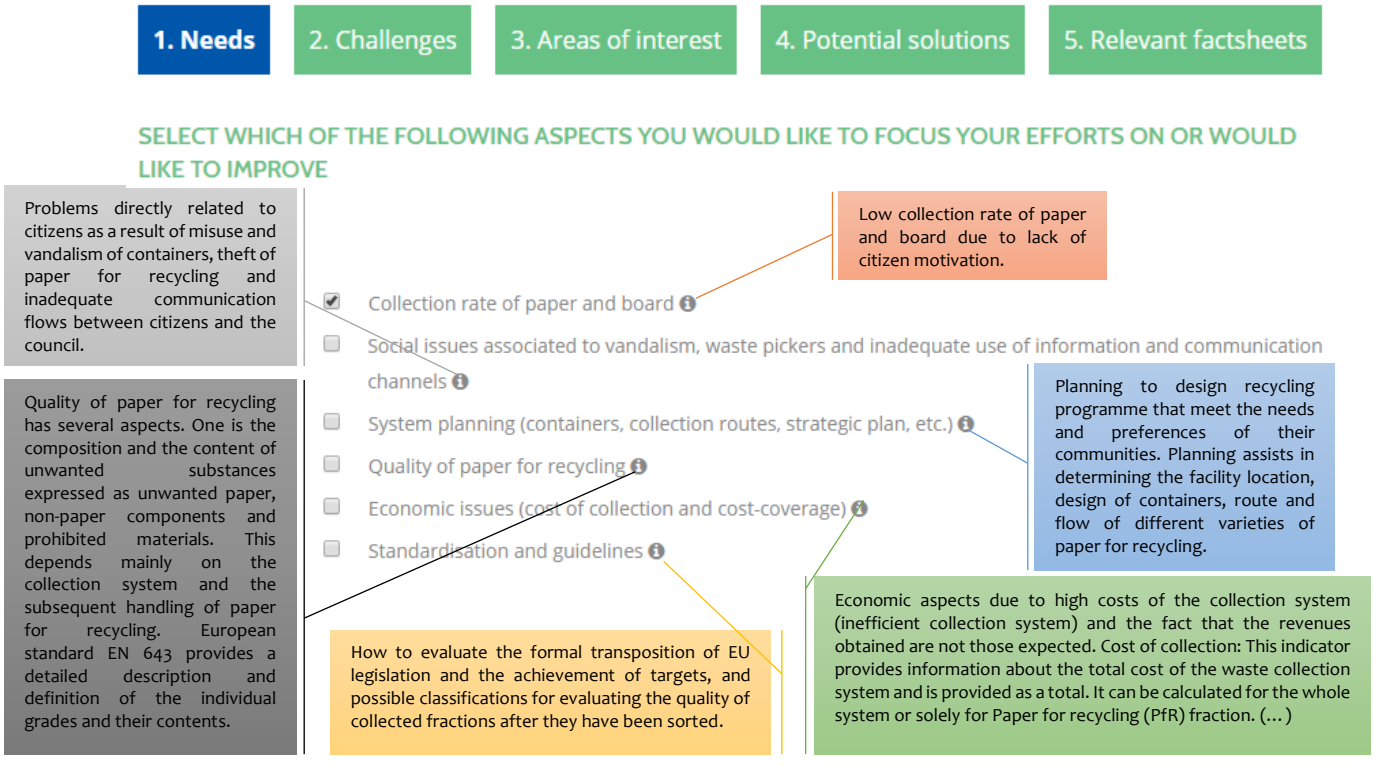

Figure 19. Level 1 of the Selection Tree: NEEDS

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Second level: CHALLENGES

Once needs have been selected in Level 1 (let's imagine only the first option "Collection rate of paper and board" has been chosen), the selection tree then takes the user to the second level of questions: CHALLENGES. On this level, the question which municipalities must answer is "*Select which of the following aspects you would like to improve*". However, the options here are more specific; Level 1 classifies the NEEDs identified in a general approach to drive the user on to a more specific level of CHALLENGES (Level 2).

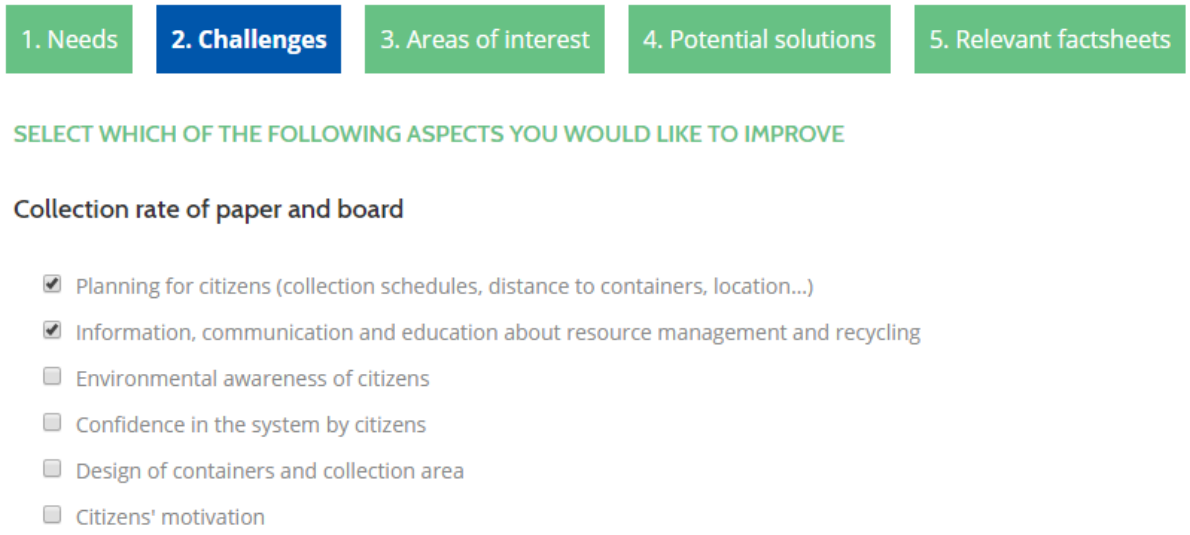

Figure 20. Level 2 of the Selection Tree: Challenges for each identified need.

Third level: AREAS OF INTEREST

Once levels 1 and 2 have been completed (let's imagine only the first two options in Level 2 "Planning for citizens (collection schedules, distance to containers, location…)" and "Information, communication and education about resource management and recycling" were chosen), the user is then taken to Level 3. This level divides the CHALLENGES in Level 2 into AREAS OF INTEREST.

The question that municipalities must answer at this level is "*What kind of solutions are you looking for*". By answering this question, the user will define the type of areas of interest in which the municipality can potentially improve.

Some of the CHALLENGES (Level 2) do not need further classification into AREAS OF INTEREST. Hence, for these CHALLENGES there is no Level 3 (see Figure below "Planning for citizens (collection schedules, distance to containers, location…). Conversely, other CHALLENGES such as "Information, communication and education about resource

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management and recycling" clearly require further classification in AREAS OF INTEREST to address the problems defined by the user more specifically.

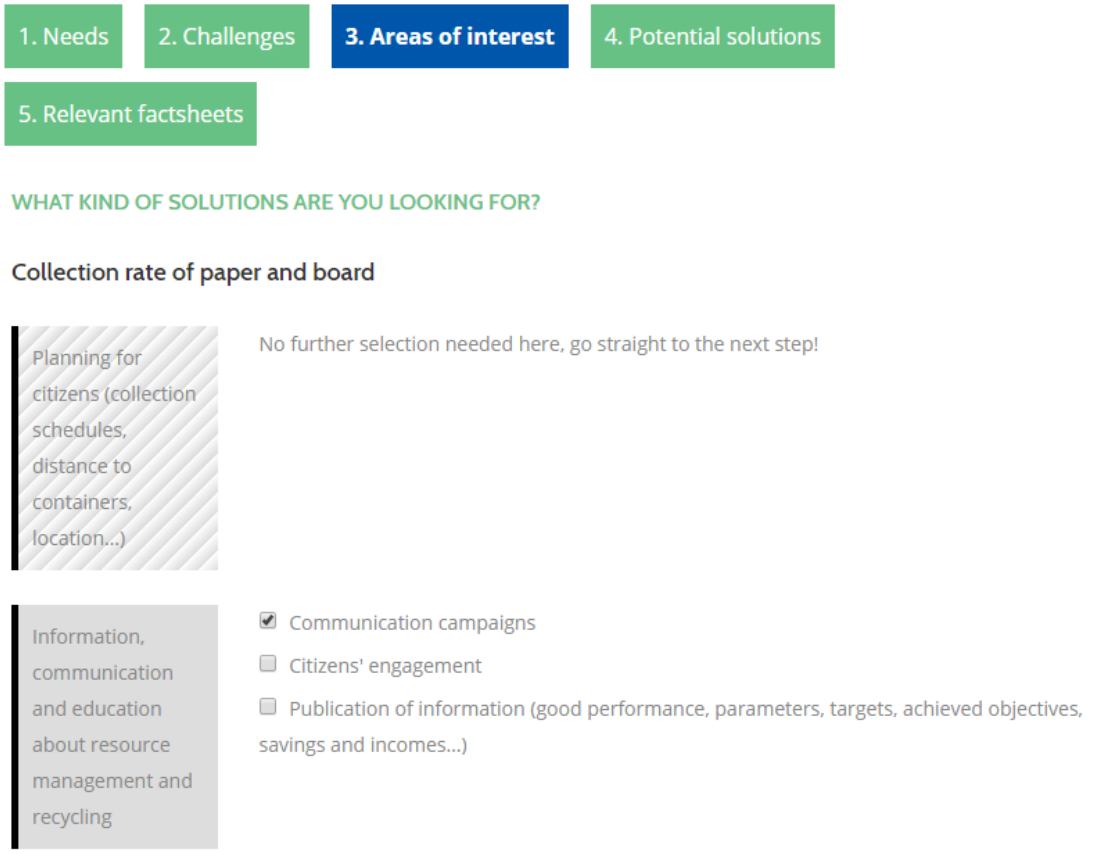

Figure 21. Level 3 of the Selection Tree tool: Areas of Interest according to each challenge selected.

Fourth level: Potential solutions

Then, the selection tree takes the user to a list of the most suitable GPs and BPs that can be applied in the municipality, according to the selected problems. The user can select the most suitable ones for their municipality from this list.

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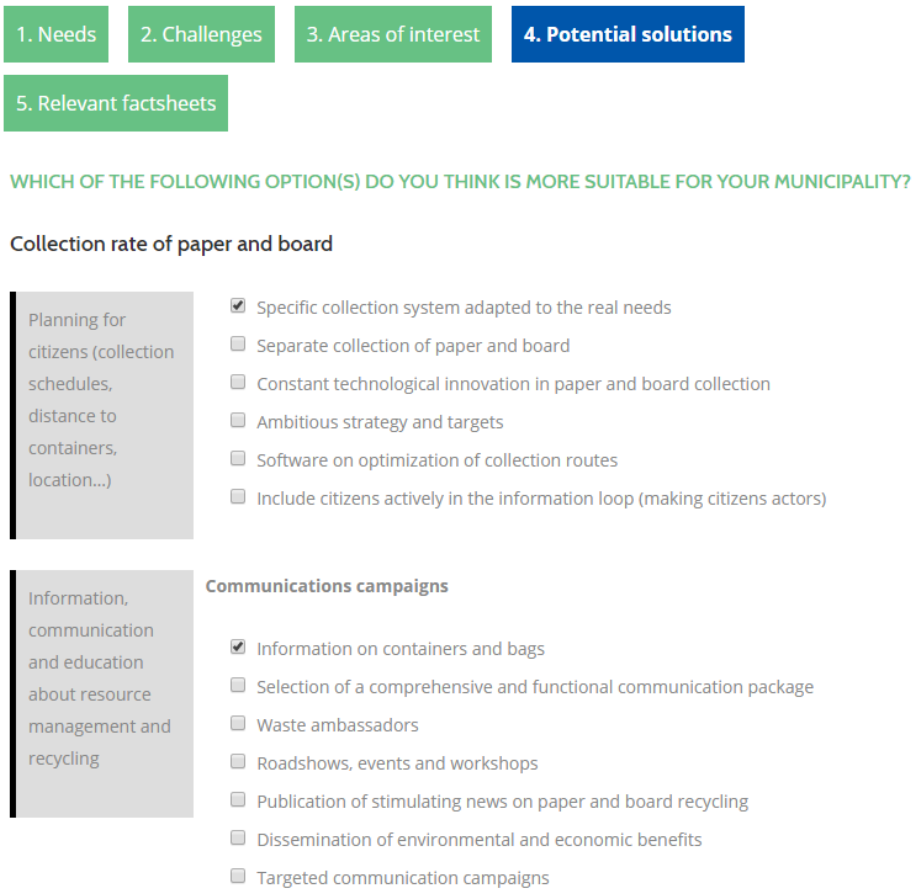

Figure 22. Level 4 of the Selection Tree Tool: Potential Solutions

Fifth level: Relevant factsheets

In the last step, the selected FACTSHEETS (let's imagine the first one from each group has been selected) can be downloaded in pdf format (please see section 4.2 of the Handbook for further information about FACTSHEETS).

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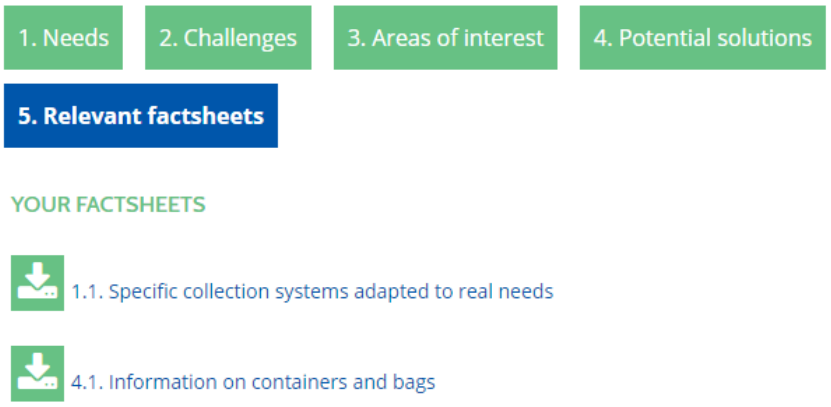

Figure 23. Level 5 of the Selection Tree Tool. GP and BP factsheets