D 2. 9. Technical Documentation of R4: Circular Economy Planning Module

WP2

Aclima

Public

Reviewers: SGI, MOBA, SOFTLINE

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Abbrevations and Acronyms

API	Application Programming Interface
CE	Circular Economy
CEBM	Circular Economy Business Models
CEPM	Circular Economy Planning Module
D 2.9.	Deliverable 2. 9.
ISP	Incentive System Planner
JSON	JavaScript Object Notation
KPI	Key Project Indicator
LER code	Lista europea de residuos / European Waste Catalogue
NACE	National Classification of Economic Activities
NGSI	Next Generation Service Interfaces
PA	Public Administrations
REST. API	Representational State Transfer. API
WM	Waste Management
WMC	Waste Management Company
W4T	Waste4Think

1. Summary

In this report we will describe the main functionalities and the supporting technical architecture of the CEPM, one of the tools included as part of the ISP of W4T.

This tool is designed to give support to public managers of municipalities to identify and assess innovative CE practices fitted to their waste management and socioeconomic profile at the same geographical level. This tool will also give support to other users such as companies, entrepreneur and researchers to identify ongoing innovative businesses, and potential circular material flows, based on available waste streams.

In D2. 9. we provide functional and technical description of the CEPM. In the first section of the document (chapters 2 and 3) we describe expected functionalities, and main use cases. In Section 2 (chapter 4), we will provide a broad description of the component and its relations with the rest of components developed in the project. Finally, Section 3 (chapter 5) will provide a technical description of the different components that compose the module, a set of mock-ups of the user interface and a description of the API.

2. Objectives

The CE holds high potential to contribute to sustainable economic growth and resource efficiency. While the benefits of this CEPM are increasingly recognized, there are range of barriers that is difficult the real transition to a circular model, from both public and private sides. It is of great importance to integrate a holistic assessment in the uptake of circular innovative practices to avoid barriers and select those one that could be scaled up more successfully for certain starting conditions like WM level or socioeconomic framework or a certain area.

The objective of the CEPM was to create a new tool to ease this kind of assessment activities, developing a practical tool to facilitate public policy-making and private decision-making, allowing to:

- Assess the impact and returns of implementing new CE practices.
- Identify regulatory gaps that hinder the implementation of suitable CE practices.
- Identify new CEBM, investment & diversifying opportunities based on new CE material flows in the municipalities and surrounding territory.

The tool will give support to PA in identifying ways to improve their recycling and by-product utilization ratios, identifying best CE practices adapted to their waste generation profile, socioeconomic characteristics and WM objectives.

The tool will also allow identifying ongoing innovative businesses in CE linked to available waste streams, and the composition of industrial and commercial fabric in municipality and surrounding territory.

3. Description of the Circular Economy Planning Module

Developments of a software tool to identify CEBM and policy practices to improve recycling and by-product utilization ratios, adapted to waste generation patterns and socioeconomic framework of European municipalities and regions.

No such tool has been identified in the market, this kind of assessment is made by specialized environmental or policy consultants through data mining and contrast procedure with public and private stakeholders of a municipality, region or a country.

Development of the CEPM will provide a specific tool for consultants, public officials, entrepreneurs and private companies for doing the assessment of circularity of a specific municipality or region, making easier the identification of opportunities to adapt circular strategies and business models.

3.1. Main functionalities

The tool main functionalities according to the end user are summarized in the Table 1.

Table 1. CEPM main functionalities according to type of user

Public User	Companies, entrepreneurs, researchers
The tool offers the possibility to introduce custom data to set up current scenarios for waste management level and socioeconomic framework of the municipality or region study case	The tool identifies potential circular flow scenarios on a specific geographical area.
Identify best potential practices to improve the CE in the municipality according to the current municipal WM level and socioeconomic framework from the starting scenarios. The tool identifies possible ways to establish strategies of CE in influence area of the administrator	The tool Identifies potential material flows from the available waste streams and potential end users (industrial and commercial sector) based on ongoing circular business models included in the best practices database.
Identify potential WM performance enhancement based on project KPIs	
Identify socioeconomic returns of implementation of best practices based on project KPIs database	

Identify Barrier & risk = Policy recommendations: The tool identifies what regulations influence the potential flows of waste identified indicating that may constitute a barrier and the ability to act on this a barrier	
The tool identifies potential policies or incentives that the administrator can implement in his area of competence	

3.2. Use cases

The use cases for the tool are linked to the following identified user needs:

1. The municipal person in charge of WM needs to identify and assess different kind of practices (policies, social actions, business incentives.), suitable to achieve the municipality WM strategy targets and objectives.
2. A person in charge for business development of a WMC to look for CEBM
3. An entrepreneur to search for ideas that can be implemented in the municipality our surrounding territory.
4. A researcher to identify potential users for certain waste streams.
5. A waste generator to look for potential users for their waste.

According to these needs two main use cases are defined:

Table 2. Main functionalities for a responsible of municipal waste use case

USE CASE I User needs: 1	a. The person responsible for municipal WM needs to identify best practices to enhance overall city WM or certain urban waste streams b. The person responsible for municipal WM could select the geographical area that the tool can cover [area of competence (geographical area in which the administrative competence of the public administrator is limited) + area of influence (geographical limit for the establishment of circular value chains] c. The tool offers the possibility to use standardized data libraries or introduce municipal custom data to create a starting scenario: _WM data (waste stream e.g. organic) _ Socioeconomic framework data (typology e.g. rural, nº of inhabitants, etc) _ Normative/legal data

	d. - The tool creates a scenario describing the actual situation. This scenario should reflect WM level situation e. - The responsible for municipal WM should introduce the aim level (e. g. A municipality has a 20% recycling rate and it wants to reach 80% recycling rate) f. - The tool will show potential best practices that could be considered in order to reach that level according to the municipality current WM performance and socioeconomic framework g. - The responsible for municipal WM could select different criteria to filter the potential best practices according: _Best practice type: policy, campaign, new business, technology. _Target practice type: prevention, sorting, recycling _Target waste streams h. - The responsible of municipal WM could select potential best practices. i. - The tool would then assess the impact of implementing the selected CE practices: _Identify potential enhancement compared to current scenario: +WM (prevention, sorting, recycling) +Socioeconomics returns _Identify regulatory gaps that hinder the implementation of CE best practices considering the replication level: +Municipalities with more similarity +Geographical proximity +Viability +Replication at local/ regional/ European levels. j. The tool will generate a report with selected practices performance data that would be saved **Output:** Public User gets a report, showing the potential returns of best practices implementation and additional barriers and risks to be considered.

Table 3. Main functionalities for a business manager use case

USE CASE II User needs: 2,3,4,5	a. A business manager/entrepreneur/researcher wants to identify best practices in Circular Businesses in certain waste streams b. Business manager/entrepreneur/researcher could select the geographical area that the tool can cover (geographical limit for the establishment of circular value chains). c. The business manager/ entrepreneur/ researcher could select different criteria to filter the potential best Business practices: _Target waste streams _Target economical sector and industry d. The tool will show potential best Business practices that could be considered according to the selection criteria e. The business manager/ entrepreneur/ researcher could select potential best practices. f. The tool would then identify regulatory gaps that hinder the implementation of CE best business practices in the selected geographical area g. The tool will generate a report with selected best business practices data that would be saved **Output:** Business/entrepreneur/researchers gets a report showing CEBM, which allow them to capture additional value from certain waste streams, and additional impacts and risks to be considered for implementing these businesses in their municipality or region.

4. Relation with other components

This module will help urban planners and entrepreneurs to assess the viability of implement a set of best practices in a territory. As shown in Figure 1, the CE is connected to several other components.

A set of best practices is already retrieved (see Deliverable D1.2 for details) and are coded following the data model defined in Deliverable D2.1. On the other hand, different scenarios could be made using the what-if scenario module (see Deliverable D1.2 for details).

Information to fill these scenarios could be provided completing the relevant forms (see Section 5.2 below) or retrieved automatically from the persistence layer. Finally, to visualize the results, this module uses components of the dashboard.

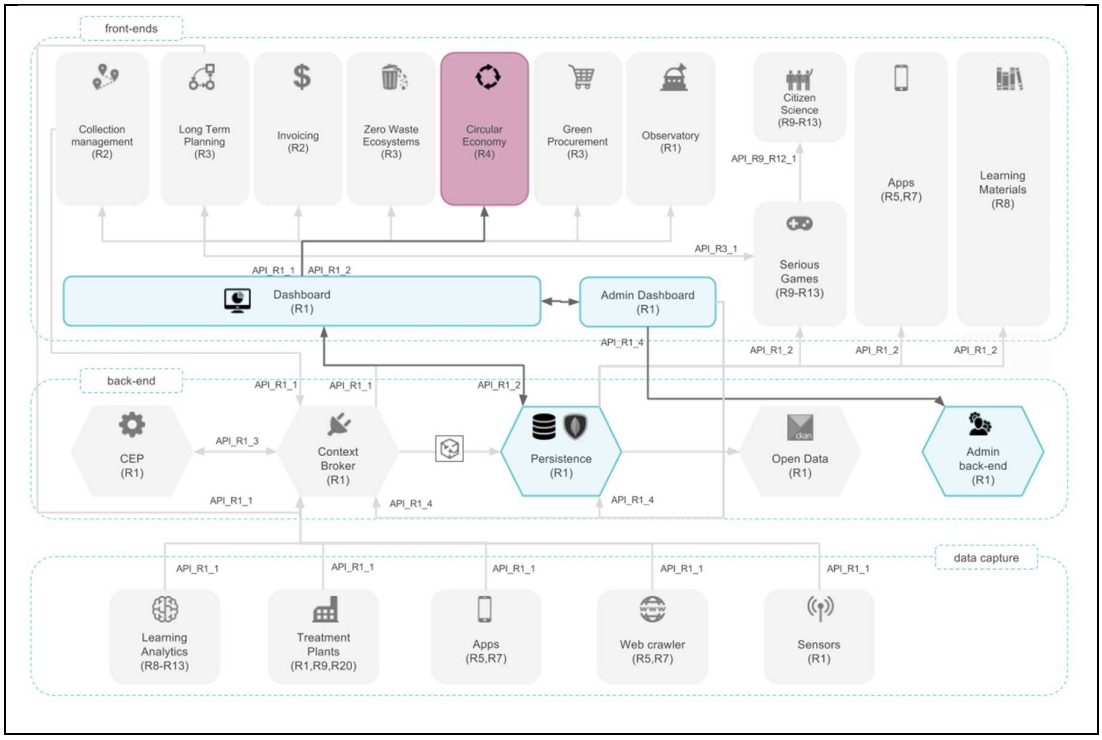

Figure 1. Overall architecture of Waste4Think

The typical use of the system is described in the Use Case A12 (see Deliverable D1.1) and provide the following functional requirements to the following targets groups of the system:

		Target Group																	
		Social Groups of Interest						Generators						Managers					
		C	S	SME	R	A	EC	DG	NRG	CG	IG	FWG	NG	WCO	WCC	TPO	FWM	ZWE	WMPB
R4_FR1.1	Provide recommendation to foster circular economy				A14										A14	A14			A14

Figure 2. Functional requirements according to the different target groups

5. Circular Economy Module architecture

The CEPM will provide innovative CE practices to be applied by both municipalities and companies. The objective is to identify for potential circular flows from waste streams available in the area to reduce the waste amount.

The architecture follows the traditional MVC (Model View Controller) paradigm, explicitly separated in three components that rely on different physical systems and their communication must be done through the Internet. Figure 3 provide a diagram of the different components of the CEPM.

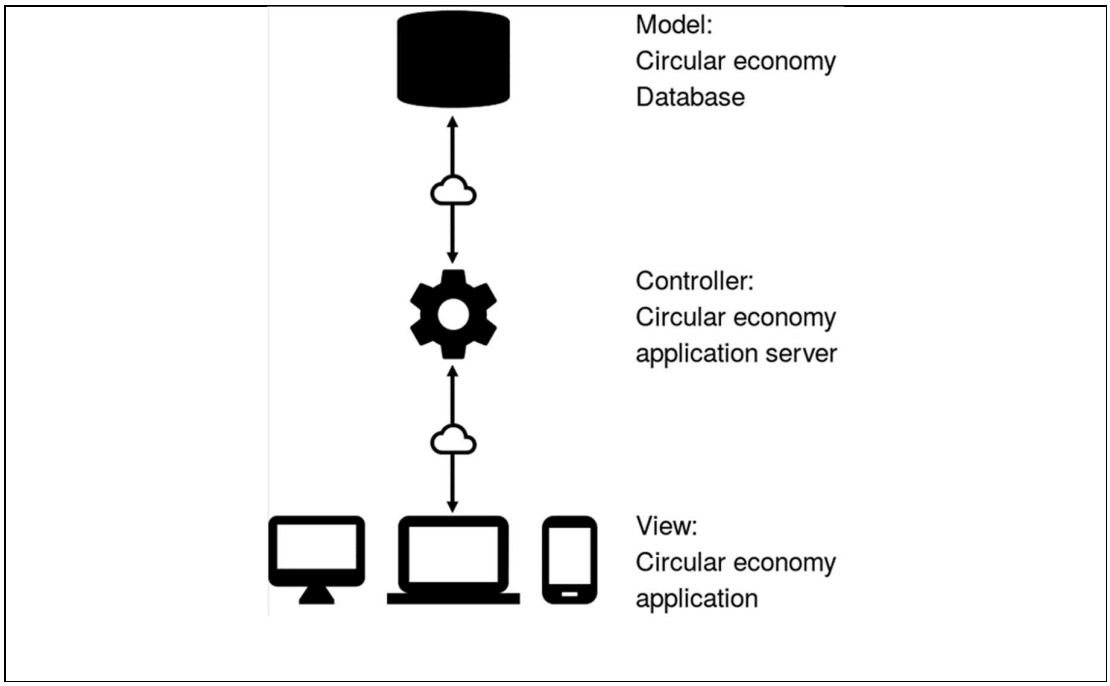

Figure 3. Components of the Circular Economy Module

These components provide the following functionalities to the system:

Table 4. Main functionalities of the Circular Economy Planning Module

		Model	View	Controller
R4_FR1.1	Provide recommendation to foster circular economy	X	X	X
R4_FR1.1.1	Allow to create baseline and what-if scenarios	X	X	
R4_FR1.1.2	Evaluate the impact that several best practices have to foster circular economy	X		X
R4_FR1.1.3	Search for viable circular economy best practices	X	X	X

A detailed description of these components can be found in the next sections.

5.1. Databases

Main datasets of the module focus on the compilation and description of the current situation of municipalities, waste streams of companies and the available and listed CE practices carried out by other entities. The databases will be hosted at the W4T´s FI-WARE cloud server as they need to be widely accessible through the Internet by all the W4T's modules.

Three types of database will be compiled:

- Information related to the area of study
- Industrial and commercial activities
- Circular economy best-practices

The following sections detail the content of these databases.

5. 1. 1. Municipalities database

Quantitative and qualitative information about the current state of the municipality. The CEPM requires the current state of the municipality to offer the most appropriate strategies and the ones that contribute with the greatest impact. Municipalities will be categorized into different types based on the following characteristics:

- **Municipality type:** Main land use of the municipality: rural, urban, semi urban or any other meaningful value.
- **Municipality area:** Geographic area of the municipality.
- **Population:** Number of citizens in the municipality.
- **Activities:** Main activities that take place in the municipality such as: tourism, industry, services, agriculture or any other meaningful value.

- **Collection system:** Describe the current collection systems the municipality is using. Potential values are: Door2Door collection; 2, 3, 4, or 5 fractions bring bank system; or pneumatic.

- **Baseline separate collection rate:** categorize the starting point in bands such as 0-25%, 25-50%, 50-75%, >75%.

These attributes define the current baseline for the municipality and help suggesting possible improvements and impacts in terms of CE.

5. 1. 2. Industrial and commercial activities database

All industrial and commercial activities will also be stored for a certain area in order to find new feasible business models that improve the CE flows. Information stored about these entities will mainly be composed of:

- **Activities:** Classification of Economic Activities codes of the tasks carried out by the entity using NACE or similar codes.

- **Location:** Geographic location of the activity.

- **Input waste streams:** Typical waste types that the entity consumes and an estimation of the quantity per day. This can be a waste with LER code or EoW (End of Waste) subproducts. A mechanism to automatically generate estimation for the quantity of waste per day will be provided in case it is needed.

- **Output waste streams:** Waste types that the entity receives and an estimation of the quantity per day. This can be a waste with LER code or EoW (End of Waste) subproducts. A mechanism to automatically generate estimation for the quantity of waste per day will be provided in case it is needed.

- **Billing:** Annual turnover of the company.

- **Employees:** Amount of employed people.

Activities and waste streams are the key point for the module to look for new business models that close waste circles or create new flows that minimize the impact.

5. 1. 3. Circular Economy best practices database

A database of good practices will be drawn up with both real best practices carried out by municipalities and companies, as well as theoretical ones suggested in the bibliography. This knowledge base will serve to identify feasible strategies and how these would affect the studied municipality or company. Best practices will need to capture the following information:

- **Municipality or company:** Provide the description (including all the information mentioned in Section 2.1.2) of the municipality or company where it was applied.

- **Inputs:** LER codes (or EoW/ subproduct) and amount of wastes affected by the best practice.
- **Outputs:** LER codes (or EoW/ subproduct) and amount of wastes affected by the best practice.
- **Stage:** List of stages in which the practice was applied: recycle, reuse, valorization, ecodesign, prevention or any other value.
- **Scale:** The geographical scope of the strategy, that is, local, regional, European or other value.
- **Viability:** How feasible it is for this strategy to be applied in other areas.
- **Cost:** Final cost of the strategy.
- **Impact:** Environmental impact reduced by the strategy.

A more in-depth description can be found in Deliverable D2.1, in which the attributes of each entity are extensively detailed.

As already said, this database has a close relationship with D1.2, in particular with the "Best Practices database in Circular Economy" since the fifteen good practices defined in this deliverable will pour the Circular Economy best practices and New Business Models of the Circular Economy Module.

In this way, what we have is a basis for the Circular Economy Module but what we want is an open database that is fed throughout the project with the collaboration of all the partners that will be invited to identify good and best practices to be collected in the full extended data-base.

In the end, what we are going to achieve is an extensive list of good circular economy practices collected both in the project and in a wider level.

The Circular Economy Module has been intended as a web-interface that at the same time will link good practices to the project website, being an open space in which users can add new good practices.

5.2. Views

The expected behaviour of the software together with simplified views of the user interface is described here. The views will be built using the HTML5 standard together with some JavaScript frameworks such as JQuery or AngularJS. These will be connected and the necessary data will be retrieved, using the Controllers public API, described in Section 2.3.2.

CEPM will have two operation modes according to the strategies that want to be identified by the module. If the user wants to look for best practices that can be applied to its municipality or companies and evaluate the impacts and costs of its implementation, it

will go to the Best Practices operation. Whereas if the user wants to identify CEBM, it will be head to the New Business model's operation.

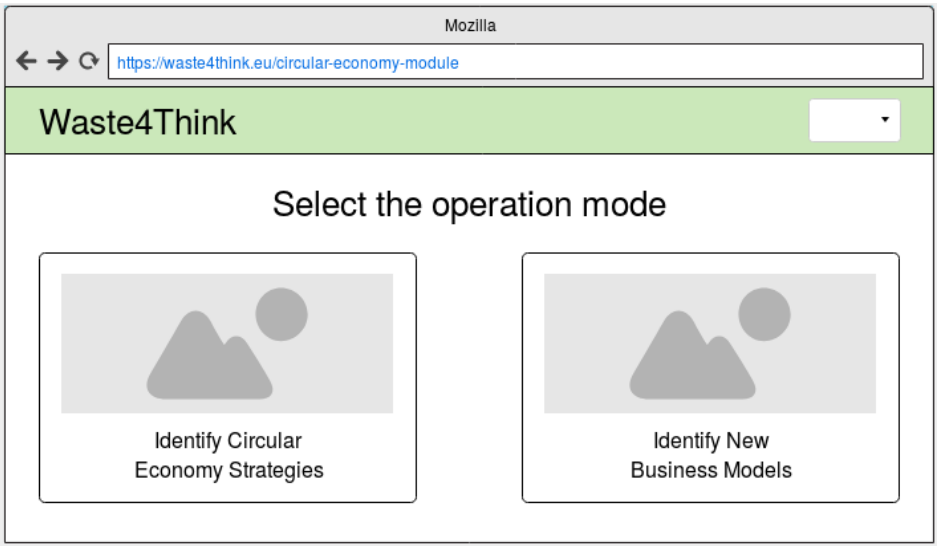

Figure 4. Mock-up of the screen to select the operation mode

5. 2. 1. Best practices in Circular Economy

This operation will analyze the current status of a municipality or company and suggest which best practices are more suitable to be implemented according to impact and cost. The user needs to select an entity from the databases or if not registered, register the new municipality or company.

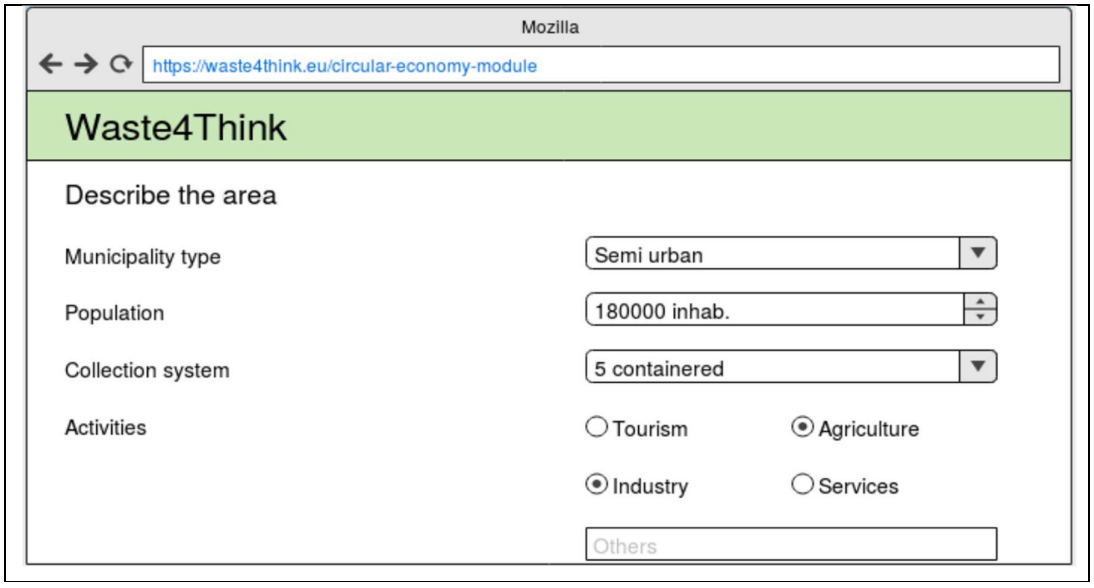

Figure 5. Mock-up of the screen to insert data of the Municipality

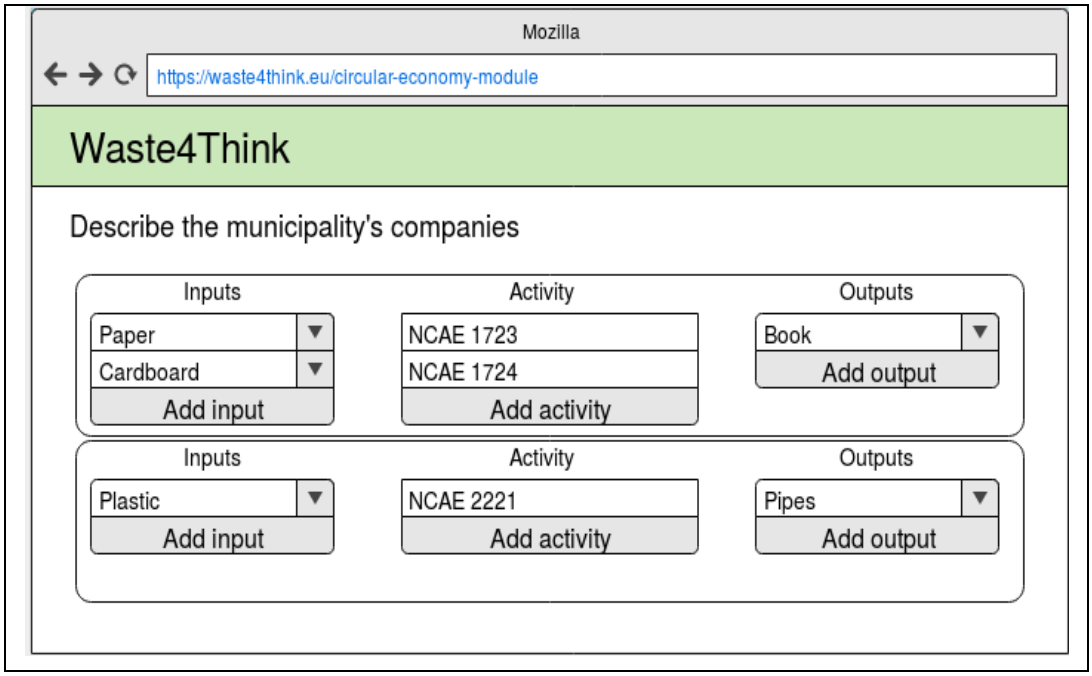

Figure 6. Mock-up of the screen to insert data of the municipality´s companies

The module will use these inputs to search the best practices database for those that were implemented by similar entities. It will perform a search process in the database.

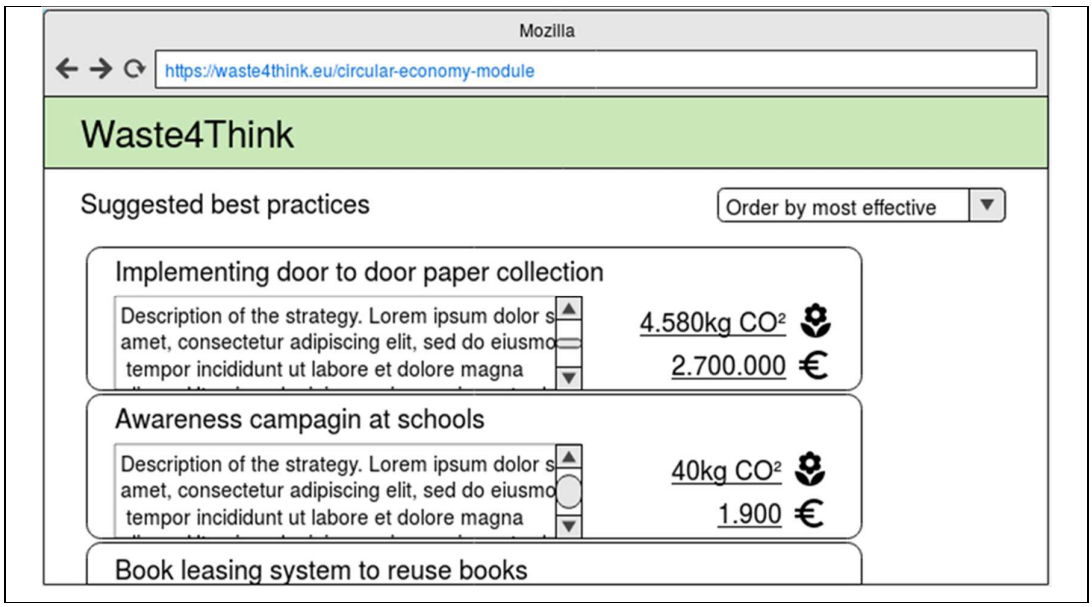

Figure 7. Mock-up of the screen that shows the best practices according to the inserted data

Finally, the user will be able to see the estimated effect each best practice could have in its scenario. This approximation will be done comparing the features of both the analyzed municipality or company and the one that implemented the best practice.

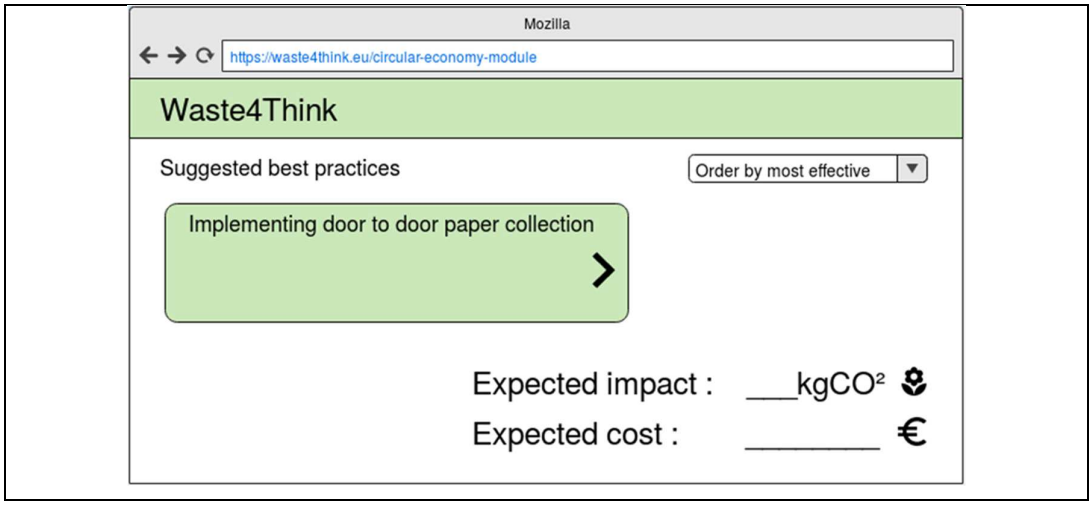

Figure 8. Mock-up of the screen that shows the chosen best practice by the user

5. 2. 2. New Circular Economy Business Models

The CEPM will identify new business models that can emerge regarding a waste stream for both the municipalities and companies settled in a geographic area. For this purpose, the user will need to select the waste stream it wants to reduce and a geographic area.

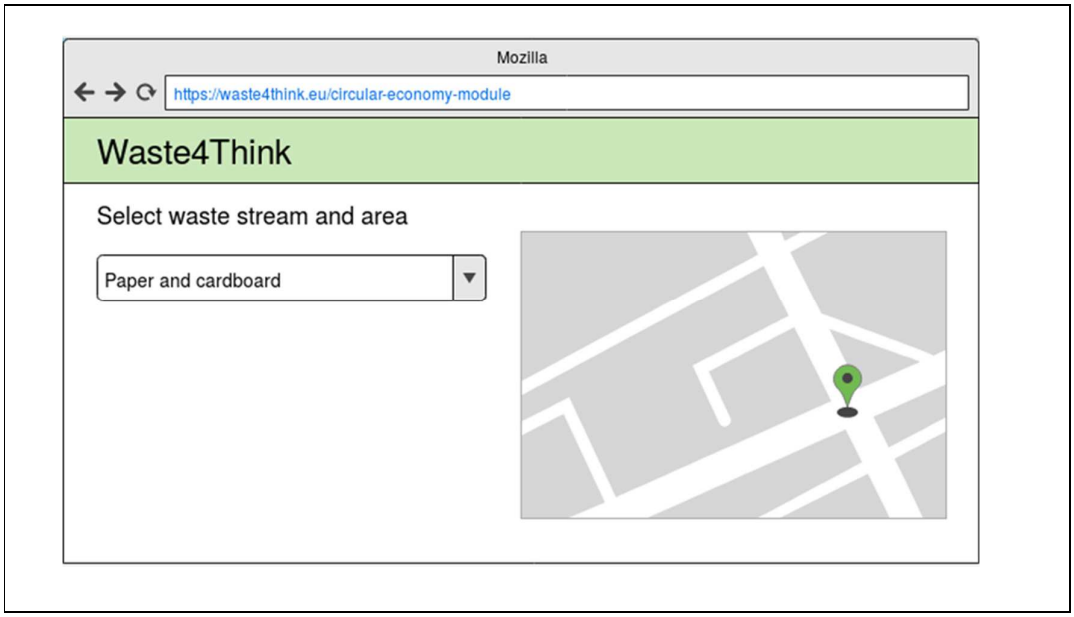

Figure 9. Mock-up of the screen to insert data about waste stream and area

The CEPM will search the best practices database for new business models that can be applied to the waste stream and companies in the selected area.

Figure 10. Mock-up of the screen that shows the different Business models according to the inserted data

5.3. Controller

The controller of the CEPM is the brain of the application. It is required to identify and suggest the most suitable best practices and new business models that are feasible to be applied in a municipality or company.

For this purpose, the controller will receive the municipality or company of study. It will extract its attributes described in Sections 2.1.1 and 2.1.2 and categorize the entity according to a list of categories defined in the controller. Using this categorization, the controller will build a FIWARE query that will retrieve the best practices that are suitable to be applied to the entities of the municipality's or company's category.

5. 3. 1. FIWARE querying

FIWARE provides a Simple Query Language with simplified syntax to retrieve entities which match a set of conditions. Specially, the Circular Economy module will benefit from the use of several of the operations already provided by FIWARE, such as the creation/update/deletion functionalities as well as the retrieval of entities through filtered search. In particular, geoqueries will not be used due to the current limitations of the FIWARE API (it only allows point geometries). More precisely, for the Circular Economy module (regarding that more complex comparisons and searches must be made) all the best practices will be downloaded from FIWARE and further filtered and processed in the module's logic. Special operations will be provided apart from the FIWARE API due to the need to customize the results and provide higher levels of granularity and support for special aggregations.

A query is composed by a list of statements separated by the ';' character. Each statement expresses a matching condition. The query returns all the entities that match all the matching conditions (AND logical operator).

- The syntax of a query consists of a list of tokens separated by the character. This list of tokens addresses a JSON property name, in accordance with the following rules:
- The first token is the name of an NGSI attribute (target NGSI attribute) of an entity.
- If filtering by attribute value, the rest of tokens (if present) represents the path to a sub-property of the target NGSI attribute value (which should be a JSON object). Such sub-property is defined as the target property.
- If filtering by metadata, the second token represents a metadata name associated to the target NGSI attribute, target metadata, and the rest of tokens (if present) represent the path to a sub-property of the target metadata value (which should be a JSON object). Such sub-property is defined as the target property.
- The target property value is defined as the value of the JSON property addressed by the list of tokens described above i.e. the value of the target property. In case only one token is provided (two in case of filtering by metadata), then the target property will be the target NGSI attribute itself (or the target metadata in case of filtering by metadata) and the target property value will be the target NGSI attribute value (or the target metadata value in case of filtering by metadata). The value of the target NGSI attribute (or the target metadata in case of filtering by metadata) should not be a JSON object in this case.

In case some of the tokens include ".", you can use single quote (') as separator. For example, the following attribute path 'a.b'.w.'x.y' is composed by three tokens: the first token is a.b, the second token is w and the third token is x.y.

The list of operators (and the format of the values they use) is as follows:

- **Equal:** ==. This operator accepts the following types of right-hand side:
  - Single elements, e.g. temperature==40.
  - A list of comma-separated values, e.g. color==black,red.
  - A range, specified as a minimum and a maximum, separated by .., e.g. temperature==10..20.
- **Unequal !**=. This operator accepts the following types of right-hand side:
  - Single element, e.g. temperature!=41.
  - A list of comma-separated values, e.g. color! = black, red.
  - A range, specified as a minimum and maximum separated by .., e.g. temperature!=10..20.

- **Greater than:** >. The right-hand side must be a single element, e.g. temperature>42.

- **Less than: <.** The right-hand side must be a single element, e.g. temperature<43.

- **Greater than or equal to: >=.** The right-hand side must be a single element, e.g. temperature>=44.

- **Less than or equal to:** <=. The right-hand side must be a single element, e.g. temperature<=45

- **Match pattern:** ~=. The value matches a given pattern, expressed as a regular expression, e.g. color~=ow.

Unary negative statements use the unary operator '!', while affirmative unary statements use no operator at all. The unary statements are used to check for the existence of the target property. Example: temperature matches entities that have an attribute called 'temperature' (no matter its value), while !temperature matches entities that do not have a temperature called 'attribute'.

5. 3. 2. Controller API

The controller will expose a REST API through which the views will communicate and retrieve information. The public API must allow the following operations:

Retrieval of information

- GET /api/municipalities: Retrieve the existing municipalities in the database.

- GET /api/municipalities/area/polygon: Retrieve the existing municipalities inside a geographic area from the database.

- GET /api/companies: Retrieve the existing companies in the database.

- GET /api/companies/municipality/municipality_id: Retrieve all the companies in a municipality.

- GET /api/get/companies/area/polygon: Retrieve the existing companies inside a geographic area from the database.

- GET /api/best-practices: Retrieve the existing best practices in the database.

- GET /api/best-practices/area/polygon: Retrieve the existing best practices inside a geographic area from the database.

Update of information

- POST /api/municipality: Create a new municipality in the database. Must send the attributes from Section 2.1.1.

- PUT /api/municipality/municipality_id: Update a municipality. Must send the attributes from section 2.1.1.

- POST /api/company: Create a new company in the database. Must send the attributes from section 2.1.2.
- PUT /api/company/company_id: Update a company. Must send the attributes from section 2.1.2.

- POST /api/best-practice: Create a new best practice in the database. Must send the attributes from section 2.1.3.

- PUT /api/best-practice/:best_practice_id: Update a best practice. Must send the attributes from section 2.1.3.

- DELETE /api/best-practice/: best_practice_id: Delete a best practice.

- Extrapolation operations

- POST /api/finder/best-practices/: Identify and get the best practices suitable for the given municipality or company. Must send the attributes of section 2.1.1 or 2.1.2.

- POST /api/finder/business-models/: Identify and get the new business models suitable for the given area or municipality. Must send the attributes of waste stream, area and the ones from section 2.1.1 or 2.1.2.

- POST /api/impact/best-practice/best_practice_id: Estimate the impact a best practice would have for the given municipality or company. Must send the attributes of section 2.1.1 or 2.1.2.

- POST /api/impact/business-model/business_model_id: Estimate the impact the new business models would have for the given area or municipality. Must send the attributes of waste stream, area and the ones from section 2.1.1 or 2.1.2.

5.4. Real example

Emilio Rivas lives in Bilbao, Spain, and he is the Head of the Waste Management Service of the city council. His responsibilities extend to the provision of all aspects of waste management: refuse collection, recycling, street cleanliness, transportation to landfill sites and environmental waste contracts with the private sector. Always looking for an approach that allows to reduce the environmental impact and minimize the costs of urban waste management through a correct classification and characterization of them.

The challenges for Emilio

Emilio is faced with many challenges in his daily work. At a time when the impact of current spending cuts is deepening, local authorities are facing a complex mix of pressures, including the needs:

- To reach a 50% recycling rate by 2020, requirement of the EU Waste Framework Directive.
- To improve the selective collection, transport and treatment of household waste in general.
- To identify and adopt the most suitable technology to recover resources from our 'left-over' (residual) waste.
- To educate and influence the community to take on long term changes to reduce unnecessary waste at its source and offer opportunities to reuse and renew valuable resources which would otherwise be sent to landfill.
- To address the impact that waste has on Climate Change by adopting low emission waste management solutions where feasible.
- To promote the minimization of the use of products that generate waste of difficult or no use, due to the impossibility of introduction in the productive cycles.
- To prevent the use of materials with harmful effects for the environment and the health of people.
- To minimize the use of containers and packaging, to comply with the reduction objectives foreseen in the legislation on packaging waste.

One Monday morning Emilio arrives at work. When he looks at the mail, he finds an email from one of the citizens who runs a hotel and explains a problem he is facing. It turns out that he wants to change the mattresses of all the beds in the hotel because they are already 10 years old, but he doesn´t know what to do with the old mattresses since the City Council would go to pick them up if it were two or three mattresses but it doesn´t take charge of larger amounts. The hotel owner does not know any company that manages these types of waste and it would also be very expensive. In advance, it seems that the mattresses will end up in landfill. However, Emilio will consult the Circular Economy Planning Module to see what options he could have.

Solving challenges with Waste4Think

With the Circular Economy Planning Module tool designed in the framework of the Waste4Think project, we show that we can help people like Emilio improve the waste management system of the municipality he works for.

Emilio inserts data corresponding to the information of the area of study:

- **Municipality type:** Urban area
- **Municipality area:** 41, 60 km²
- **Population:** 345 110 inhabitants

- **Activities:** tourism, industry and services
- **Collection system:** 5 fractions bank system
- **Baseline separate collection rate:** 25- 50%

The tool will afterwards create a scenario describing the actual situation and will also review all the best practices within Circular Economy. In this case, Emilio will search for New Business Models and according to the information entered, the tool will provide the options that have the most significant impact on the municipality.

Among the different cases, Emilio chooses The Furniture Recycling Group one in the UK which has designed, developed and produced the world's first automated pocket spring recycling machine, created to streamline the mattress recycling process significantly and reduce the number of mattresses sent to landfill each year.

Emilio then raises the option that some recycling plant had access to a machine like this, then it could significantly reduce the 167,000 tons that are currently sent to landfills every year and, in this way, to face one of the challenges with which he was.

6. Key Project Indicators (KPI)

For ensuring that the CEPM is effective, it is necessary to update Key Project Indicators (KPIs). These indicators act as a measurement tool for the responsible of municipal waste management or the business manager/entrepreneur/researcher to assess how well the CEPM service is doing in the context of a CE, allowing their companies/ municipalities to estimate how advanced they are on their journey from linear to circular. In the D1.3 Sustainable Assessment Models, the KPIs that the CEPM will use have been defined, as follows:

Table 5. Circular Economy Module KPIs

Objectives	KPIs
Reduction of the municipal waste generation	T1. Average reduction of municipal waste generation (kg/year)
To eliminate the primary waste deposited into landfills and to maximize waste re-use and recycling	T2. Increase of the average of urban waste sorted
	T3. Decrease of the average of waste sent to final disposal
	T3.1. Dry recyclables to primary destination (%)
	T3.2. Organic recyclables to primary destination (%)

	T3.3. Residual waste to primary destination (%)
To improve the integral waste management service	E1.1. net GHG emissions (kg CO2/ kg of waste) collection & treatment
	C1.2. Treatment canon (€/ton)
	C1.3.1. Collection and Transport cost (€)
	C1.3.2. Final management cost (€)
	C1.3.3. Other management costs (€)
	C1.1. Budget applied to awareness and prevention campaigns (€)
	S.2.1. Number of workers (n)

7. Comments from external reviewers

7.1. External reviewer 1

DATE: 22/11/2017

Issue	Yes	No	Score (1=low to 5=high)	Comments
Is the format of the document correct?	X		5	
Does the format of the document meet the objectives of the work done?	X		5	
Does the index of the document Collect precisely the tasks and collect precisely the tasks and issues that need to be reported?	X		5	
Is the content of the document clear and well described?	X		5	
Does the content of each section describe the advance done during the task development?	X		5	
Does the content have sufficient Technical description to make clear the research and development performed?	X		5	
Are all the figures and tables numerated and described?	X		5	
Are the indexes correct?	X		5	
Is the written English correct?	X		5	
Are main technical terms are correctly referenced?				
Is a Glossary present in the document?		X		

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Partner: SOFTLINE

7.2. External reviewer 2

DATE: 24/11/2017

Issue	Yes	No	Score (1=low to 5=high)	Comments
Is the format of the document correct?	X		5	
Does the format of the document meet the objectives of the work done?	X		5	
Does the index of the document Collect precisely the tasks and collect precisely the tasks and issues that need to be reported?	X		5	
Is the content of the document clear and well described?	X		5	
Does the content of each section describe the advance done during the task development?	X		4	If I understood it right, this is still under development and will be completed in the future.
Does the content have sufficient Technical description to make clear the research and development performed?	X		5	
Are all the figures and tables numerated and described?	X		5	
Are the indexes correct?	X		4	The links on the lists refer the user to the beginning of the document. Some of them are not linked.
Is the written English correct?	X		5	Just need to look out for some words or typo errors. Marked with comments throughout the document revision.
Main technical terms are correctly referenced?	X		5	
Glossary present in the document?	X		5	The words in the text should be cross-referenced to the Glossary for a quick revision of the reader.

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7.3. External reviewer 3

DATE: 27/11/2017

Issue	Yes	No	Score (1=low to 5=high)	Comments
Is the format of the document correct?	X		4	Text seems to have wrong "margin" when opened in Google docs
Does the format of the document meet the objectives of the work done?	X		5	
Does the index of the document Collect precisely the tasks and collect precisely the tasks and issues that need to be reported?	X		4	Figure 1: API's linked to Serious Games (Virtual City) incorrect, as there are no plans to import data directly into the game. The game will not be a simulation with the precision of the data. The focus will be the principles of CE in waste management. Relevant data, f.ex knowledge base or best practices, can be integrated into the game, but this will a one time event and will not be dynamic.
Is the content of the document clear and well described?	X		4	Page 8: User Needs: 2,3,4,5 (what do these numbers refer to?)
Does the content of each section describe the advance done during the task development?	X		5	
Does the content have sufficient Technical description to make clear the research and development performed?	X		4	
Are all the figures and tables numerated and described?	X		5	
Are the indexes correct?	X		5	
Is the written English correct?	X		5	
Main technical terms are correctly referenced?	X		5	
Glossary present in the document?	X		4	Section 3. NCBM? Not defined in glossary

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