PROMOTION OF
PUBLIC PROCUREMENT OF
INNOVATION
FOR RESOURCE EFFICIENCY AND
WASTE TREATMENT

DELIVERABLE 2.3

Common report on targeted improvements

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Authors	Ylva Alonzo Berit Gullbransson Fredric Norefjäll Maria Thomtén		
Reviewers	Project partners		
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Content

1. INTRODUCTION

1.1 THE PPI4WASTE PROJECT

PPI4Waste is based on an integrated approach that will permit to define needs, targets, improvement of functional performances and complete the cycle of preparation activities to implement Public Procurement of Innovation (PPI) processes in the waste sector, while making know-how on procedures for procurement of innovation widely available through the establishment of a purchasing community, making state-of-the-art solutions accessible to a considerable potential number of procurers, capacity building and assessment of feasibility plan for uptake of PPI in the waste sector. The overall objective of this 30-month project, whose work plan has a concise structure supporting the workflow to achieve its main aim, is to achieve resource efficiency, sustainable waste management and sustainable consumption throughout Europe by increasing the use of public procurement of innovation through a structured coordination action of networking, capacity building and dissemination. The cornerstone of the project is to boost resource efficiency through PPI, on the basis of the waste hierarchy. The establishment of both the Purchasing Community and Interest Group in the first phase of the project permits to create critical mass and achieve all objectives towards the reinforcement of early acquisition of eco-innovative solutions for resource efficiency and waste management through joint or coordinated PPI processes.

1.2 WORK PACKAGE 2 'DEFINITION AND ASSESSMENT OF POSSIBLE NEEDS AND EMERGING SOLUTIONS'

The PPI4Waste Work Package 2 focuses on defining and assessing needs among public procuring organisations in charge of municipal waste management in the EU. Since municipal waste is primarily a public sector responsibility and as consequence of the large disparities between countries regarding the waste production and waste management situation, the PPI4Waste project will include activities to identify common needs between public sector organisations in Europe. The establishment of common needs will enable a large group of potential buyers to be formed, which is vital to ensure critical mass when collaborating on public procurement. In parallel, emerging solutions are identified and assessed. The objectives of the work package are to:

- Approach and define real Public stakeholders target challenges through the assessment of their needs and ambitions;
- Check if the needs can be met in by innovative products and/or solutions close to the market in order to uptake PPI.

In this work package, PPI4Waste partners set the path to identify the needs of public procurers, and the current state of the art of the emerging innovation in the waste sector. At this stage it is necessary to identify specific targets and strategies for waste management for participating buyers in the consortium, identify national schemes and draw a complete map of targeted improvements and possible emerging solutions so as to, in the next steps of the project, prepare contracting authorities to use PPI to lead innovation and meet the future challenges in the waste sector.

1.3 DELIVERABLE 2.3 COMMON REPORT ON TARGETED IMPROVEMENTS

1.3.1 DELIVERABLE OVERVIEW

This deliverable (D2.3), 'Common report on targeted improvements', is based on task 2.2 in the PPI4Waste Description of Work, 'Assessment of possible needs', that aims to define the common needs of solutions to the waste-to-resource challenges or system failures which are possible to solve with PPI.

The aim of the deliverable is to describe the overall methodology designed by the project consortium for the assessment of common needs and the identification of targeted improvements (the PPI potential for each of these needs).

Finally, the results from using this methodology - analysing agreed common needs and targeted improvements for the project partners - are presented.

1.3.2 RELATIONS TO OTHER DELIVERABLES

This deliverable is one of the core deliverables in the PPI4Waste project, representing the foundation upon which the future work of the PPI4Waste project is built.

The agreed common needs are the basis for all future activities within the project, and the design of the methodology for agreeing common needs and identifying targeted improvements correctly is therefore crucial.

The deliverable thus has clear links to other PPI4Waste deliverables, in particular deliverable 2.2 'Report on agreeing common needs' which is also related to task 2.2. Deliverable 2.3 focuses on the outcome of the process described in D2.2, and will thus go further into detail on the common needs agreed by the project consortium. In parallel to the analysis of possible needs, possible emerging solutions will be identified in task 2.3; 'Cross-border state of the art', resulting in deliverable 2.4; 'State of the art of emerging solutions'. This deliverable has the objective of supporting the identification of innovative solutions with the highest potential in PPI. Input from task 2.2 is essential for task 2.3, since the review of existing innovative solutions must begin with the identification of common needs.

2. THE ROLE OF PPI – IN THE PPI4WASTE CONTEXT

The PPI4Waste project explores mechanisms through which barriers to innovation and procurement of innovation can be overcome. As recognized by the EC[1], circular economy systems aim to keep the added value of products for as long as possible and to eliminate waste. Altering the present linear model into a more circular economy requires fundamental changes throughout value chains. This transition would not only imply innovative technology, but rather full systemic change including organisation, society, finance methods and policies. A major challenge for such a change is related to waste; in particular to the landfilling of municipal waste. The European Commission has adopted an ambitious Circular Economy Package, which includes revised legislative proposals on waste to stimulate Europe's transition towards a circular economy which will boost global competitiveness, foster sustainable economic growth and generate new jobs.

The revised legislative proposals on waste set clear targets for reduction of waste and establish an ambitious and credible long-term path for waste management and recycling. Key elements of the revised waste proposal include:

- A common EU target for recycling 65% of municipal waste by 2030;
- A common EU target for recycling 75% of packaging waste by 2030;
- A binding landfill target to reduce landfill to maximum of 10% of all waste by 2030;
- A ban on landfilling of separately collected waste;
- Promotion of economic instruments to discourage landfilling ;
- Simplified and improved definitions and harmonised calculation methods for recycling rates throughout the EU;
- Concrete measures to promote re-use and stimulate industrial symbiosis - turning one industry's by-product into another industry's raw material;
- Economic incentives for producers to put greener products on the market and support recovery and recycling schemes (eg for packaging, batteries, electric and electronic equipment's, vehicles).

Innovation procurement is a tool for public authorities to obtain innovative solutions adapted to their specific needs. In Public Procurement of Innovative Solutions (PPI) the procuring organization acts as launching customer for innovative goods or services which are not yet available on a large-scale basis.

Innovation is about finding new and better ways of doing things. A better-designed product or system can improve efficient waste handling while reducing environmental impact. Some innovations will save costs immediately for public authorities, whereas others will require an initial investment in order to realize longer-term gains. In a time of decreasing public budgets, innovation can facilitate the delivery of vital infrastructure and services. This is important in

[1] European Commission. Towards a circular economy: A zero waste programme for Europe. COM(2014) 398 final.

considering the role of procurement in the waste chain. Methodology for the assessment of possible needs and identifying targeted improvements

The uptake of PPI to meet the EU waste challenges within the scope of the innovation system of the waste management chain requires finding the targeted improvements in order to know if the whole innovation system is ready and if it is possible to uptake PPI to implement innovative solutions.

The methodology used is defined by, and based on, situations that require implementation of collaborative public procurement initiatives that would efficiently tackle the EU waste challenges, identifying and assessing priority targeted needs in the scope of municipal waste treatment.

One of the first project activities for PPI4Waste consortium partners was to support a number of contracting authorities to define the common needs of solutions to the waste-to-resource challenges or system failures that are possible to solve with public procurement of innovation. The process and methodology used for this purpose has been developed on the basis of partner's knowledge and experience on waste and public procurement and inspired from the experience acquired on waste and procurement in the EU projects Ecopol, Wastecosmart, Probis and INNOCAT. This task is labelled: Assessing the "Common needs".

The methodology for the assessment of possible needs and identifying targeted improvements should be seen as one process, but are described more in through its two individual parts in the coming sections. The full process is visualised in figure 1.

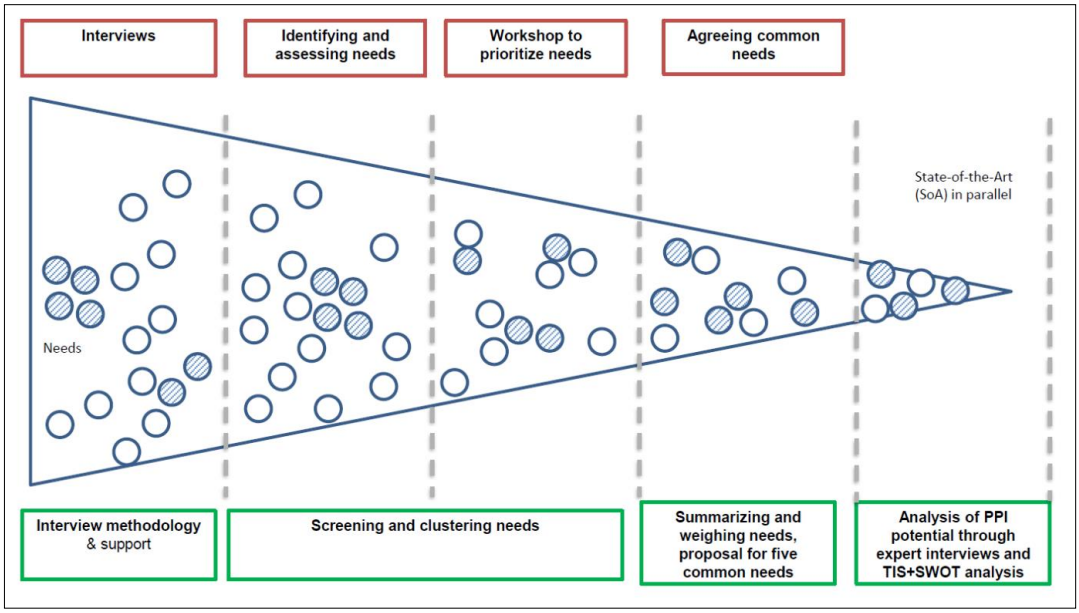


Figure 1: A visualisation of the methodology for agreeing common needs as well as identifying targeted improvements. The activities in red boxes have been conducted by all PPI4Waste consortium partners while the activities in green boxes have been the responsibility of task leader SP. The dotted lines symbolize toll gates for this task.

3.1 Assessment of possible needs

The assessment of possible needs related to the waste management chain among contracting authorities within and outside the consortium has resulted in the agreed common needs presented in chapter 4.1. The methodology used has already been described in detail in PPI4Waste D2.2. However, in order to provide a comprehensive picture of the full process of this task, a brief description of the methodology for assessing needs is necessary.

The methodology for assessing needs supports the identification of needs faced by contracting authorities in different countries, regions and cities in order to support them to describe and understand their situation and challenges regarding municipal waste management. The identified needs are core needs of the contracting authorities that can be related to societal challenges, among others. The methodology used has also supported the identification of drivers behind the needs.

The common needs targeted in the PPI4Waste project are in focus for all subsequent activities and deliverables during the development of the whole project. In order to create an essential basis for PPI initiatives which will allow an effective demand-side intervention, the methodology developed for assessing possible needs has been designed considering the following aspects:

- Orientation on societal needs and waste management activities in the area of waste-to-resource
- Analysis of the core needs of solutions for the contracting authorities
- Analysis of the drivers behind the participating buyers needs for innovative solutions in order to sort out what is possible to procure.

These needs must be translated into practical concrete needs that can be procured. There are many drivers and influences on the process of identifying needs in the direction of the policy maker's ambitions.

In the process of assessment of common needs, , four main areas/drivers/channels have been analyzed in order to define the needs for procurement of innovation:

- Mission or Policy articulating demands on restraints directly influencing needs. This is the local interpretation of the EU waste challenges.
- Market initiated development and opportunities creating needs for change.
- Needs discovered in evaluating past and current procurements and situations
- The process of defining and finding internal management improvements.

In the first stage of the assessment of needs, partners interviewed contracting organisations[2] to identify current and real needs for innovative solutions in the waste management chain, resulting in close to 100 needs in total. In this process the waste hierarchy has been used as the reference and a way to interpret and rank needs related to the EU waste challenges.

[2] A description of the interview document can be found in D2.2. Further, a list of the interviewed organisations can be found in Appendix I of the same deliverable.

The common needs were also prioritized in accordance with the waste hierarchy including prevention activities, to focus the needs identification under the circular economy approach.

At this stage a method to analyse, cluster and prioritize different needs was developed by SP. A pre-analysis of the needs was conducted including a screening, an estimation of whether the needs are procurable or not, and a clustering of the identified needs. The needs were clustered according to the steps in the waste chain and also according to overarching topics such as awareness, policy, support systems etc. Following the pre-analysis, a full analysis and prioritization of needs was conducted through a workshop format involving all consortium partners. The analysis aimed to prioritize the needs by selecting the most important ones, and also included the crucial aspect of assessing if the needs are procurable or not. To this end, a map with a spider graph[3] was used.

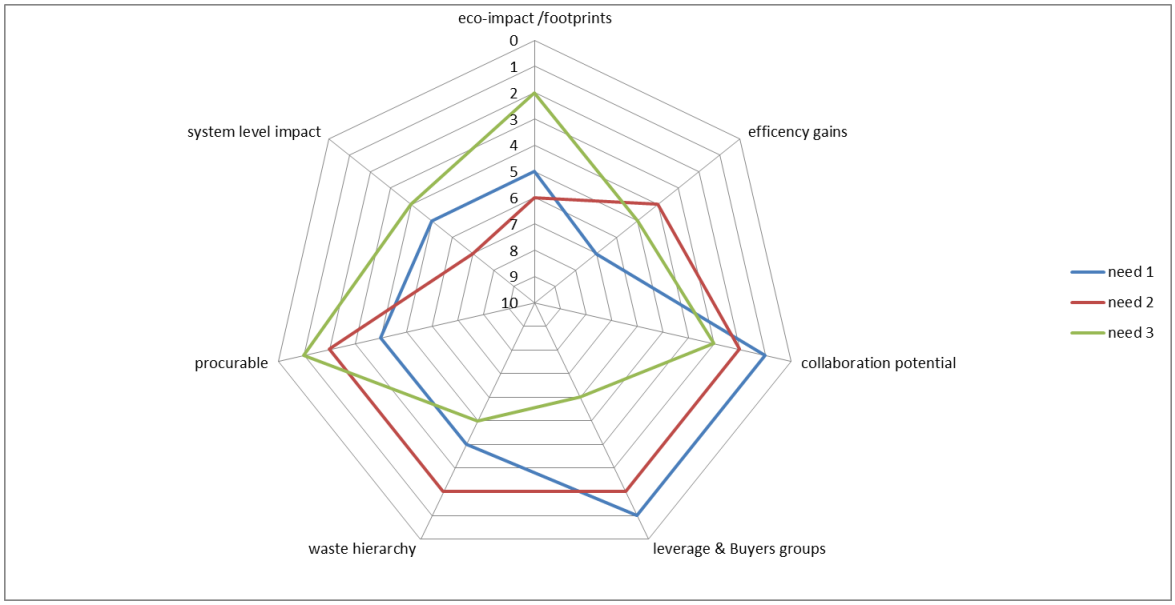


Figure 2: Spider graph – needs analysis visualization

The model was used to visualize the impact of different needs relative to each other. On each axis in the spider graph there is one aspect of the need. The scale of each axis is 0-10 and the plotting of each need is a very rough estimate only in purpose to compare the examples at hand. As an example three needs prioritized from the interview might have a similar impact in the spider graph model and the visualisation helps in finding the aspects that differ. This helped focus discussions and the prioritization of what needs to regard when selecting the common needs.

In the workshop, with the purpose to find strong "common needs", the partners and expert were asking questions and assessing how strong needs were relative each other. Some examples of questions that were used:

- Is it possible to procure a solution to the need? Is procurement only a part of the changes needed for the solution?

[3] See Appendix II of D2.2.

- Are there interest and the right conditions for collaborative initiative? Within the project? Outside the project?
- Is there leverage from buyers groups potentially interested in meeting the needs? Is this interesting for a larger group of buyers?
- On which level of the waste hierarchy is the need? What change could the solutions create? What size and impact is probable?
- How will the solutions to the need reduce eco impact? Will it reduce environmental footprint? Is this only one type of waste? Is it waste with a large footprint? Other important environmental improvements?
- How big are the efficiency gains or savings if the need is met? What is the impact on more efficient waste handling?

Through this process, project partners agreed on selecting five common needs that might be met by procurement activities. These common needs are presented in chapter 4.1. In parallel, state- of –the - art solutions to the needs are investigated to find out if there are no acceptable or comprehensive solutions to the five needs on the market.

3.2 Identifying targeted improvements

PPI is a tool to find solutions to a specific need when there is none available on the current market. In order to identify targeted improvements, there is a need to analyse if there are plausible innovative solutions available to meet the five common needs. Innovative solutions can be found beyond the current markets, among what is almost available. There cannot be a search for “innovative” solutions directly, since there is no information on exactly how these might look or how they can meet the common needs. The project has therefore taken the approach of studying the conditions for innovative solutions to the common needs to emerge in regional markets. A PPI process might only bring a solution to the need in case the right conditions exist.

These types of questions can be answered by using innovation systems analysis coupled with SWOT analysis to study the potential for PPI in each of the five targeted areas of common needs agreed by the PPI4Waste consortium. The study highlights blockings and possibilities for innovation and change for each need. The final result pinpoints the elements needed to enable a change of the current situations (implementing a solution to the need) through PPI – the targeted improvements. Input to the study has been gathered through interviews with members of the PPI4Waste expert group, based on the TIS approach. An analysis (including SWOT analysis) of the answers results in synthesis on targeted improvements.

3.2.1 INNOVATIONS SYSTEM APPROACH

Innovation System analysis is a method for analysis of the innovation system that encompasses all actors, institutions and physical parts that influence the development, diffusion and use of a technology or a technological field (see figure 3 below). Among these structural elements, a defined set of processes occurs which creates the dynamics of the innovation system. These processes are called innovation functions; processes that need to take place to ensure that a system performs well. By analysing the occurrence of these processes, conclusions can be drawn on what actions are needed in order to develop or change the innovation system further. Applying the TIS-approach in an analysis of the five common needs in PPI4Waste will enable the identification of possibilities for change of the current situation. A special focus will be put on the role of procurement of innovations as a likely trigger/enabler for solutions to the needs to emerge.

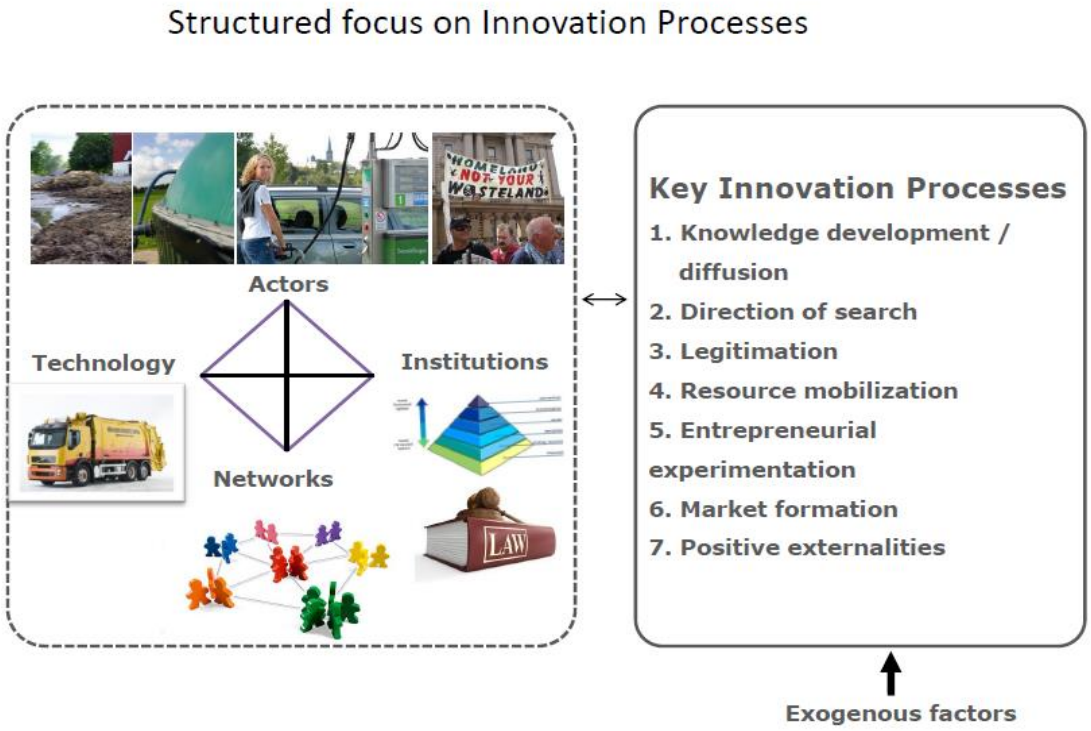


Figure 3: Structure of adapted TIS

3.2.2 INNOVATION SYSTEM INTERVIEW FORM

SP has developed an interview template based on the innovation system approach that can be found in Appendix II. This template has been used as a basis for semi-structured interviews with the PPI4Waste expert group. The interview template is mainly applicable to waste experts and PPI experts with knowledge on waste management.

The first part of the template relates to the structure of the innovation system and the implementation of a new solution in order to change the current situation. In this part, Actors and networks and Institutions are important factors affecting the outcome. The second part of the interviews relates to the innovation system processes and investigates if there are solutions available to solve the needs. The dynamic innovation processes to be studied through the

interviews are Entrepreneurial activities, Market, Guidance for search[4], Resource mobilization, Knowledge development and dissemination[5], Creation of Legitimacy and Policy. By studying the functions and structure of the innovation system, and the interaction between them, barriers and opportunities for innovation and change can be identified.

3.2.3 SWOT ANALYSIS

The results from the interviews were collected in a SWOT analysis table. The idea behind the SWOT analysis is to evaluate the **S**trengths, **W**eaknesses, **O**pportunities and **T**hreats involved. With this information it is possible to uncover opportunities to exploit, and threats can be managed and eliminated. By looking internally and externally, a strategy that can help to improve the current status of the needs can be crafted. The SWOT analysis matrix is illustrated in Figure 4.

Figure 4: The SWOT analysis matrix.

In this particular context, the SWOT analysis has been applied to analyse whether or not a PPI is the right tool for solving a need or not.

3.2.4 LEVEL OF SYSTEM READINESS

This matrix is a way to support the evaluation of the innovation system capacity and especially in this case the possibility to perform a PPI. Both the impact on the structure and the dynamics of an innovation process are taken into account in this analysis. The matrix also shows the possibility to assess if a PPI can be done by the public organization and if it can influence the market and the society. The matrix is an overview of the system readiness and shows where interventions are needed in order to enhance the system readiness. The model gives an indication of what's most important and should be further analyzed in order to reach the targeted improvements. This understanding can be used in the strategies for procurements of innovations.

The headlines in the matrix are referring to the different interview questions. The different colors indicate the level of existing important key processes. The red indicates where it's most

[4] The term "search" refers to a search for solution to the needs, either in companies or in the public. Research is one example, but search is wider than only research.
[5] The term "knowledge" refers to a public knowledge, not specific research.

important to focus in order to be able to perform a PPI. The red color can sometimes indicate "low hanging fruits" to pick to be able to start and sometimes the absolute necessary step to let it all happen. This method is partly based on a subjective analysis from the outcomes of conducted interviews and the outcome varies depending on the knowledge of the interviewer and the interviewed person. A generic example of this visualization is shown in figure 5 below.

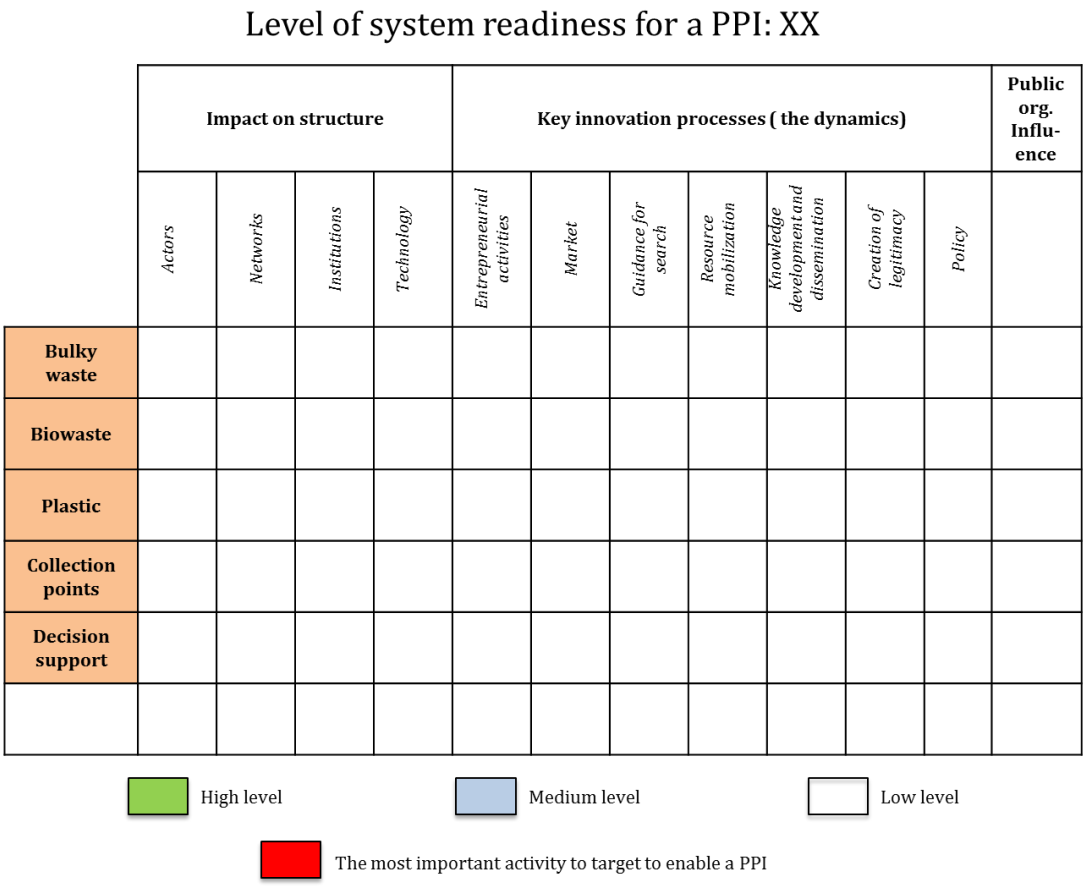


Figure 5: Level of system readiness for a PPI

Both the impact on the structure and the dynamics of an innovation process are taken into account in the analysis behind the matrix. By combining the TIS analysis with a SWOT analysis, the level of system readiness for a PPI and thereby the targeted improvements can be identified.

4. IDENTIFYING TARGETED IMPROVEMENTS

4.1 AGREED COMMON NEEDS TO ANALYZE

The following needs have been agreed on by the PPI4Waste consortium through the methodology described in previous chapters:

1. Bio waste management;
2. Plastic separation;
3. Bulky waste management;
4. Separate collection for specific waste streams/development of collection points;
5. Decision support system for waste management.

These five common needs are further presented in the following sections through a short description of the need. In appendix II a longer description of each need is done together with the main underlying drivers, and the rationale for the choice. Working with these common needs also gives to the different procurement organization a possibility to act on different waste management levels, starting with the same information on state-of-the-art.

4.1.1 BIO WASTE MANAGEMENT

In short, this need is how to collect bio waste separately, and how to treat and use bio waste more efficiently. According to the round of interviews conducted with contracting authorities, this need is often related to collection, treatment and use of bio waste. This includes specific issues such as how to increase the amount of bio waste that is collected, or how to establish a separate collection system (targeting a wide public or specific segments). Overall, there might therefore be a need for decision support on a system level such as multivariable decision-making which would indicate feasible solutions for a specific context. Other necessities that were raised in the round of interviews include a will to increase the treatment capacity of bio-waste and increased local composting. In addition, a treatment scheme for organic waste which would minimise the impact while having a realistic cost of the recovery was mentioned.

Main drivers

Legislation on different levels is a key driver for this need, such as EU[6] or national legislation. An example of a national legal requirement would be to ensure the compliance of sorting, preparation for reuse, recycling and valorisation objectives[7]. Other examples are national laws regulating the disposal of waste by landfill or biodegradable waste. The EU waste hierarchy and the White Book on bio waste are other drivers mentioned in interviews.
Another driver that has been mentioned in interviews is the will to increase composting production. There are also organisational objectives acting as drivers to this need.
Overall, the final product from the treatment process will act as a driver for what process and equipment that is needed. For instance, if biogas should be upgraded and used as a fuel or for electricity production, this will affect the need.

[6] Directive 1999/31/EC on the landfill of waste, and Directive 2008/98/EC on waste (waste framework directive)
[7] An example from the Spanish context; Law 22/2011 of July 28th, of waste and polluted soils. This legislation is the national implementation of the EU waste framework directive.

Rationale for the choice

SP has assessed the cluster of needs associated with bio waste management (with a specific focus on collection and treatment), and the rationale for choosing this need as one of the PPI4waste focus needs is:

- Respondents in interviews - including the procuring partners of the PPI4Waste project - have considered this need to be of importance.
- During the PPI4Waste needs workshop in Gothenburg[2], this need was rated high from numerous aspects. Thus, a solution to the need would have an impact on the aspects we found important for the project's targets, specifically on eco-impact reduction and efficiency gain. The need is also related to a high level in the waste hierarchy.
- The need can be framed and structured for a TIS analysis.
- Needs related to bio waste management (especially collection and treatment) are very likely to be important for the purchasing community.
- Innovative solutions to the need can be procured. It can also be handled from different starting points and with different ambitions (different countries or regions).
- The need is easy to communicate.

4.1.2 PLASTIC SEPARATION

The need relates to separate plastic from the other waste streams as well as sorting different types of plastics, with the target to use plastic from waste as a recyclable material.
The results from the round of interviews with contracting authorities have indicated that separation and sorting of plastic need to be improved. In general, material recovery is perceived to have some flaws. As an example, the separation step in the waste management chain in some countries hasn't changed for decades. Improving separation and sorting would increase the rate of recovered material. In some countries, according to conducted interviews (more information in Appendix III), mechanical sorting of different types of plastics is not satisfactory due to poor sorting rates. Thus, large amounts of plastic are incinerated or put on landfill.

Main drivers

The most evident driver behind the need is to increase the recycling rate of packaging waste (which also includes plastic packaging) according to the EU directive[8] on packaging and packaging waste, and according to the Action Plan for Circular Economy[9]. Other drivers are regional waste plans and overarching environmental aspects.

Rationale for the choice

The rationale for choosing this need as one of the PPI4waste focus needs is:

- This was highlighted as an important need in the round of interviews (that also includes one of the procuring partners in PPI4Waste).
- The need was rated high in the PPI4Waste needs workshop in Gothenburg[2]. In the workshop, the need was estimated to be on a relatively high level in the waste hierarchy

[8] Directive 94/62/EC of 20 December 1994
[9] http://ec.europa.eu/priorities/jobs-growth-investment/circular-economy/docs/communication-action-plan-for-circular-economy_en.pdf

and solving the need would have a considerable eco-impact reduction. In addition, it was estimated that there is interest and conditions for collaboration on this need.
- The need can be subject to a TIS analysis.
- A need related to plastic separation is considered relevant for the purchasing community.
- It is possible to procure innovative solutions to the need, and the need is independent of the starting points and ambitions of a country or region.
- The need can easily be communicated to a wide audience.

4.1.3 BULKY WASTE MANAGEMENT

The need relates to the management of bulky waste as part of a circular economy.
For instance, respondents in interviews with contracting authorities have mentioned issues related to pre-treatment of bulky waste, new systems for bulk waste treatment and sorting facilities for bulky waste. A specific example that was raised was that the collection and processing of mattresses[10] should be increased.

Main drivers

The drivers behind this need are diverse. Environmental impact, financial compensation and necessity for improvement are some examples from the round of interviews. An increase of material recovery and minimization of the deposit is another driver (the latter has been highlighted by partner Mancomunidad Del Sur).
Legal requirements have only been mentioned at national level[11], but are also relating to new Proposal[12] of Directive amending Directive 2008/98/EC on Waste, inserting bulky waste in municipal waste including white goods, mattresses and furniture.

Rationale for the choice

The rationale for choosing this need as one of the PPI4waste focus needs is:
- The need has been scored as important from many respondents in the interviews. In addition, it is related to the needs of the procuring partners of the PPI4Waste project.
- The need related to handling of bulky waste was considered as important in the PPI4Waste needs workshop in Gothenburg. It particularly scored high in the aspect of eco-impact reduction and efficiency gain.
- A TIS analysis could be conducted for the need.
- Needs for developing handling of bulky waste can be a relevant topic for the purchasing community.
- It is possible to procure innovative solutions to the need, and the need is independent of the starting points and ambitions of a country or region.

[10] An example from the Netherlands, Sweden and the US.
[11] The Spanish Law 22/2011 of July 28th, of waste and polluted soils, and the “Royal Decree 1481/2001” of 27 December regulating the disposal of waste by landfill.
[12] file:///C:/Users/afurphy/Desktop/cellar-c2b5929d-999e-11e5-b3b7-01aa75ed71a1.0018.02-DOC_1.pdf

- The need can easily be communicated to a wider group. For instance, the need for increased collection and processing of mattresses[8] is easy to grasp and can thereby be communicated as an example.

4.1.4 SEPARATE COLLECTION FOR SPECIFIC WASTE STREAMS/DEVELOPMENT OF COLLECTION POINTS

This need deals with how to sort waste at collection points and to make collections points as efficient as possible for the different purposes they serve in the waste management chain. The design and functionality of collection points can facilitate efficient waste collection and sorting. The collection points must also be efficient in the scope of their role in the waste management chain. As seen in the round of interviews with contracting authorities, this could include specific questions such as number and location of collection points, how to design collection and sorting, what waste to compact or pre-treat, how to engage and communicate with the public about waste management, when and how to use mobile collection points, how to include up-cycling, re-use or recycling schemes or business models in the collection points.

Main drivers

A key driver is to ensure the fulfilment of separate collection objectives in line with the current legal requirements, as legislation on different levels – such as EU law[13] or local waste management plans – specifies that solutions for separate collection of packaging, paper, etc. shall be set up. Collection points can also be a part of fulfilling other legal needs to collect and separate specific types of waste streams, like hazardous waste, bulky waste, complex waste, etc. Another driver for this need is the will to improve the separate collection of specific waste streams in a specific area. In addition, better security and health has been mentioned as a driver in the round of interviews.

Rationale for the choice

The rationale for choosing this need as one of the PPI4waste focus needs is:

- The need for developing collection points is scoring high in importance for many of the respondents in the interviews, including one of the procuring partners of the PPI4Waste project.
- This need scored high at the PPI4Waste needs workshop in Gothenburg. This means that a solution to the need would have a large impact on aspects that have been found important for the project's targets. In particular, the need was estimated to be on a high level in the waste hierarchy, and a solution to the need would have a high eco-impact reduction and efficiency gain.
- The need can be framed and structured for a TIS analysis.

  It is possible to procure innovative solutions for this need. It can also be handled from different starting points and with different ambitions (different countries or regions).
- The need is easy to communicate.
- This need is interesting since it can connect important European focus areas such as digitalization and waste and resource efficiency.

[13] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008

4.1.5 DECISION SUPPORT SYSTEM FOR WASTE MANAGEMENT

The core need is to take informed decisions of where to sort in the waste chain. There is a need for IT systems to support decision-making process and continuously improve the efficiency in sorting (in the waste chain) in the local context.
Aspects to include in the multi criteria decision making can for instance be:

- LCA
- Logistics
- Transports
- Local conditions, population density, city/rural, distances, etc.
- Types of waste(including household and green waste)
- Types of collection point/methods/bins possible
- Health and environmental aspects, noise, smell, etc.
- Need for separation, compacting, dehydration, etc.
- Efficient use of the public to transport and sort waste in a system perspective
- Possibility of valorisations and payments for handling of waste fractions like:
    - Plastic
    - Bio
    - Glass
    - Paper
    - Etc.

The need for IT system decision support can be illustrated in looking at the bio waste sorting need as an example of a multivariable decision making that could benefit from calculations and statistical comparisons of alternative solutions and best practices.
Other IT solutions that are somewhat related to this need and that were mentioned in interviews with contracting authorities are;

- The development of citizen involvement systems
- Use of applications to facilitate control and improvement of the services
- Integrated control/alert systems for the management of container collection in the streets.
-

Main drivers

A main driver for the IT solutions mentioned above is modernization and innovation to optimize available resources. Another is to improve control and management of waste collection services, alongside the development of evaluation systems of quantity and quality of waste generated and delivered to the different collection services that permit redesign of communication campaigns, collection systems and treatment plants.

Rationale for the choice

The rationale for choosing this need as one of the PPI4waste focus needs is:

- This need was rated as very important by respondents in the interviews.
- The need for IT solutions was scored as relevant in the PPI4Waste needs workshop in Gothenburg. A solution to the need was rated particularly high in efficiency gain.

- The need can be framed and structured for a TIS analysis.
- Needs for developing a support system can be relevant to the purchasing community.
- It is possible to procure innovative solutions to the need. It can also be handled from different starting points and with different ambitions (different countries or regions).
- The need can be communicated to a wider audience.

4.2 Conducted TIS-based interviews

In order to highlight existing barriers and possibilities to go through with a PPI within the waste management area in Europe, experts within the area of waste management was interviewed and not experts responsible for public procuring. Appendix III represents the Interview material, both the interview document for the expert group and the interview questions. Many of the experts interviewed chose to speak in a more general way of all the identified five needs, which made it difficult to discuss specific conditions within one or several of chosen needs. Although it was not possible to go into details linked to chosen needs, the interviews have provided a good picture of the situation in each country concerning the vital processes needed in order to perform a PPI. During those interviews where one or two specific needs where in focus, it was easier to determine if there is innovation system readiness. These interviews made it also easier to compare the level of state of the art and the knowledge and possibilities on the market that could cover the need of the procuring organization.

4.2.1 Dynamics essential for PPI-implementation

The interviews focused on finding out possibilities and eventual existing barriers for implementing the innovation as an outcome of a PPI within the waste management area; if there are changes needed to get a working innovation chain and if these needed changes and innovations are procurable. In order to find these possibilities / strength and theses barriers / threats, the interviews were based on ten different dynamics.

4.2.2 Summary of interviews

In appendix IV a summary of all interviews based on each dynamics / function is represented. It is important to take into account that each summary is a snapshot of the situation in the opinion of the interviewee and does not claim to be a complete picture of the situation in each country.

4.3 SWOT-analysis

All conducted interviews have been analysed with the SWOT-method. These SWOT-analyses are represented in appendix V. They have been applied to analyse whether or not a PPI is the potential tool in pushing the development in the waste management area. The table below describes main strengths and weaknesses discussing the different dynamics needed:

DYNAMICS / PROCESSES / FUNCTIONS	Strengths / opportunities	Threats / Weaknesses
Impact of change on the waste management chain	• Circular economy • Existing waste chains with closed looped	• Behaviors and attitudes need to change among citizens • Low political will • Lack of cooperation among different actors
Actors and networks	• Traditional actors and networks available	• New actors and platforms need to be created • Traditional actors might block new ideas • Lack of new actors for example from the IT, eco-design • Each need has different key actors: this might complicate the picture
Institutions (Legislation)	• EU legislation • Standards with higher demands available	legislation from other areas not synchronized with targets in waste related legislation • Citizens habits and behaviors • New fiscal measures are needed
Entrepreneurial activities	• Technology avalable • Industrial symbiosis • Social Entrepreneurship	• Mind shift needed among waste management companies • Lack of new Business models • New companies have to enter the market • Lack of entrepreneurs • Low level of risk-taking
Market	• Fiscal measures incentives can help to form a market • Demand for high quality products from waste • Technically possible to retain high level resource quality • Revenue from recycled products to support the investment in facilities	• Lack of market for new waste products • Recycled raw materials are not competitive in terms of price
Guidance for search	• Important actors are ready to take the next step in developing innovative solutions • Local authorities collaborate with universities in research on waste • Public organizations are doing research on policy measures and economic incentives and cooperate with sector federations etc • Aggregated knowledge available	• Research needs to be disseminated all over Europe • Potential lock-in effect by dominant suppliers: low participation possibility for smaller actors. • Benchmarking usually focusing on “business as usual” solutions

	from actors such as OECD, the UNEP and ISMA.	
Resource mobilization	• Frontrunners have good financial situations in developing new innovative solutions • EU has supported waste facilities • Employment measures might develop the human resources	• More funding is needed to meet needs • The money should be transferred from collection to handling • Working with public procurements and innovation takes a lot of extra resources that most organizations don't have
Knowledge development and dissemination	• Public knowledge of waste collection is high • There is a continuous need to repeat information about recycling • Education programs in schools • Universities are more addressing eco-design issues	• Understanding about the waste issue is low • Difficulty to communicate in multilanguage countries/cities • The idea is to make recycling easier for the residents than it is not to recycle. • A huge challenge to communicate in an effective way with residents about their attitudes towards recycling.
Creation of legitimacy	• There is no real resistance to the waste issue	• Waste management is often seen as expensive • Lack of political will and legitimacy • Low interest within the municipalities • Waste management industry as a whole does not involve the end-users
Policy	•Examples of collaboration in value chain approach for specific materials • There is a large scope for innovation with existing policies	• Need for new sets of policies and instruments in order to reduce the material use • Need to think under circular approach to work with innovation • Need to involve the end-user • Lack of vision as "Zero waste" • Need for product regulation

4.4 Level of system readiness and Identified targeted improvements

The interviews confirm the projects basic assumption that PPI can play an important role for changes in the waste management chain. All countries want to change in the direction of meeting the EU waste challenges, but they start from different levels of development in the waste management area. The countries that are frontrunners have a clear and established focus on development towards a circular economy.

Looking at the common needs in this project there is also different development and ambitions for each need within the countries. In order to get a comprehensive view of each covered need the system readiness model has been used for each interview. All system readiness matrixes based on conducted interviews, are presented in appendix VI. Important targeted improvements are colour marked in red. Figure 6 is an example from an interview. The results from the interview matrixes have been compiled and analysed to get the results and targeted improvements in this section.

It is important to note that these interviews are snapshots for the purpose of learning, discussing and building methods and understanding within this project. They are not in depth analysis of the situation. If the method is used in a country for a specific need, it is the user that defines the selection and numbers of interviews to get the level of reliability needed.

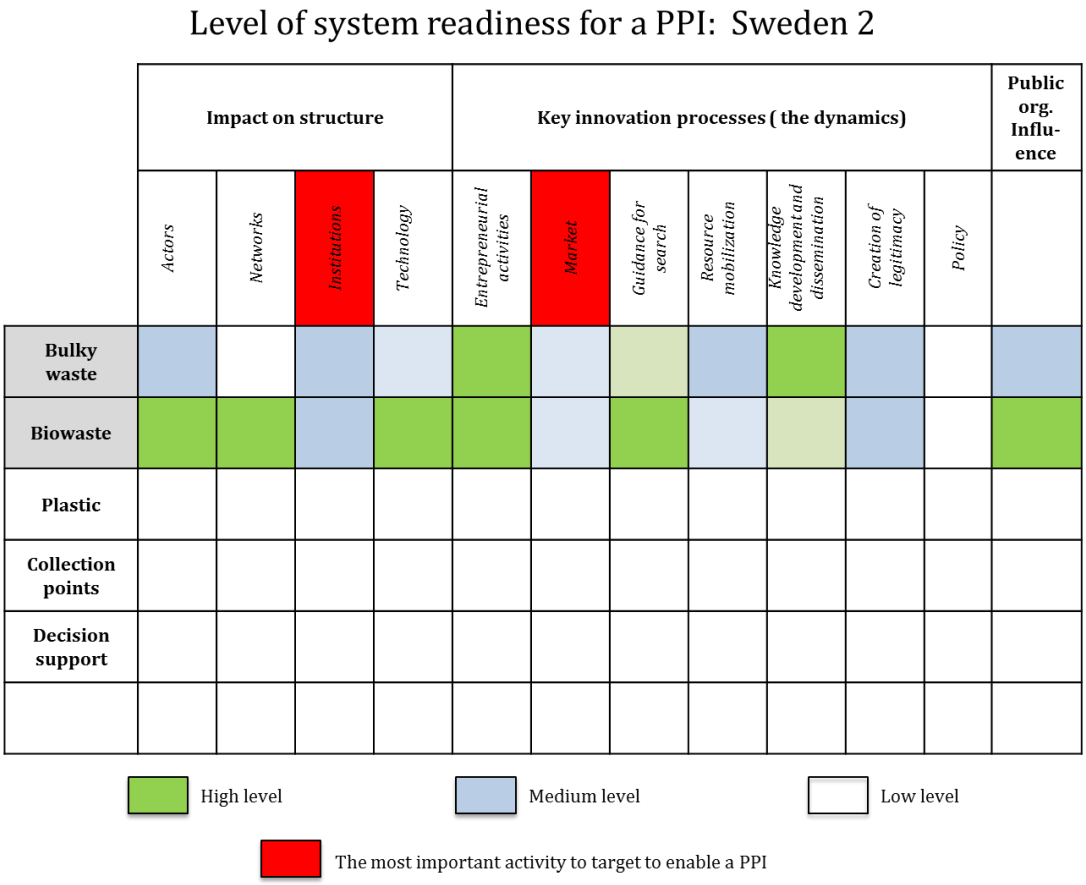


Figure 6: Level of system readiness for a PPI: Sweden 2

4.4.1 ACTORS AND NETWORKS

Actors and networks in this report are represented by the figure below;

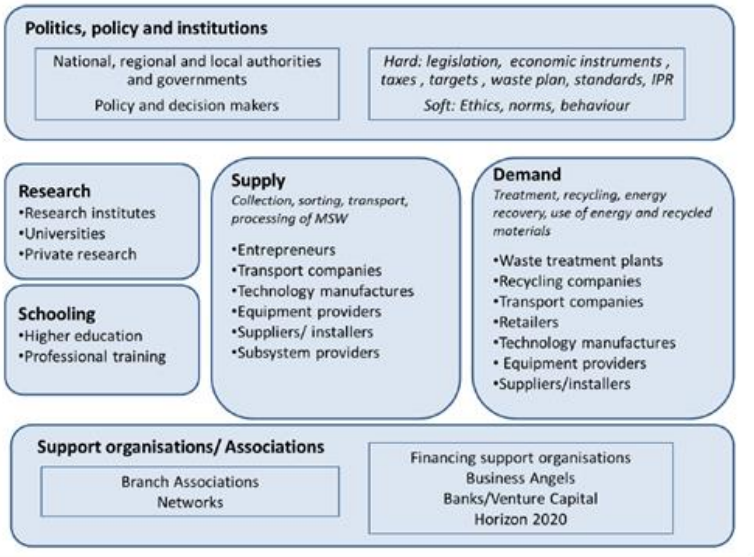


Figure 7: Actors and networks

The interviewed experts represent different positions in the waste management system and they have different ability and opportunity to influence the system. At European level all types of actors are represented. When comparing the innovation system for the common needs areas in this project with other successful innovation systems, some actors are missing.

In most cases cultural shift and changing attitudes are needed, as well as enabling of new business models. In developing waste management it's important to change behaviours and attitudes. Municipalities and waste management companies need to work close together in changing citizen's behaviours and attitudes.

A common challenge is the centralisation and size of the waste management solutions. As an example it is difficult to find new non-centralised solutions for treatment of organic waste (bio refineries, protein, composting etc.) and there is a lack of entrepreneurial actors.

In the waste management area there are some social entrepreneurs, especially in the area of Bulky waste, but there is an overall need for more actors and business models. For the creation of a circular economy networking and knowledge sharing have to increase, especially in and between value chains. Another example is the creation network of knowledge institutes for raw materials and material recovery from waste.

4.4.2 INSTITUTIONS – LEGISLATION

The EU legislation of waste management is in effect in most of the regions, but it is not always transparent how EU law becomes local legislation and how it is enforced. Some countries use legislation as a framework to impose higher standards and some countries delegate the legislation to regions or municipalities.

Other legislation that also influences the dynamics of the innovations system and the actors are laws on health, environment, hygiene and working conditions. In many countries the full costs for the waste management is not visible for the citizens.

Changing the tax system from residents to consumers and implementing differentiated waste charges for types of waste will make the cost more visible. Moving costs from waste handling higher in the waste hierarchy could save resources from ending up in landfills and save money for the public. This could also affect attitudes and behavior. "In the end it's all about the household economy".

4.4.3 ENTREPRENEURIAL ACTIVITIES

Entrepreneurial activities mean existing companies and/or entrepreneurs offering promising innovative solutions and technology options as well as new entrepreneurs entering the waste management area. There could also be companies leaving the market as a result of new innovations.

Waste management companies need a mind shift and open their business proposals from only working with collection of waste towards guiding their clients in enhancing the value of waste on one hand and find new markets for recycled materials on the other hand. If waste collection companies don't follow the development in this area they could lose market share if their clients sell their waste directly to another company working with recycling.

Examples of new entrepreneurial activities are; creation of platforms to match companies that could use one another's waste streams (industrial symbiosis), product-service combinations, 3D-printing as a way of designing products in a decentralized way - this can boost local products and generate less transports.

There are consultancies and small companies that develop innovative advice and services in waste management, but the overall sectors seems to be conservative and slow to adapt to circular thinking and circular business models.

Medium sized enterprises are supporting innovative development within the waste management area to a certain extent. They do cooperate concerning recycling and suppliers to recycled products and exchange and engage with universities in development.

There is a general need for new actors and entrepreneurial and innovative companies who could bring in new solutions and disruption to the business as usual scenario.

4.4.4 MARKET

If an innovative solution or innovative product would be launched to develop one of the identified needs within the waste management area, this dynamic discuss who would take the lead to make sure there will be a good market present for the future solution (public/private/other?). This dynamics also affects a potential need of a specific product, a need to form a new market and in that case if a PPI could support the development of this new market. Potential barriers could be tax reduction, or an insufficient demand for the product or material remaining from a plastic sorting machine.

The first market is the market for solutions to waste management challenges. The second market is the market for products or materials from waste.

The first market is mainly focusing around technical and logistics solutions to waste handling, but the possibilities for a second market heavily influence the opportunities and choices in procuring and implementing waste management solutions.

Generally the private companies source and develop new solutions without assistance from the public sector. Investing in high quality recycling can be expensive, and may not be competitive in the market, unless it can retain as much of the resource quality as possible. Therefore household/municipal waste can be less interesting for resource recovery if there is lower quality or lower percentage of the recyclable material.

There is not a big market today for new products from waste, but there is a large potential. The market is changing from using bio waste as heat generation, towards refining fuels, towards production of high quality products as proteins or compost for local urban agriculture.

A supporting action that would be appreciated is fiscal measures for opening the biowaste market would come at a European level.

In some areas like the plastic recycling area it can be lack of competent actors, in others like bulky waste there is a challenge for available space and user involvement in the city or recycling station.

From the municipal perspective social entrepreneurship as a business model has a big potential as it is not only counting the cost of recycling but also regards waste management and user involvement in a social perspective. In the area of handling bulky waste there are examples of municipalities considering new perspectives and taking a larger responsibility for transportation, user involvement, re-use, learning and the employment situation.

4.4.5 GUIDANCE FOR SEARCH

The term “search” refers to a search for solution to the needs, either in companies or in public sector. Research is one example, but search is wider than only research. This dynamics includes the identification of actors and frontrunners controlling the search for solutions. One important factor is if the research that is conducted is in the same direction as the search for solutions to the chosen need supported by specific programs or policies.

There is a lot of interest in finding circular solutions and moving up in the waste hierarchy. There is not always the same interest in solving some of the issues of conflict between the new (theoretical) solutions and the established ways of handling waste. Re-using waste could trigger issues in health, environment, chemicals, risk and public opinion etc.

There are big differences between the needs. There are frontrunners in search for innovative solutions within bio waste and bulky waste, but their interest to innovate is driven by the need to improve efficiency, reduce cost and most often to achieve the legal targets.

There is a paradox of the strong actors in waste management being conservative and at the same time they are the ones engaged in research and testing and could be ready to take the next step towards circular solutions. Smaller actors try to find new business models and disrupt the traditional markets and at the same time most focus and fight to manage the everyday survival.

4.4.6 RESOURCE MOBILIZATION

Resource mobilization means financial resources for implementing a solution. It could be financial resources addressed to research/applications/pilot projects etc.

In the transition towards waste as resources there is a need for new financial solutions, especially to bridging the gap for new innovative SMEs to enter the sector.

Cities and municipalities spend a lot of money on collection waste, but for change and transition to a circular economy more investments are needed. An example is the need for investment in composting, sorting and biogas facilities.

Traditionally investments are focused on large facilities and not spread out over the value chain or over the different steps in the waste management chain. In some cases incinerators or biogas facilities have been built without supporting collection, sorting or logistics ending up in scarcity of input to the facilities.

In the broader economy there are funding opportunities for SME’s, but there is lack of specific waste related public funding, to support the private waste companies to encourage innovation within waste management.

There are sources of financial support from the European Union and it is important since public procurements of innovations initially take a lot of extra resources that most organizations do not have.
Waste management solutions that create jobs or support re-industrialization in Europe are easier to find funding for initial investments.

4.4.7 KNOWLEDGE DEVELOPMENT AND DISSEMINATION

The term "knowledge" is referring to the public knowledge. The importance is the general knowledge in terms of quality, quantity as well as basic or advanced level. For the innovation level the number of projects, research patents and articles are relevant. Actors that are active in these activities are relevant as well as if and how the knowledge is disseminated. One other aspect is if there are any competing messages disseminated for example recycling versus incineration.

In most interviewed countries, there is an active communication with the citizens in place. The communication, performed by all kinds of media, is driven by both public authorities and private waste companies. Public knowledge in waste management and sorting varies from good to poor. The public knowledge of waste collection is high in the front runner countries, but there is a need for continuous information.

For all countries interviewed it is important that in school children at all ages are educated in waste management. One important driver for innovation in a region or a country is strong research in universities and research institutes in waste management.
Public organisations are doing research on policy measures and economic incentives to stimulate change towards circular solutions and there is a need to disseminate existing research at European level in order to make new knowledge and results of research available in an easier way. There is a lot of aggregated information from organizations such as the OECD, the UNEP and ISMA.

University research within the waste area seems to focus mostly on technology and it's rather traditional. There seems to exist an emphasis in universities towards addressing eco design and minimization of waste rather than towards waste handling issues.

4.4.8 LEGITIMACY

This dynamics focuses on eventual resistance to implement an innovative solution as well as from where it is coming. There might be active lobbying powers in the system in relation to legitimacy, policy, direction of search and resources, and these might form new coalitions.
Communication of a public need or a future procurement might create legitimacy for the solution.

The main resistance for the development within the waste area is about costs. There is no real resistance to the waste issue. Nevertheless the interest within many municipalities is really low. It is important to express political will for good and innovative waste management in order to create change in the municipalities.

One problem is the compartmentalisation of cost in the usual municipal budget even if there are good examples that show that good solutions do not cost more. The cost for educating school children in sorting could lead to future savings or revenues from cleaner and sorted waste streams enabling value creation from waste.

Another challenge is to get waste management issues to be a part of the agenda for city planning and building. It seems difficult to create legitimacy for waste issues in relation to other societal needs in planning and investing.

4.4.9 POLICY

Policies and legitimacy are used to force changes towards an overall vision or goal in the region. The policy of using Innovative procurement can, for example, be seen as a strategic tool used in different degrees to drive innovation and market formations at different levels in the system.

There is a need for new sets of policies and instruments in order to reduce the material use and move towards a circular economy. This change concerns all actors; producers, consumers etc, and will also support the changes needed in the waste management sector.

There is also a need and a trend for product regulations and demands on products that are easier to disassemble. If this change could reduce for example all different plastic products to only a few, the waste stream would be easier to recycle and valorize.

With respect to PPI, the biggest opportunities would lie within the material chain approach which is based on a holistic view on materials and product throughout their life cycle. There are examples of value chain governance for materials that are becoming scarce or the raw material extraction is more expensive than “mining the waste”.

There is an important scope for innovation but it is not only a lack of policies, it is also about political leadership and how to. This is where the work and the change have to be done. There are different forms of procurement and innovation processes and they are all linear. One must dare to think more circular for working with innovation and also include the end user much more. More services development and business development are also needed; however, the PPI is easiest for the technology.

Today the changes in most countries are slow and incremental. There is a problem with too low set targets. In order to have transformative change in the waste management sectors the targets must me more radical. A quote from one of the municipalities illustrates this well. “When it comes to bio waste, the municipality that decided that all waste should be collected is a winner.

5 RECOMMENDATIONS

5.1 SYSTEM READINESS

In countries with long tradition working in the structured waste management area it is obvious that the knowledge among the citizens is high but to be able to reach the top level of hierarchy (circular economy) there is a clear need for attitude and behavioral change. Different approaches have been discussed during the interviews. New competences have entered the market such as philosophers and sociologists. Waste management is becoming a part of traditional educational areas such as design, social sciences, economy, technology and digitalization.

A crucial key factor to enable innovations and PPI is a clear policy and strategy from the national and sometimes regional authorities. Countries not having a supporting set up of policies hard as well as soft will have difficulties to enable a change and develop innovations.

Having knowledge, legislation and policies in place, available financial resources are also necessary; otherwise actors won't be able to take the risks that come along with innovation.

This study shows that the development of waste management in an innovative way does not rely only on new technology implementation, but rather on the total system, addressing all key aspects in the innovation system mentioned in the system readiness model.

Under a system perspective, which means including the whole chain from procuring to implementation, it is possible to get an idea of whether there is a potential for success in the implementation and the change needed. In order to achieve a successful PPI, both the procurement and the implementation have to be taken into consideration. If the implementation is successful the result ends up in a win-win situation for both supplier and procuring organization.

5.2 SYSTEM LEVEL IMPACT

Procurement has a significant role towards change with more system impact. This could be the case when new technology is introduced or new ways of collection, processing or treatments are implemented.

The system level impact of a PPI should be considered in the PPI strategy as it makes it easier to argue the cost or risk of a PPI, and enable cost benefit reasoning in the strategy. Considering the scope of the PPI therefore is one of the first considerations for the procuring organisation in order not to spend energy on solving a need with very small impact.

An important recommendation in finding targeted improvement is to focus on what is almost on the market. In most procuring organizations and procurement strategies this requires a focus shift from what is on the market to what is almost on the market.

Beyond the market readiness, organizational or social innovation is crucial in a new business model, which does not include only technology development.

As first customer, the procuring organization might need to find out why the solutions are not available and if it is something that the PPI process can handle.

If there is a strong procurable need, the PPI process could be one of the pathways to a solution. It is recommended to start with a strategy or a concrete project in search of solutions that includes multiple pathways towards acting as first customer. The choice of procurement tool depends on what is on the market or close to market and that will not be discovered until the market engagement and interaction. PPI should be used in the same toolbox as Pre – Commercial Procurement (PCP) and "innovations friendly" procurements (as Environmental Performance Contracts or Performance Based Contracts)

PPI should be used as a tool within the procuring organization as soon as the first market surveys indicate there are no solutions on the current market. There seems to be a need for capacity building in order to make PPI part of the procurement in most procurement organizations.

5.3 PPI IN A POLICY MIX

PPI is a policy instrument that can be used to meet needs and influence the innovation system. However it is not a standalone measure. Procurement as such should also be part of a larger toolbox of policy instruments used by the public to facilitate the first procurement of a new solution. The public can support research in the earlier TRL-levels; it can support the functions influencing the TIS, the procurement of the first solution, the activities supporting the niche development and the scale up of the solution in order to create a market.

In this perspective PPI is preferably a link in a chain and not a solitary activity. The use of PPI instrument as reoccurring function in facilitating innovations and act as a first customer should be part of the overall toolbox of policy instruments and it should be embedded in the procurement activities within the public organizations with the needs for solutions.

In order to realize the full benefits of a PPI, the public sector should include the niche management and scale up in the strategy. Acting as the first customer is the difficult part, but if the solution is not reaching more buyers, it is useless. The leverage of a plan for scale up and the creation of critical mass of buyers can facilitate the commitment to deliver innovative solutions.

The most leverage of procurement comes from using it in a policy mix. The procurement should be supported by changes in policy, organisation, awareness, capacity and other actions supporting the change. Procurement can also be a part in other actions made to change the waste management chain like outsourcing, re-organisation, product-to-service shifts, partnering and system changes.

The PPI process can also be used for a solitary need or as a way of meeting a societal challenge if there is very strong single need and the solution has big impact.

In considering if a mission-oriented PPI is the right solution, the organization should consider the market/technology readiness level, the buying power or scale up potential of the buyers for this specific solutions and the potential impact on the effectiveness of the waste management chain

addressed. In such a case, the PPI should also be used in combination with other economic, regulatory or subside instruments and the effect should be measured not only by the direct effect of the procurement, but also by the impact on the core needs driving the PPI process.

Analyzing the core societal need and the innovation system to find the role of mission-oriented PPI requires a lot of capacity building in the strategic and analytic work.

The benefit of this strategy is that not the whole procurement system of the organization needs to be on the higher level of making PPI procurements. It could be temporary elevated using “scaffolding” thinking in order to work for a single PPI action. The downside is that there might be no organizational learning or capacity building that lasts.

APPENDIX I

REFERENCES

European Commission. *Towards a circular economy: A zero waste programme for Europe.* COM(2014) 398 final.

Ecopol Background document

Directive 1999/31/EC on the landfill of waste

Directive 2008/98/EC on waste (waste framework directive)

Law 22/2011 of July 28th, of waste and polluted soils

Directive 94/62/EC of 20 December 1994

Royal Decree 1481/2001 of 27 December regulating the disposal of waste by landfill.

Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008

APPENDIX II

INTERVIEW MATERIAL

INTERVIEW DOCUMENT FOR EXPERT GROUP

This first part of the interview material, was sent to the experts before the interview in order to give them information on the PPI4Waste project and the intention of the interview.

Dear interviewee,

The PPI4Waste project explores mechanisms through which barriers to innovation and innovation procurement can be overcome, including an assessment of needs and their innovation potential. This interview document will be used to investigate the innovation potential of a number of common needs.

INVESTIGATION OF THE INNOVATION POTENTIAL FOR COMMON NEEDS

Innovation is about finding new and better ways of doing things. Some innovations are made by organizations in the process of changing the waste management chain. There are some needs that cannot be met by the organization and must be procured. If there are no solutions in the market that meets the need, an innovation is necessary. If there is a need to procure a solution that is not available in the market or that needs to be improved, there is room for making a Procurement of innovation. Public Procurement of Innovation (PPI) can lead to a sharing of the additional risks and costs involved in buying and using Eco innovative solutions and to a more rapid market uptake of such solutions. This is not to be mixed up with pre-procurement, where research is needed to find a solution.

*Currently, the waste management achievements by European countries with regards to European policies and trends vary in a broad range. In addition, barriers to public procurement of innovative solutions include the absence of cross-border coordination and lack of access to best practices and to knowledge of close-to-market innovative solutions. Therefore, the project "Promotion of Public Procurement of Innovation for Resource Efficiency and Waste Treatment" — **PPI4Waste** - has an overall objective to structure and coordinate networking, capacity building, dissemination and use of innovative procurement as a mechanism for achieving resource efficiency and waste management and prevention on a large scale across Europe. The cornerstone of the project is how to boost resource efficiency through PPI, on the basis of the waste hierarchy. The scope is set to municipal solid waste (MSW). MSW is a waste type consisting of everyday items that are discarded by the public. The composition of municipal solid waste varies greatly from country to country and changes significantly with time. The different waste streams of MSW can be sorted and treated separately. These waste streams are categorized as Bio waste (food waste and garden waste), Paper and packaging, Plastic, Hazardous waste, Electrical waste (WEEE), Bulky waste, other recyclable MSW and non-recyclable MSW. Most definitions of MSW do not include industrial wastes, agricultural wastes, medical waste, radioactive waste or sewage sludge.*

The PPI4Waste project will promote the use of innovation-oriented public procurement in the waste sector. The project will explore mechanisms through which barriers to innovation and innovation procurement can be overcome, including assessment of needs. The PPI4Waste project includes activities to identify common needs between public sector in Europe in order to create groups of buyers and in this way to draw common specifications and to prepare joint or coordinated procurements of eco-innovative solutions in the field of resource efficiency and waste prevention, reuse and recycling. As an input to the assessment of needs and their innovation

potential, PPI4Waste project partners will interview contracting authorities and experts across Europe.

AGREED COMMON NEEDS AND THEIR INNIVATION POTENTIAL

Within the PPI4Waste project, five common needs for contracting authorities within the waste management chain have been established:

1. Bio waste management - this need is how to collect bio waste separately, and how to treat and use bio waste more efficiently.

2. Plastic separation - the need is how to separate plastic from the other waste streams as well as sorting different types of plastics, with the target to use plastic from waste as a recyclable material.

3. Bulky waste management - the need is how bulky waste can be managed as part of a circular economy.

4. Separate collection for specific waste streams/development of collection points - this need deals with the question of how to sort waste at collection points. The need is to make collections points as efficient as possible for the different purposes they serve in the waste management chain.

5. Decision support system for waste management - the need is to make informed decisions of where to sort in the waste chain. There is a need for IT systems support in making management decisions and continuous improvements on where and how to sort most efficiently (in the waste chain) in the local context.

These common needs are the results of a thoroughgoing process that includes the identification of a large number of needs through interviews with representatives[14] from contracting authorities in different European countries. The large number of needs from the interviews were thereafter analyzed and prioritized by the PPI4Waste consortium, with the aim to select five common needs to be used as a foundation for the coming stages of the project.

The potential for PPI in each of the five targeted areas of common needs agreed by the PPI4Waste consortium will now be investigated. The study will highlight blockings and possibilities for innovation and change for each need and will be conducted as interviews with experts, and an analysis of the responds. The final result from the study will pinpoint the elements needed to enable a change of the current situations (implementing a solution to the need) through PPI.

State- of –the - art solutions to the needs have been investigated to find out if there are no acceptable or comprehensive solutions to the five needs on the market. The next step is to analyse if there are plausible innovative solutions available to meet the five needs. To find innovative solutions we must look beyond the current markets and into what is almost available. We cannot look for the “innovative” solutions directly, since we don’t know exactly how they might look or how they can meet the needs. Instead this project will study the conditions for

[14] These 14 representatives are all related to procurement of local waste management and many of them belong to municipal administrations.

innovative solutions to our needs to emerge in regional markets. If there is the right mix of conditions, a PPI process might bring a solution to the need.

These types of questions can be answered by the approach of a method for innovation systems analysis called TIS.

INTERVIEW METHODOLOGY – TIS APPROACH

TIS (Technological Innovation System) is a method for analysis of the innovation system that encompass all actors, institutions and physical parts that influence the development, diffusion and use of a technology or a technological field. Among these structural elements, a defined set of processes occur which create the dynamics of the innovation system. These processes are called innovation functions; processes that need to take place to ensure that a system performs well. By analysing the occurrence of these processes, conclusions can be drawn on what actions are needed in order to develop or change the innovation system further. Applying the TIS-approach in an analysis of the agreed needs in PPI4Waste will enable an identification of possibilities for change of the current situation. A special focus will be on the role of procurement of innovations as a likely trigger/enabler for solutions to the needs to emerge in regional markets.

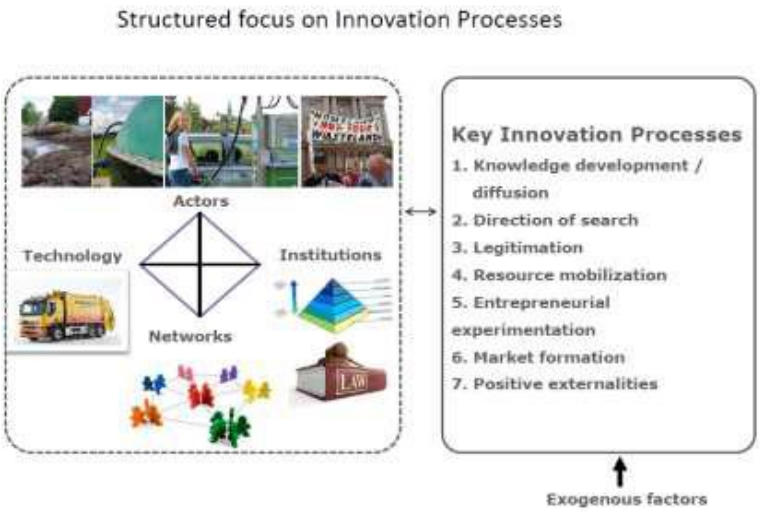


Figure 1: Structure of an adapted TIS.

The purpose of these interviews is to obtain information related to the socio-political framework for waste management in each region and their current trends. This document provides a description of the methodology and a set of questions. The interviews will be held as a semi-structured discussion, as the questions are merely intended as guidance for the discussions. Each respondent is asked to identify which need(s) that are relevant in their region and the chosen need(s) will be the focus of the interviews.

The questions are structured in a two-step TIS approach. The first part relates to the structure of the innovation system and the implementation of a new solution in order to change the current situation. In this part, Actors and networks and Institutions are important factors affecting the outcome. The second part of the interviews relates to the innovation system functions and investigates if there are solutions available to solve the needs. The dynamic innovation functions to be studied through the interviews are Entrepreneurial activities, Market, Guidance for search, Resource mobilization, Knowledge development and dissemination, Creation of Legitimacy and

Policy. By studying the functions and structure of the innovation system, and the interaction between them, blockings and possibilities for innovation and change can be identified.

INTERVIEW QUESTIONS

First of all, please identify which need(s) (from needs 1-5[15]) that are most relevant in your region, where the public is or could be an important customer. These needs will be the focus of the interview discussions. How can these needs be described in your specific context?
Please note that the following interview questions are merely intended as guidance for the interview discussions.

1. Impact of change on the waste management chain

Innovations are needed to transform a system, creating impact that changes the fundamental structures. Incremental changes in products and processes are the starting point, moving to new products, value chain optimization and business models, and finally creating industrial symbiosis. Below is a schematic picture of the impact of change in the waste management chain. For instance, a technology change is an innovation but in order for such a change to have an impact on a societal level other changes are needed as well.

If the current situation for the chosen need (from needs 1-5) would change so that a possible solution would be implemented in your region, where in figure 2 below would this change have to take place? Please describe the situation.

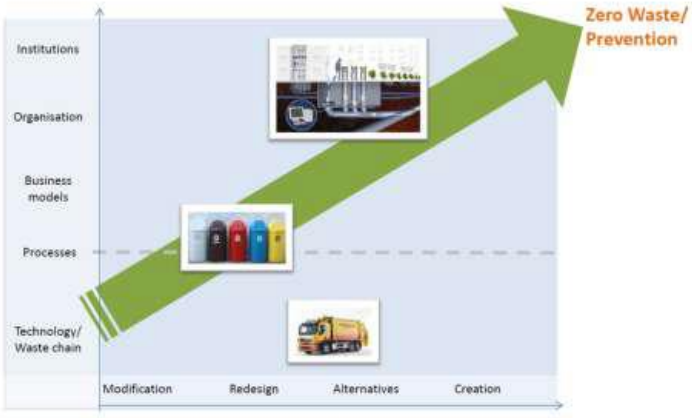


Figure 2: Impact of new interventions in the waste management chain.
Source: OECD (adopted).

[15] biowaste management, plastic separation, bulky waste management, separate collection for specific waste streams/development of collection points and decision support system for waste management

2. Actors and networks

For the chosen need (from needs 1-5[16]), please describe the actors and networks that are needed to implement a possible solution to the need, and if they are present today. Actors and networks of an innovation system are mapped in figure 3 below. Further, is the public an important actor as a buyer of solutions in the waste management chain?

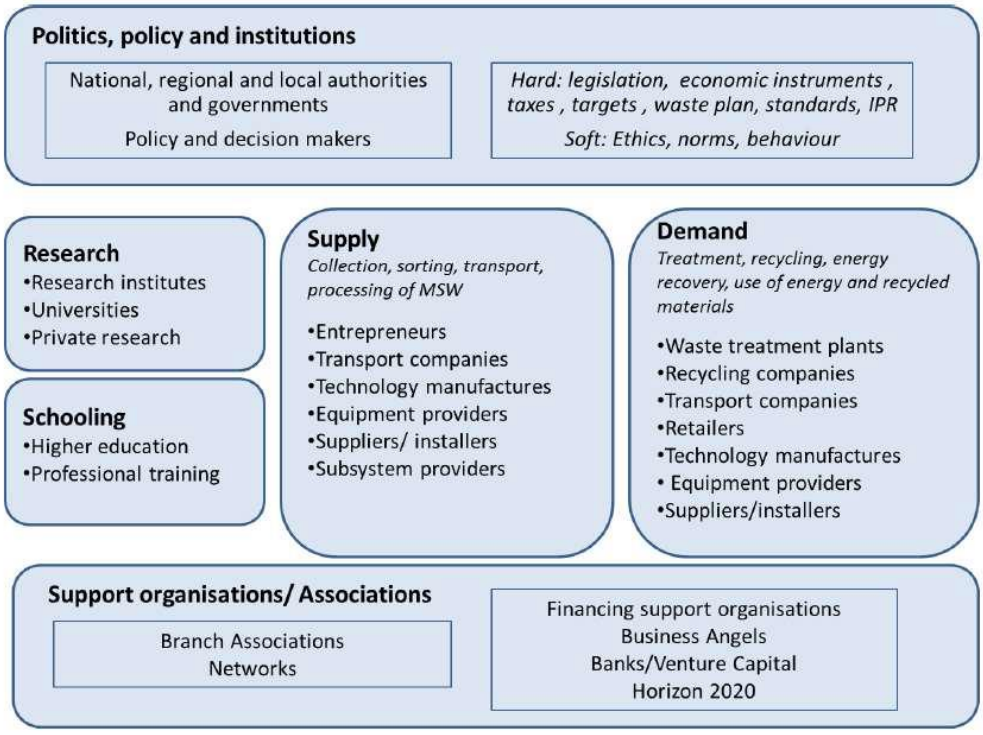


Figure 3: Map of key actors in an innovation system.

3. Institutions (Legislation)

Please describe legislation (besides EU legislation) that drives or hinders innovation for the chosen need (from needs 1-5). This legislation can be soft (habits, routines, customs, established practices) or hard (laws and regulations).

4. Entrepreneurial activities

Please describe available, promising solutions to the chosen need that you are aware of in your region. What is the situation regarding entrepreneurs who can develop suggestions for solutions to the chosen need? For instance, are there enough entrepreneurs?

[16] biowaste management, plastic separation, bulky waste management, separate collection for specific waste streams/development of collection points and decision support system for waste management

5. Market

If an innovation would be developed to solve the chosen need, what would the market situation for this innovation in your region be? For instance, who would take the lead to make sure there will be a good market present for the future solution? (public/private/other?) According to you, could a public procurement of innovation (PPI) support market formation for to the chosen need?

6. Guidance for search[17]

Please describe the search for a solution to the chosen need conducted in your region, if there is one.

Which actors are involved?

> *For instance, if your chosen need is bio waste management, are there activities among researchers or companies developing skills or knowledge within this field? Is there a strong interest in the field of bio waste management compared to other fields within waste management in your region?*

7. Resource mobilization

As far as you know, are there sufficient financial resources for implementing a solution to the chosen need in your region? If so, what are these resources currently used for? (research/applications/pilot projects or other?)

8. Knowledge[18] **development and dissemination**

Please describe the general knowledge base (among the public) within the field of the chosen need in your region. For instance, is the knowledge basic or advanced? Which actors are active?

9. Creation of legitimacy

Is there much resistance to implementing a solution for the chosen need in your region? If there is resistance, please describe it.

10. Policy

Would the implementation of a solution to the chosen need be supported by current policy? Is the need for a solution established and communicated?

[17] By the term "search", we refer to a search for solution to the needs, either in companies or in the public.
Research is one example, but search is wider than only research.

[18] By the term "knowledge" we refer to a public knowledge, not specific research.

Investigation of the innovation potential for common needs

Within the PPI4Waste project, five common needs for contracting authorities within the waste management chain have been established:

1. **Bio waste management** - this need is how to collect bio waste separately, and how to treat and use bio waste more efficiently.
2. **Plastic separation** - the need is how to separate plastic from the other waste streams as well as sorting different types of plastics, with the target to use plastic from waste as a recyclable material.
3. **Bulky waste management** - the need is how bulky waste can be managed as part of a circular economy.
4. **Separate collection for specific waste streams/development of collection points** - this need deals with the question of how to sort waste at collection points. The need is to make collections points as efficient as possible for the different purposes they serve in the waste management chain.
5. **Decision support system for waste management** - the need is to make informed decisions of where to sort in the waste chain. There is a need for IT systems support in making management decisions and continuous improvements on where and how to sort most efficiently (in the waste chain) in the local context.

INTERVIEW QUESTIONS

These questions were used during the interviews.

First of all, please identify which need(s) (from needs 1-5[19]) that are most relevant in your region, where the public is or could be an important customer. These needs will be the focus of the interview discussions. **How can these needs be described in your specific context?**
Please note that the following interview questions are merely intended as guidance for the interview discussions.

1. Impact of change on the waste management chain
Innovations are needed to transform a system, creating impact that changes the fundamental structures. Incremental changes in products and processes are the starting point, moving to new products, value chain optimization and business models, and finally creating industrial symbiosis. Below is a schematic picture of the impact of change in the waste management chain. For instance, a technology change is an innovation but in order for such a change to have an impact on a societal level other changes are needed as well.

1.1 If the current situation for the chosen need (from needs 1-5[1]) would change so that a possible solution would be implemented in your region, where in figure 1 below would this change have to take place?

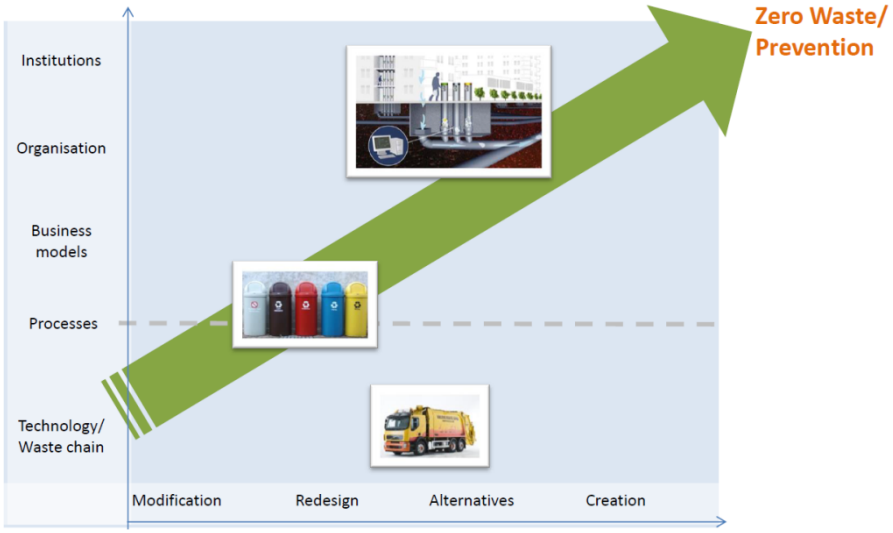


Figure 1: Impact of new interventions in the waste management chain.
Source: OECD (adopted)

1.2 Are public procuring organisations a large enough actor to have an impact on the whole waste management system? For instance, would they buy a significant share of a new product?

[19] biowaste management, plastic separation, bulky waste management, separate collection for specific waste streams/development of collection points and decision support system for waste management

2. Actors and networks

2.1 For the chosen need (from needs 1-5[20]), what actors and networks are needed to implement a possible solution to the need? Actors and networks of an innovation system are mapped in figure 2 below.

2.2 Are the actors needed for finding and implementing a solution to the chosen need present today?

2.3 Where in figure 2 below would you place yourself?

2.4 Is the public an important actor as a buyer of solutions in the waste management chain?

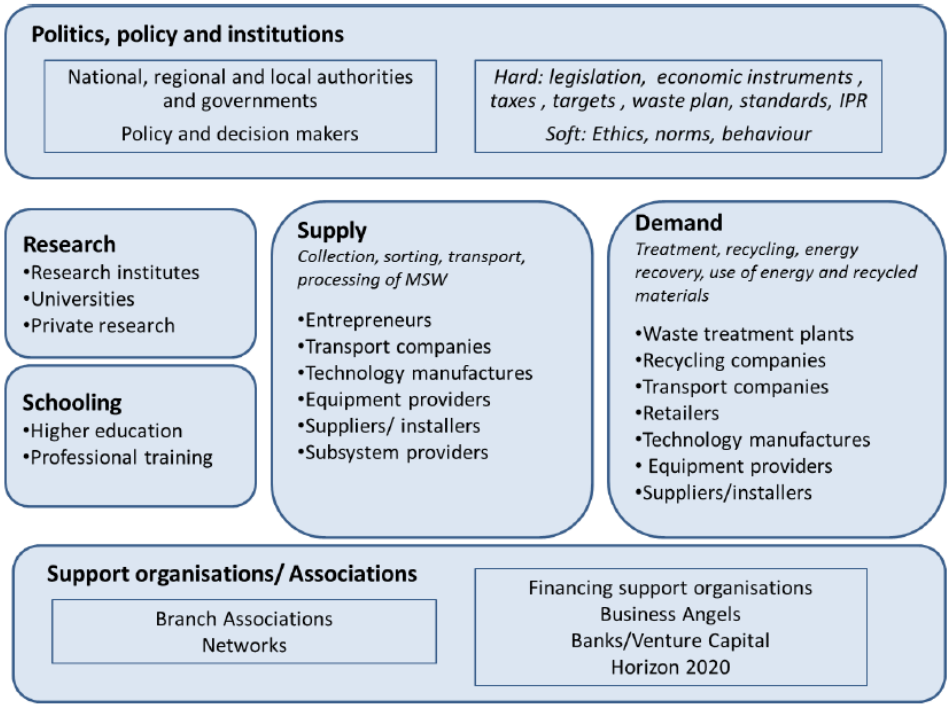


Figure 2: Map of key actors in an innovation system.

3. Institutions (Legislation)

Besides EU legislation, is there legislation that drives or hinders innovation for the chosen need (from needs 1-5)? This legislation can be soft (habits, routines, customs, established practices) or hard (laws and regulations).

[20] biowaste management, plastic separation, bulky waste management, separate collection for specific waste streams/development of collection points and decision support system for waste management

4. Entrepreneurial activities

4.1 To your knowledge, are there any available, promising solutions to the chosen need (from needs 1-5) within your region?

4.2 What main technology options are available to solve to the chosen need in your region?

4.3 Are there enough entrepreneurs who can make suggestions for solutions to the chosen need?

4.4 Are there any new entrepreneurs entering the system of to the chosen need? Would a new solution to the chosen need put entrepreneurs who are dominating today out of business?

4.5 Are public organisations important customers for SMEs in your region?

5. Market

5.1 If an innovation would take place for to the chosen need in your region, who would take the lead to make sure there will be a good market present for the future solution? (public/private/other?)

5.2 Do you think that a new market must be formed in order to implement a solution to the chosen need? Is there a demand for solutions to the chosen need today? Could an existing market be opened up?

As an example, if you have chosen the need for plastic separation, a new separation machine could solve the need. Do you think that there is a market and a demand for such a machine outside of your region today, and is the demand large enough for upscaling?

5.3 According to you, could a public procurement of innovation (PPI) support market formation for to the chosen need?

5.4 Are there any institutional incentives/barriers to market formation for the chosen need?

e.g. tax reduction, or an insufficient demand for the product or material remaining from a plastic sorting machine.

6. Guidance for search

By the term "search", we refer to a search for solution to the needs, either in companies or in the public. Research is one example, but search is wider than only research.

6.1 As far as you know, is search for a solution to the chosen need conducted in your region?

For instance, if your chosen need is bio waste management, are there activities among researchers or companies developing skills or knowledge within this field? Is there a strong interest in the field of bio waste management compared to other fields within waste management in your region? Such interest can be indicated through bio waste management being mentioned in political or economic agendas, planned economic incentives, study trips and demonstration plants.

6.2 Which actors are controlling the search for solutions to the chosen need?

6.3 Is the public demand a driver/enabler for the direction of search?

6.4 To your knowledge, who are the frontrunners in the search for solutions to the chosen need?

6.5 Is research that is conducted in the same direction as the search for solutions to the chosen need supported by specific programs or policies?

7. Resource mobilization

As far as you know, are there sufficient financial resources for implementing a solution to the chosen need in your region? If so, what are these resources currently used for? (research/applications/pilot projects or other?)

8. Knowledge development and dissemination

By the term "knowledge" we refer to a public knowledge, not specific research.

8.1 What is the general knowledge base within the field of the chosen need in your region, in terms of quality and quantity?

8.2 Is the level of knowledge on the chosen need basic or advanced?

8.3 Are there many projects, research patents and articles on the chosen need?

8.4 Which actors are active within knowledge development and dissemination of the chosen need?

8.5 The knowledge that is developed – is it disseminated? How and to whom?

8.6 Are there competing messages disseminated within the chosen need?

9. Creation of legitimacy

9.1 Is there much resistance to implementing a solution for the chosen need in your region? If there is resistance, where is it coming from?

9.2 What is the lobbying power of the actors in the system in relation to legitimacy, policy, direction of search and resources?

9.3 Are coalitions being formed? Are there strong partnerships? Between whom?

9.4 Would a public procurement of innovation related to the chosen need create legitimacy?

9.5 Would the communication of a public need or a future procurement create legitimacy for the solution?

10. Policy

Would the implementation of a solution to the chosen need be supported by current policy? Is the need for a solution established and communicated?

APPENDIX III

COMPILATION OF ANSWERS FROM INTERVIEWS

1.1 SHORT PRESENTATION OF INTERVIEWED EXPERTS

Belgium: The situation within the waste management area in Belgium is represented by two organisations;

Mr John Wante at the Department Waste and Materials Management OVAM Public Waste Agency of Flanders. The OVAM in Flanders coordinate projects, draw up new waste policies and policy measures, works with eco-design and new business models and new markets for recycled products. This organization is responsible for the framework of waste and material management within the Flanders region in Belgium. They put together Flemish waste management plans in cooperation with all relevant stakeholders, inter alia municipalities. These waste management plans form a legal basis that municipalities have to comply. They contain targets within both collection and recycling. The OVAM bring general rules and waste prevention and discuss with local municipalities about how to reuse material. They give guidance of good criteria of public procurement and stimulate local authorities to do more green public procurements (buy products or services that require less material use, or that have a longer life span, are better reusable or recyclable or contain more recycled materials).
Public procurements are done both by municipalities and regional authorities in Flanders.

Mr Nicholas Scherrier at Bruxelles Environnement Div. Information, Coordination générale, Economie circulaire, Dpt. Déchets. The Brussels-Capital Region represents 19 municipalities (communes) including the city of Brussels which is part of it. The representative of this region for waste management works at "Bruxelles environnement" a public administration responsible for strategies and planning of waste management. There is another public organization about waste, "Agence Bruxelles Propreté" that is responsible for waste management on field. This organization does most of the public procurements regarding collection and management of wastes.

These two interviews had a more general focus, but the representative from Brussels region also discussed bio waste and plastic in more detail.

Croatia: The situation in Croatia within the waste management area is represented by **waste expert Mr Marijan Galovic**, active in a company working with waste management plans, mostly with public companies and authorities and mostly in recycling. The company is specialized in developing waste management plans, packaging is part of this and are suppliers of know-how to the municipalities.

This interview is focusing on plastic separation and separate collection.

Ireland: The situation within the waste management area in Ireland is represented by **Mr Dara McGowan, at Meath County Council which is a local authority bordering Dublin**. This interview focuses on bio waste management, bulky waste management and separate collection for specific waste streams/development of collection points.

Netherlands: The situation within the waste management area in the Netherlands is presented by two representatives;
Mr Maarten Goorhuis from The Royal Dutch Solid Waste Association, NVRD is the largest national waste management association of the Netherlands. The NVRD unites municipalities responsible for waste management and management of the public space, and the public waste management companies in the Netherlands.
Mr Herman Huisman from International Cooperation RWS-WVL- Environment, an administration that's monitoring and benchmarking services and costs of municipalities for their waste management.

Both interviews cover all needs in general.

Spain: The situation within the waste management area in Spain is represented by **Mr Francisco Peula, at the Municipal Waste Treatment Service in Granada Province Council** which is a regional authority in Spain.

This interview focuses on bio waste management as being the most important subject, but also waste collection and equipment for bio waste and plastic separation.

Sweden: The situation within the waste management area in Sweden is presented by two representatives;
Mr Stefan Persson is representing Rhetikfabriken, a consulting company with main focus areas such as public/private partnerships and procurement, design and innovation, and the development of sustainable communities through entrepreneurship and clean tech solutions.
Mr Pål Mårtensson is representing Göteborg Kretslopp o Vatten, a part of the municipality of Göteborg with the main focus on influencing people's long-term understanding.

Focus for these interviews were bio waste management, Bulky waste management, Separate collection for specific waste streams/development of collection points and Decision support system for waste management.

1.2 COMPILATION OF INTERVIEW RESPONSES DIVIDED INTO 10 DYNAMICS ESSENTIAL FOR PPI-IMPLEMENTATION

1.2.1 IMPACT OF CHANGE ON THE WASTE MANAGEMENT CHAIN

Green Public procurement in **Flanders** is about three things; technology, cultural shift and finance. The cultural shift is about changing attitudes; for eg when you start a car sharing-program and you have to think in a new way and change the logistics etc. The financial aspect on public procurement is for eg when local authorities are going to move in to new buildings and you have to look a t the life circle cost of the building and not only the construction costs or the price to by the building. One issue that has an impact in public procurement in Flanders is that there might not be enough suppliers for innovative products or services, which might put legal problems to the procurement. PPI can make a difference in developing the waste management area in Flanders since the public sector stands for about 15% of all purchase in the region.

Today in **Brussels** there is a system of door-to-door collection of waste; blues bags for tetra paks, metal packaging and plastic bottles, yellow bags for paper and carton, white bags for the residual waste, green bags for gardening waste, and at a pilot scale orange bags for other organic wastes. There could be a huge reduction of waste today thrown in white bags if there would be a way of sorting out more plastics and bio waste as well. This would implicate a change of logistics and treatment facilities (adaptation of the sorting plant for the blue bag, incineration plant and new PCI and less waste to be reated) and of course a new structure to treat organic wastes.

There is no treatment for bio waste today in Brussels (only a small fraction is composted in a decentralized way). The trend is going towards a bio methane plant, but there are still issues to solve, for example how to valorise the methane gas and the digestate. This implicates a change of infrastructure and interregional planning. Before starting a process towards this, Bruxelles Environnement wants to investigate if bio methanisation is the best solution. They would like to have recommendations from European Commission about this.

There is one incineration facility with 3 ovens in Brussels. The region is aiming to a more circular economy, and therefore Bruxelles Environnement wishes to reduce incineration and increase recycling.

When it comes to collection and treatment of bio waste and plastic, there is a need for new processes and business models. Bruxelles Environnement thinks a pay-as-you-throw system would be very effective, but there is no political will for this as the measure is unpopular. Politicians don't want to force citizens to pay for waste management by establishing the pay-as-you-throw system. Citizens today don't realize that they already pay for waste collection in their taxes. All restaurants that are situated in the city of Brussels have little room for storing their waste; sorting organic wastes is a huge problem for them.

According to the representative of Brussels region, regional administrations could have an impact on the development of waste management if using public procurement of innovation – PPI. In the region of Brussels the management of organic waste will either be managed by the on field regional organization "Agence Bruxelles Propreté" directly or decided by them via

public procurement. The regional representative prefers a PPI since the private sector is more likely to come up with an effective and innovative new solution.

There is a great need for developing the waste management chain in **Croatia** especially when it comes to bio waste collection (non-existing) and plastic separation. There is a big lack of understanding of which organisational systems can give results, on all levels.

In **Ireland** the waste collection service is privately owned and the market is free for the citizen to choose operator for waste collection. There is collection of 3 streams; bio waste, recyclable material and general waste by 3 separate bins at people's residents. The municipality had the responsibility for collecting waste before, but couldn't compete with private companies and lost the market. Since the local authorities don't procure services in waste management (collection, infrastructure and treatment of waste) any more, no PPI in waste management is possible. Since the waste management is done by private companies, there is limited financial support from the government for innovating projects. This reduced the development of innovative solutions in the market. Private companies look abroad to find good examples that can lead to improved efficiencies or reduced costs. Limited public procuring is made within the waste management industry. Private actors compete between themselves to increase their customer base, and this customer base is made up of domestic and commercial customers.

The future role of local authorities in waste management will be focused on education, prevention, and resource efficiency activities as well as regulating householders, businesses and waste operators and enforcing waste legislation.

In Ireland, waste disposed of to landfill is reducing due to the cost of disposal at these facilities. This is resulting in many of the active landfills closing and it is now more beneficial in terms of cost to export this waste, with the largest portion of this going to the Netherlands and Germany.

76% of domestic waste in the region goes to recovery (includes waste sent for recycling and energy recovery). Garbage trucks collect both bio waste, plastic and paper waste and the residents pay for the disposal of general waste, but generally not the bio waste or dry recyclable collections. This is because the companies gain money in selling plastic and papers for recycling and it also incentivizes improved segregation of waste at source. The number of recycling facilities is increasing, for handling bulky waste and paper etc. Ireland is well developed in recycling domestic waste.

The **Dutch** goals for Household Waste are to establish 75% separate collection by 2020 and a maximum of 100 kg. residual waste per inhabitant. These are very ambitious goals. The Ministry has developed a program together with the association of Municipalities (VNG) and NVRD to help municipalities to achieve these goals. This program (From Waste To Resource, abbreviated in Dutch as VANG) consists of four action lines:

1. Motivating municipalities to commit to higher waste separation levels
2. Assisting municipalities in achieving the targets.
3. Communication with the public
4. Closing material chains

Each action line contains a number of sub-actions. The program is expected to run until 2025.

Some of the focus areas in the VANG program are:

1) To communicate with the citizens in order to change their attitudes, behavior and habits when it comes to waste separation

2) To establish separate collection in big cities; This is often difficult due to lack of space within housings and in the public space. Communication is also often more difficult because of a greater number of different nationalities. Many big cities are therefore struggling with the implementation of separate collection and waste separation. In this area there is a big need for new and innovative solutions.

3) To increase the separation of organic kitchen waste. The separate collection of organic waste is compulsory in the Netherlands since 1993. Most Dutch households therefore have a separate bin for organic waste. In practice however this bin is dominantly used for garden waste, and much of the organic kitchen waste is still discarded as residual waste.

4) To close material chains. Not all separately collected waste can be recycled, and some types of waste are not separated because there is no recycling solution at all. One of the aims of the program is to find solutions for this. This is achieved through a collaborative approach where different actors in the value chain of a product or material are encouraged to work together to find new solutions.

With respect to PPI the biggest opportunities would lie within the improvement of waste separation in cities, the improvement of separation of organic kitchen waste and the material chain projects. In order to meet this challenge, communication is an important tool in the Netherlands.

An example was mentioned where public procurement of waste services in large municipalities, based on environment performance, where the nearest facility didn't win the tender even though they came up with the lowest price. The company that won the tender had a better combination of both price and energy efficiency, where the energy efficiency was more important than the price. These public procurements will have an impact on other municipalities in the future.

PPI could have a great influence on anaerobe digestions in the Netherlands.

The treatment of collected waste is today partially owned by the private sector. This wasn't the case in the beginning in the 90-ties when the waste system in the Netherlands was developed. Then, the private sector wasn't interested in this market since there were too many economic risks. During the last 12 years this sector has gone from being 99% public owned to now only 40%. Small family owned companies have been bought by large (international) enterprises, which led to lower prices for waste management and a fully grown and stable market. This development is making the sector more efficient.

In Spain, public procuring organisations can have an impact on the waste management system, but one of the major limiting factors to innovate is that public tenders are held for long periods of time (reaching up to 25 years). This is slowing down possibilities for innovation and limits the development in the region. The public sector is normally in the hands of the private companies and it's all about financial gain for the companies. Private companies that provide the service of waste collection and/or treatment is very limited by the costs of the service they are willing to

take the local authorities. In many cases the price of the tender prevents them from offering innovative equipment and systems.

In Sweden, the ongoing trend to recycle more makes the contact with the manufacturing industry even more important than before. Products need to have a higher quality and be easier to re-use / recycle. Trade in bulky waste such as secondhand or recycling is done in different ways, either through private initiatives or through municipal projects. In this context, the business models for such businesses are important. The financial aspect is of great significance in getting sustainable activities. If the municipality operates in this kind of business, the social corporate responsibility is another aspect that comes in.

Above all, there is a need of new business models as there is enough of technology today. There is a inhabit of working with new business models both in terms of separate collection for specific waste streams/development of collection points and decision support system for waste management.
There is bad decision support system for waste management in Sweden.

There is no need for more legislation with the collection area. Public administrations and organizations can influence the development a lot, both in concrete procurements and by the signals they give in acting in one way or another.

1.2.2 ACTORS AND NETWORKS

Belgium is a small market and the access to suppliers and actors depends on what products and services are needed. Many products are designed abroad, which minimize the influence you have on greening the design of products. There are trade organisations in **Flanders** working within the waste management area, but their main focus is finding new markets for recycled materials, and not within the procurement business.

There aren't many suppliers or industrial parts in **Brussels**. There are organizations such as "Ressources" for example that is the federation of social economy enterprises active in the waste management (reuse and recycling).

In **Croatia** there is a lack of political willingness to change. There are no actors at political level with visions and belief in change within the waste management area. If the political will get in place, the industry, that doesn't exist in this area today, will follow since there will be a quantity of waste material to handle.

Legislation mainly comes from Europe and **Ireland** generally meets its European waste management targets with some exceptions. Local authorities can practice control by local legislation or soft regulations through permissions for different collection and treatment methods. The regional plan provides the framework for waste management for the next six years and sets out a range of policies and actions in order to meet the specified mandatory and performance targets. Most importantly the plan seeks to assist and support the community and local business to develop resource efficiency and waste prevention initiatives. A key plan target is to achieve a 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan. In tandem, the plan identifies measures to develop a circular economy where waste management initiatives stop being confined to treating and disposing of waste, instead supporting initiatives that value waste as a resource or potential raw material.

In **the Netherlands**, projects for innovations and cooperation for the whole value chain have started with a focus on materials or products for which there are no effective recycling solutions, taking the example of network of diapers-producers. Municipalities which achieve high separation rates are confronted with a relative large share of diapers in the residual waste. All actors in this value chain have been asked to access the problems and difficulties with respect to diaper recycling and to work together on solutions to overcome these.

In the **Spanish** region Innovations don't come from the region since there aren't companies specializing in the field of waste management. At the University of Granada is a small group to research in waste management. In other regions of Spain there are few college specializing in waste management, which hinders the technological development of the sector.

One of the serious problems in waste management in Spain is the system of municipal waste collection. The containers are in the public roads and they have an anonymous nature, that hindering citizen participation in the selective collection of waste.

Procuring organisations in **Sweden** begin to see the wholeness when it comes to procuring. There are most likely a lot of actors and networks within the bulky waste area bulky waste, an area that creates a lot of jobs: workshops for furniture restoration repair cafés. Though there is a need for new business models for these kinds of activities. It's expensive to restore old objects and the need for expert knowledge is big. One important question to ask is if there are enough customers when working with new businesses from bulky waste. There are a lot of eco-companies wishing to invest partly for environmental reasons but also for economic reasons, there are large green trends.

1.2.3 INSTITUTIONS (LEGISLATION)

Regional legislation of waste issues in **Flanders** describes different types of recycled waste, and the quality of recycled materials. This regional legislation put up higher targets for recycled materials and bio-waste, than the European legislation. Municipalities are responsible for collecting household waste and there is an advanced system for sorting waste at source, stimulated by pay-as-you-throw-schemes, the separate kerbside collection of waste, an extensive network of recycling parcs and reuse centres. There is separate collection for glass, paper, plastic, metal etc. For recycling of bulky waste there are about 20-40 different recycling boxes and containers at collection points. More than 70% of waste is separately collected for recycling, 27% goes to energy recovery and less than 1% goes to landfilling. There are about 10 incineration plants for household waste in Flanders, most of them are operated by municipalities or a mix of private and public companies.

When it comes to legislations within the area of bio waste and plastics in **Brussels** there are mostly European legislations for these areas. Concerning organic wastes, the high level requirements of Animal By-Product (ABP) European laws, even on kitchen wastes, could hinder innovation in their recycling.

The waste management plan for **Croatia** is still under development but there will be a lack of enforcement of separate collection measures. The legislation is not enforcing anything. There is a pronounced target set to a recycling level of 50 % of all waste until 2020.
For example, bulky waste management; there is information on how to collect it but there is no recovery/recycling and no framework of how to treat the collected waste.

Legislation mainly comes from Europe and **Ireland** generally meets its European waste management targets with some exceptions. Local authorities can practice control by local legislation or soft regulations through permissions for different collection and treatment methods. The regional plan provides the framework for waste management for the next six years and sets out a range of policies and actions in order to meet the specified mandatory and performance targets. Most importantly the plan seeks to assist and support the community and local business to develop resource efficiency and waste prevention initiatives. A key plan target is to achieve a 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan. In tandem, the plan identifies measures to develop a circular economy where waste management initiatives stop being confined to treating and disposing of waste, instead supporting initiatives that value waste as a resource or potential raw material.

The EU legislation of waste management has been fully transposed in the **Netherlands.** In most cases the Netherlands have higher legal requirements for waste management than the EU requires. The geographical conditions in the Netherland, being a river delta to a large extend, combined with a relative high population density has led to a frontrunner position in environmental policies. There are minimum standards (more than 80 standards) concerning treatment of waste. In the Netherlands the objective is that 75% of household waste should be separated. In order to get all this in place, it is important monitor the actual recycling rate which is achieved as a result of the following recycling processes.

When it comes to legislations that drives or hinder innovations in **Spain**, there is legislation at the national level, and all 17 regions have their own laws. Everyone knows about the waste legislation but there is no financial capacity to follow them and there are no consequences if the legislation isn't followed.

There is no lack of legislation in **Sweden** within the waste management area. The need is to use the legislations in a more creative way. You cannot forbid someone not to use the collection point even though the people misbehave. When it comes to trade, one can get around the rules by municipal companies. The question has been investigated and there are no real obstacles. Hygiene and health is an issue that is driven hard by the union and they have strict rules for all workplaces must be followed.

1.2.4 ENTREPRENEURAL ACTIVITIES

New activities are undertaken in **Flanders** by some companies that are working with re-use of for eg office furniture. Other examples of new entrepreneurial activities are; creation of platforms to match companies that could use one another's waste streams (industrial symbiosis), product-service combinations, 3D-printing as a way of designing products in a decentralized way - this can boost local products and generate less transports – activities that could change the landscape of material management.

When it comes to waste management companies, older companies need a mind shift and change their business proposals to clients and not only work with collection of waste, but also guide their clients in changing their production in order to enhance the value of waste on one hand and find new markets for recycled materials on the other hand. If waste collection companies don't follow the development in this area they will lose market since their clients then might sell their waste directly to another company working with recycling.

Waste incineration in Flanders is today under big pressure since less and less waste need to be incinerated. Within the nearest 5 years some facilities may need to shut down. In Flanders they have a policy that import of waste to incineration facilities only is acceptable if it covers a smaller part of the facilities capacity. Waste shouldn't be transported, it's not eco smart and the municipalities shouldn't make important business with waste from other countries, according to the Flanders policy. Flanders wants to avoid overcapacity in the waste incineration market, as this would lead to lower prices for incineration and make recycling less competitive.

It's difficult to find new non-centralised solutions to treatment of organic waste (bio refineries, protein, composting etc.) in **Brussels**, there is a lack of entrepreneurial actors.

Consultancies in **Croatia** propose easy solutions already available in other countries since many years, and don't develop innovative ideas suitable for the Croatian market.

In terms of technology – there is some development in waste sorting but the companies are not sending the right message of what the technology can be used for. They're not selling in Croatia. The consultancies active in Croatia aren't focused on new solutions and innovations.

The waste economy doesn't exist in Croatia according to the representative. In Croatia there are 3-4 companies working with recycling, and the main question is whether to develop systems or materials first. There is a need for strong directions from the government.

In Ireland, the obstacle in developing innovations within the waste management area is that the market is completely privately owned and the municipality has limited control over development in a certain direction through a procurement / PPI. Private companies are driven by their business needs; there are limited new processes being developed by the private companies. Some of these private waste companies have their own treatment facility or transfer station, while others may not. The Private waste companies that don't have their own treatment facilities will procure access to the facilities owned by others.

Entrepreneurial activities mean existing companies and/or entrepreneurs offering promising innovative solutions and technology options as well as new entrepreneurs entering the waste management area. In **Netherlands** there are actors who are willing to be a part in the development of new innovative ideas. There are people willing to develop new innovations. One of the obstacles is the difficulty to get funding for developing an innovative service or product and to create a market for this. Support in terms of business investment funds is needed. Furthermore there should be room for experiment within the environmental and/or spatial legislation. There are a lot of entrepreneurs such as; waste collectors, recyclers, manufacturers of equipment etc. Medium sized enterprises are supporting innovative development within the waste management area to a certain extend. They do cooperate concerning recycling and suppliers to recycled products. But they can also be conservative not willing to take those kinds of risks that are needed to take in order to develop innovative services and products.

There is very little budget for waste management in **Spain**. The companies are working for very little money which does not give much room to develop innovations and implement improvements. The question is how it could be done without raising taxes.

In **Sweden**, the knowledge is available in the area, but you might need a different technology, and this can develop logistic, IT solutions, tools etc. It seems to be an area with a lot of entrepreneurial activities with a high level of innovations. There are a lot of competitions,

innovation weeks, science festivals etc. The problem with these activities and innovations is that it is often difficult to get some volume in these products.

The idea of social entrepreneurship is growing both in the area of bulky waste and bio waste. What is lacking today is economic sustainability for these activities.

The decision support system is lacking innovation and moreover a whole mindset. In order to get a good decision support system you need a triple helix approach, where SME, academy and public sector is working together. The level of understanding for decision support system is still low in Sweden.

1.2.5 MARKET

In **Flanders** they work with industrial symbiosis and plan to cooperate in industrial symbiosis with the Netherlands. There is no big market today for new products in waste management area. There is a lot of international business with for eg plastic export to China. There are no fiscal measures stimulating recycled materials in Flanders, these initiatives must be taken at a national level. The Flanders representative would appreciate if fiscal measures for opening this market would come at a European level.

The market for bio waste products might exist around **Brussels** but only if one can produce high quality products for example compost for local urban agriculture. There is already a lot of existing compost products on the Belgian market.

When it comes to plastic treatment there aren't many competent actors in Belgium but for the main plastics (PET, PP/PE and PVC). The main challenge is to find a method for high quality recycling for plastics, the market isn't there yet. Today 60% of collected packaging plastic wastes in Belgium are recycled in Belgium.

When it comes to bulky waste, a challenge is the lack of available space. If upcycling is chosen even more space is needed in order to keep the bulky waste from breaking when it's stored or collected. Upcycling is a good example of how to work with enterprises from the social economy in the Brussels region.

There is no national market for recycled materials in **Croatia** since there is no organised separate collection. Without recycled material there can be no developed market. If the country gets at strong political will, there are actors willing to invest and develop this market.

Generally the private companies source and develop new solutions without assistance from the public sector in **Ireland**. While the private sector generally provide the collection and treatment facilities, the Local Authorities manage the recycling facilities (i.e. civic amenity sites and bottlebanks). There are generally local companies providing the waste collection service, with limited competition form the larger international companies.

NGO's and social entrepreneurship work with bulky waste (old furniture, technologies, WEEE etc) New companies for reuse, training and education are appearing in the market providing employment opportunities for people who may have had difficulty getting employment previously.

In the **Netherlands**, another important issue is the quality of the recycled material. It is important to retain as much of the resource quality as possible during the recycle process. If a product has a high quality in the first line, the recycled product will also be of high quality and this makes it more attractive at the market. Though investing in high quality recycling can be expensive, and may not be competitive in the market.

The government in the Netherlands has a policy as for promoting the waste practices and policies that exists in the Netherlands through different programs on waste management to countries such as Brazil, Colombia, Hong Kong, The South of Africa etc. These activities will stimulate the SME's in the Netherlands to enter the market of waste management in these countries. Trying to influence other countries, markets leads to growing companies in the Netherlands when exporting best practise and knowledge.

There is a market for these new products and services but the market needs to be supported by the government in some way. Tax based instruments are helpful to form the market.
One example is the greening of the tax-system in the Netherlands. Today, about 15% of the government's taxes are green taxes. The taxes for the municipality's waste management are seen by the residents. It would be better to put the waste responsibility on the consumer instead of putting it on the residents. This could easily be done by increasing the price on different products which could give the possibility for the producers to take responsibility for the recycling of their product – this could set a new system in place.

It's unclear if a PPI would support market formation for bio waste in **Spain**. In the province of Granada thanks to the new waste treatment plant has increased substantially the recovery of recyclable materials. The sale of these materials has helped reduce the cost of treatment service. The treatment of bio-waste don't work very well. There is an important national debate about the bio waste collection system to choose and who will finance the costs of the investments required for the implementation of this collection and the necessary composting plants. .

At the moment the municipalities aren't working with bio waste collection.

Existing technology and circular economy are incentives to market formation. Spain must find a way to work with circular economy.

Waste management stands for about 30% of all municipal expenditure. In Spain there is considerable debate about how to achieve the European objectives in waste management without unduly increasing the current costs. On one side are the positions aimed at strengthening the systems of existing selective collection and on the other side there are existing proposals to radically change the current system and take advantage of technological innovations in the treatment plants to simplify the collection systems and thereby get a greater citizen participation in waste management.

Prevention of waste isn't a subject for local authorities in Spain. The responsibility for this is at the national level for politicians and leaders, as well as for manufacturers and distribution companies etc. They have to look through the whole packaging of goods issue.

There are difficulties for a variety of products having a market in **Sweden**. The only recovery Sweden have is incineration. Lump recycling has disappeared to some extent, but exist still in the automotive industry with a very small market in Europe.

Most people want a long lasting product with high quality, which isn't the case today.

In the city of Göteborg a website for second-hand was created but one of the problems was the logistics.

Social entrepreneurship as a business model means not only counting the cost of recycling but also to look at everything in a social perspective. Activities within the bulky waste are possible to procure if you see it in new perspectives; if the municipalities take a larger responsibility for the employment situation. In this case a PPI is possible since the perspective is broader. One criteria can be to create more jobs and in that way enhance the unemployment.

A study is made by IVL Swedish Environmental Research Institute is presenting a scientific assessment of how the second-hand trade can prevent waste.

System for collection of household waste already exists on the market but need to be developed and include other waste management streams, and can act as a base for development of the whole decision system. When a well-functioning decision system for waste management is developed at the market (PPI), there is a huge potential and leverage for this product.

There is a need for new actors; there is a lack of small entrepreneurial innovative and creative companies who could bring in for eg design and digitalization. PPI could be the key for developing this further.

Composting is important but it given a less important role in Sweden in favor of more expensive solutions such as biogas. Good source separation is a must for a good quality of the recycled material.

1.2.6 GUIDANCE FOR SEARCH

In **Flanders** there is a network of knowledge institutes for raw materials (Knowledge and Information Community on Raw Materials) and they are doing research on recycling as well. There are also a Flemish institute of technology doing research on recycled materials and materials policy, mentioning some of the researching actors in the region. The Public Waste Agency of Flanders (The OVAM) is a policymaker and focus on regulation and stimulating activities within the waste management area. They are doing research on policy measures and economic incentives and cooperate with sector federations etc. They also network with foreign organisations (for eg in the Netherlands) even though they don't have much means to do this.

The research on the area of bio waste and new solutions need to be developed further according to the expert from **Brussels**. There is an important need for spreading existing research on a European level all over Europe in order to make new knowledge and results of research available in an easier way.

In **Croatia**, there are very few or none researchers working within the area of waste management.
There are one or two companies that do a lot of research and produce significant pieces of paper for solutions. They also provide solutions and have implemented a lot of solutions in Italy already. These companies are not frontrunners in general, but are the only ones that can provide real support for organisations that conduct separate collection.

The government in Croatia states that there is no need for separate collection. Household waste should be collected in one bin and sorted out later. A new incineration facility is planned in Zagreb.

The research in waste management in **Ireland** is limited by both the private and public sector. A reason for this is the increased costs associated with research. The government offered some funding for research but there were only a small number of projects undertaken. There are a small number of companies which own the waste facilities in the region and these companies could be the frontrunners in search for innovative solutions within bio waste and bulky waste, but their interest to innovate is driven by the need to improve efficiency, reduce cost and achieve their statutory targets. These private companies are interested in new technical solutions that are proven in Ireland or abroad to provide efficiencies, cost reductions and assist them in achieving their statutory targets.

The possibility to access information by internet is sufficient today according to one of the **Dutch** experts. There are a lot of information from organizations such as the OECD, the UNEP and ISMA. Many producing companies have a high standing policy in order to comply with the regulations of waste management; they want to act as the market leader they are also in this area.

Universities in Netherlands are active in research within the waste area, but the focus is mostly in basic technology and it's rather traditional. They could be called frontrunners in the waste management.

The public sector is demanding new solutions, but they're not doing research.
These are the frontrunners for respective area:

- public waste companies bring ideas for new methods and system
- recycling technology comes from the industry
- the structure comes from the government who is pushing

There is no ongoing discussion today weather to incinerate or recycle – everyone knows that we should recycle. The municipalities have their role in collecting waste not in taking part in the public debate. Incineration companies are interested in a proper business.

There is resistance from the politicians to change on waste management because they fear that a change would bring increased costs that are hardly acceptable. The greatest interest of the Granadian society is to lower the very high unemployment rate, over 30%, existing in the province. The importance of the unemployment rate limits significantly the technological innovation, which in many cases are believed to go against job creation.

Another factor that influences the commitment to innovation is the division of powers in waste management between the different public administrations. In the province of Granada waste collection is in the hands of municipal authorities, while treatment and disposal are held by the Provincial Government.

Within the organization SAMSA (a network organization for southern **Swedish** municipal waste operations that focus on knowledge and technology transfer in the collection and treatment of household waste) there have been activities in trying to develop new knowledge within the area of waste management and digitalization. Some actors in this network are frontrunners in this

area. Thought there are two worlds; the big actors that are ready to take the next step, and the smaller actors that are fighting to manage the everyday situation.

There is an opening within the knowledge process when procuring services. New social aspects and visions are added and there is a demand for adding more research in the agreements that tends to be more of cooperation agreements than business agreements. Innovation procurements are in many aspects close connected to cooperation and research projects. There is a need to thing outside the box when it comes to public procurement.

The frontrunners when it comes to bulky waste should be at the local authorities and those responsible for the collection points since a lot of products arrive at these facilities.

In other parts of the world, waste is often collected by poor people and there is a strict hierarchy for this for eg in Brazil. In these countries it's difficult for municipalities to start taking a responsibility for bulky waste since there are already existing systems for this. If local authorities get involved in waste management in these countries, they have to look into social aspects and also take responsibility for those people that lose their income.

1.2.7 RESOURCE MOBILIZATION

Compared to other countries, **Flanders** has good financial resources when it comes to waste management and the number of jobs within both public and private sector are many. Especially compared to how many financial resources that is placed in the public building sector and in the energy sector.

When it comes to plastic waste in **Brussels**, there are enough financial resources for implementing new solutions as there is an EPR scheme. The lack is more at a technical level as there are no high quality recyclers and no market established for plastic from packaging wastes other than bottles.

Cities and municipalities spend a lot of money on collection waste in **Croatia.** The need for investment is in composting, sorting and biogas facilities. The state plans to finance waste management centres and will take care of the national issue, but more funds are needed on the local level. For every 1 Euro invested in recycling, 10 Euros are being invested in landfills and incineration.

In the broader economy in **Ireland** there are funding opportunities for SME's, but there is no specific waste related public funding, to support the private waste companies to encourage innovation within waste management. While the economy is starting to improve following the recent recession, access to funding for private companies is still a major difficulty.

The financial resources are not sufficient in **Netherlands**. Human resources will be there if the financial resources are presented.

The Netherlands has a new policy for green deals and about 200 green deals have been made today concerning all kinds of issues; phosphate from suits, cooperation's within the plastic chain, slags of waste of energy plants, recycle concretes in a more sophisticated way osv. The North-sea of circle of economy is the first international green deal. There is a new administration set in place to promote, follow and evaluate green deals. These are good

examples of how the government wants to promote the development within the field of waste management – different actors working together.

The south of **Spain** has got a lot of financial support from the European Union through the regional government for improving technology for e.g. but this isn't innovative. The universities are working to develop entrepreneurs. Local authorities are not very familiar with the bio waste management.

There is a lack of financial resources in this area in **Sweden**. We had calls earlier from national research foundations but today these issues are embedded in other research programs. Working with public procurements ant innovations take a lot of extra resources that most organizations don't have.

Göteborg Kretslopp o Vatten a Swedish exampel of a project working with influencing peoples waste knowledge, was a self-financing project with no extra funding from the municipality. Those who worked there were either employed by the municipality or in some employment measures.

1.2.8 KNOWLEDGE DEVELOPMENT AND DISSEMINATION

The public knowledge of waste collection is high in **Flanders**; there have been high rates of recycling since mid-nineties in Flanders. The citizens know how to sort waste, but there is a continuous need to repeat the information about sorting and recycling waste. There are a lot of education programs in schools at all levels from young children to university level. Universities are more addressing eco design issues. The competing messages in Flanders about waste managing are weather to recycle or to work on prevention of waste.

The public knowledge in waste management in **Brussels** region is good. And there are a lot of sorting at source, for example if the transparent bags with household waste shows waste that should have been put in another bin, the garbage man leaves the bag at the house and puts a sticker on it explaining what's wrong. In schools, children at all ages are educated in waste management. There are 3 main organizations that are responsible for communicating information and knowledge about municipal waste to the public (BE, ABP and EPR schemes including Fost Plus for packaging waste), these organizations use all media. Focus is on packaging waste, food waste, food-oil and batteries. The facts that there are a lot of different languages in Brussels, and a fast turnover, make it difficult to communicate on the waste disposal in an effective way.

The understanding about the waste issue is low in **Croatia**. The government and the professionals don't understand that waste economics will change. There is no treatment in Croatia, only landfill. Landfilling is free with no fees or taxes. When all landfills shut down, the new mechanical plants will introduce gate fees that will be a new thing for the Croatian waste economy, since municipal companies will have to start dealing with gate fees. The waste treatment won't be feasible without it. Croatia is still talking about selling waste to incinerators and selling bio waste to composting plants. The government and the professionals don't understand that recycling is the only activity that brings profit. There is no societal profit for incineration.

The level of education of waste management in schools in Croatia is working well for children in young age. There are examples of organises activities in schools for over 800 children, but these low-level activities will not work for a long time. There is a need for a systematic change. Municipalities need to put infrastructure in place – children are taught to separate plastics but there are no recycling bins or infrastructure. There is an awareness-raising effect, but there is no system to implement this on.

In **Ireland** there are limited national environmental awareness schemes being promoted at present with the aim of increasing the knowledge of waste and waste recovery among citizens. At local level there are full time employees providing environmental awareness for the public and in the schools. The private sector will carry out educational campaigns and focus this at their own customers. This generally relates to educating the customer of how to dispose of the waste correctly reducing the contamination of the bio waste and dry recyclable waste streams.

During the 90ties in the **Netherlands** there were a lot of communication activities towards the citizens. These activities might have been put aside during the latest year and there's a need to communicate the importance of and why we are recycling as well as how to do it. The residents are taught about recycling in school and schools are even collecting papers and electric supplies in order to get some extra money for their activities. In Netherlands there is a monopro-system meaning that the organization that is responsible for a certain waste area also is responsible for the awareness among the residents within this area. These organizations are very active.

The idea is to make recycling easier for the residents than it is not to recycle. It all comes back to communication and what attitude the residents have towards recycling.

NVRD has been organizing courses within the technical area for municipalities for years. Today the interest is growing in social aspects and they cooperate with universities within the area of behavior changes.

There are competed messages about what is the most favorable to focus on; source separation or post separation, and the main focus in the Netherlands is sources separation. However in the big cities, where there isn't enough space, the reality is more focused on post separation. This isn't an issue of debate today though.

The knowledge level needs to increase among citizens in **Spain** regarding waste management and resource efficiency. Everyone knows the solution of landfill, but the knowledge and confidence in waste recovery is very low. The municipality is working with information campaigns and offer visits for residents to show the treatment plant and to explain the waste management in the province. Despite the new generations a change of habits is noticed, these campaigns should be intensified. Sometime, the national campaigns made through television are mistrusted by residents who only see it as political propaganda. The attitude of the residents must be changed, and in the end it's all about the household economy – do the citizens want to pay more to get a good waste management?

There isn't much research about waste management in the **Spanish** region. In some cases local authorities collaborate with universities on research on waste. The waste management companies are normally services companies with little research and development departments, betting little innovation. In the region around Granada, companies that are active within waste management find information about new solutions by looking at what is done in other countries such as Germany, Sweden and US.

The knowledge in general within the waste management is low but is moving fast towards a higher level in **Sweden**. There is a shift of generations within the waste business which brings along more women, younger employees and new academic backgrounds.

In school information about waste management is increasing. Teachers need a good education in this area. In the universities the waste issue is fragmented. Next step is getting designers into the waste management market.

When it comes to bio waste education in general and not only scientific studies but practical handling showing people how to act is very important in Sweden. Showing that it is clean and don't take much space is crucial. Ex Schoolchildren visiting the compost plant received soil from collected food waste to bring home to influence the parents.

1.2.9 CREATION OF LEGITIMACY

In **Flanders**, the main resistance for the development within the waste area is about costs; the more you try to recycle the more it costs to get everything organized, this is what the municipalities are struggling with today. More and more responsibilities are put at local level at the same time as the targets to reach are getting higher. This puts hard pressure on the municipalities and creates resistance. There is also increasing pressure on producers via EPR schemes that are confronted with higher targets on collection and recycling.

In Flanders they try to develop a common agenda for sustainable materials management via creating a platform on circular economy where environmental and economic government agencies sit together with industry and trade federations and environmental NGO's, trying to establish green deals on a voluntary basis (for instance within the chemical industry, the building industry, the technology industry). This platform on a circular economy is linked up with a transition network for sustainable materials management, which is a learning network for front runners both in government and business experimenting with innovative business models or policy measures that lead to more sustainable materials management.

Public opinion has been changing the last 10 years in **Coratia**, and today there is no real resistance to the waste issue. Nevertheless the interest within the municipalities is really low. If the political will could be improved in good and innovative waste management, the country would develop, since there are good examples that show that it doesn't cost more with good solutions.

Quality management was recently introduced in public procurement in Croatia. PPI in terms of environmental benefits and green procurement is something for the future. But everything is changing; from choosing a supplier based on lowest price to choosing the most advantageous solutions. Unfortunately about 90% of the public procurements in Croatia are agreed before the actual procurement. Municipalities are the ones that need new ideas and solutions, but since this would cost more, there is no possibility to even consider it, since the budgets are low.

It is very difficult to create legitimacy in **Ireland** for waste issues. When building new facilities, it is difficult to get political support for any facility and the licencing and planning processes (and appeals of each of these) can take many years before permission is received to develop a facility. Larger facilities bypass the local planning process for a number of reasons, some of

which relate to the reducing the time on the project application process, as these permissions are nearly always appealed at a national level. As it is difficult to build a facility, the choice of disposal is restricted and the private sector currently find it more attractive to export the waste than to develop a facility in Ireland.

When it comes to legitimacy for waste management issues in the **Netherlands** the opinions are a bit divided. On a general level there is no problem in getting legitimacy for waste management in the Netherlands since environmental issues already are considered important. The industries see the possibility in exporting their systems to other countries. But on a more local level you find resistance, for example from some producers in the diaper industry and the citizens need a change of attitude concerning separation of kitchen waste. New actors, institutions and associations in the management of waste, try to work together as much as they can. Municipal representatives have together with the ministry if environment, developed a vision of management of waste.

58% of the waste in the municipality is non-organic. It's a relevant issue for the citizens but it is difficult to change their habits. There is a huge political resistance to implement new solutions within bio waste management in the region around Granada in **Spain**. With about 172 municipalities and a huge unemployment, it's difficult to convince the mayors to follow set programs, policies and legislations for waste management. There is a lack of financial resources within the local authorities for these kinds of improvements. Nevertheless there is one example where a new facility for waste management created about 100 new jobs.

In the southern part of **Sweden** there is no direct resistance to the collection of waste. The change is welcome, but procured services have relatively long leases which is limiting changes for the procuring organizations. There is also no economic incentive to make change and take risks.

Among the public, there are already quite a high understanding of separation, not much of the" burn everything" - attitude anymore. There is a great divide when it comes to combustion, and the EU has said that we must get away from that - Sweden insist anyway. There are strong forces who want to build up incinerations and those forces are slowing down the development. Those incineration facilities have a natural resistance. The Swedish Waste Management and Recycling association has even said that we must have incineration to get to a sorting. Recycling Industries aren't pleased with the incineration since they want recovery and recycling.

To get to the combustion as a political issue is difficult. The Green Party doesn't comment on this. Common people think it is good to get rid of the garbage and get the energy from incinerating it, but it will not last long.

San Francisco is a city where they are smart and embrace new things, it is easy to get information and they also want to be environmentally friendly. They aim to be zero waste by 2020. In Italy - over 200 towns and villages have said that they will become Zero Waste. They also have very good sorting.

Spain has 90 % high sorting in the villages and towns in the north. It is a great system but require much training.

Looking at the waste management industry as a whole, they aren't good in listening to the end users - they should tell them what to do instead of including them in the analysis. There is a need of a change of behaviors.

1.2.10 POLICY

In **Flanders** they work with economic measures like taxes on landfilling and incineration and there are retributions on certain products to finance the local collection and recycling. These could be more developed. The Flemish representative thinks that PPI could have a very positive effect on the development within the area of waste management.

There are three areas that need to be developed in order to bring about a change in the **Brussels** region:

- a pay-as-you throw system for all residual wastes to promote prevention and separate collection.
- Clear recycling targets at European level to give a clear signal for investment in recycling facilities.
- Specific Re-use targets at European level, as re-use is higher than recycling in the waste hierarchy

The result of the PPI4Waste-project could be used in Ireland to influence and change the Irish system. Today there are no possibilities to make a PPI in Ireland.

There is a need for new sets of policies and instruments in order to reduce the material use in the **Netherlands**. This will concern all actors; producers, consumers etc, There is also a need for product regulations. If we could reduce for example all different plastic products to only a few, the waste stream would be easier to recycle.

With respect to PPI the biggest opportunities would lie within the material chain approach which is based on a holistic view on materials and product throughout their life cycle. For household waste also the improvement of waste separation in cities and densely populated areas, and the improvement of separation of organic kitchen waste are areas of specific interest. In developing waste management it's important to change behaviors and attitudes. Municipalities and waste management companies in **Netherlands** need to work close together in changing citizen's behaviors and attitudes.

An implementation of a solution to the chosen need wouldn't be supported by current policy in **Spain**.

There is a great scope in **Sweden** for innovation but there isn't a clear lack of policies, it's more about leadership and how to organize services. This is where the work and the change have to be done. There are different forms of procurement and innovation processes and they are all linear. One must dare to think more circular for working with innovation and also include the end user much more. More services development and business development. However, the PPI is easiest for the technology.

The strong incineration tradition in Sweden is counteracting the possibility to motivate people in general in waste management issues.

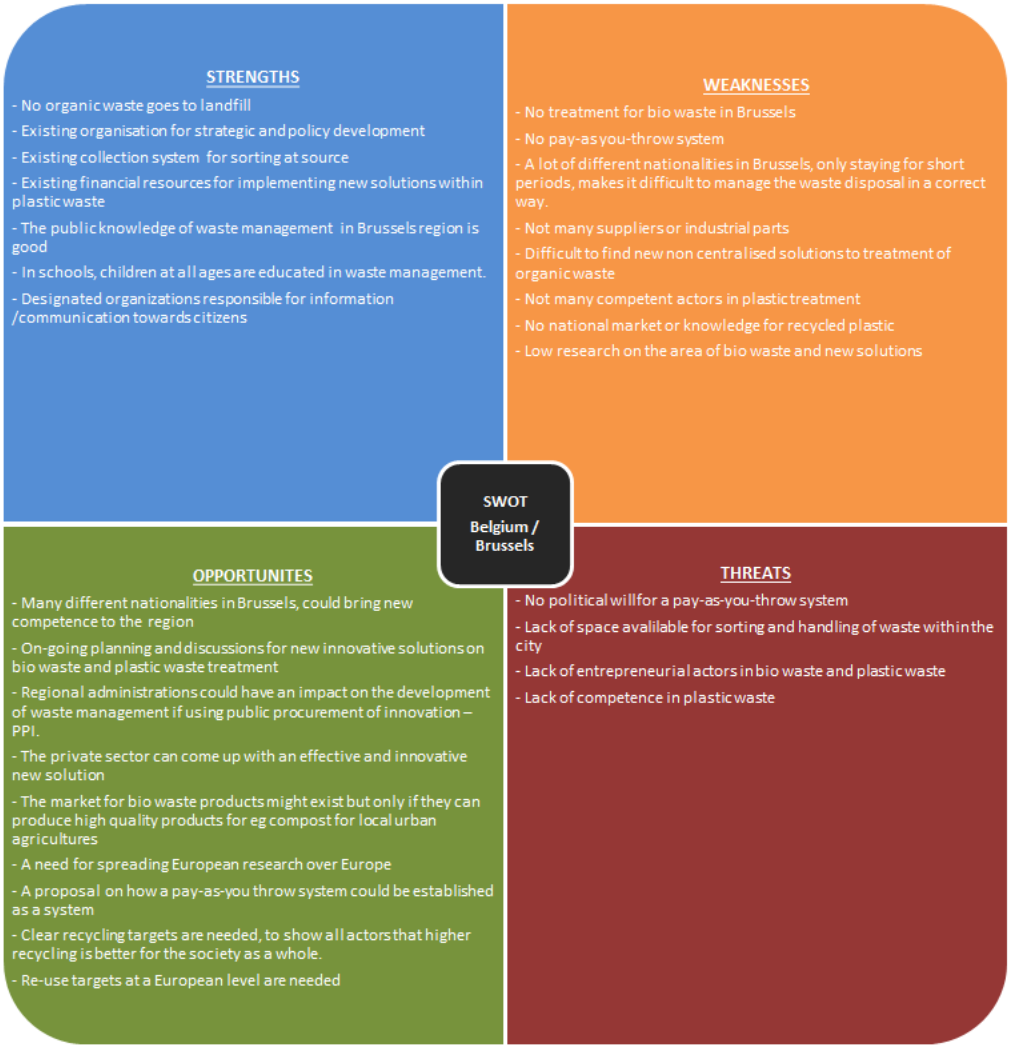
When it comes to bio waste, the municipality that decided that all waste should be collected is a winner. None of the Swedish municipalities have the vision Zero Waste. There is a problem in Sweden that we have too low set targets.

APPENDIX IV

ALL SWOT ANALYSES

1.1 BELGIUM

The situation in Belgium is explained by two representatives; one from the Waste Division of Bruxelles Environnement, the environmental administration of the Brussels-Capital Region, and one from Service Policy Innovation Department Waste and Materials Management OVAM (Public Waste Agency of Flanders).




STRENGTHS
- Regional organization working with waste policies and policy measures, eco-design and new business models and new markets for recycled products
- Regional organisation giving guidance of good criteria of public procurement and stimulating local authorities to do more public procurements.
- Higher targets for recycled materials and bio-waste, than the European legislation
- Developed collection system of household waste
- 70% of collected waste is recycled
- Active research actors within raw material and technology
- Good financial resources when it comes to waste management
- The public knowledge of waste collection is high
- A lot of education programs in schools
WEAKNESSES
-There might not be enough suppliers for innovative products or services, which might put legal problems to the procurement.
- Belgium is a small market and the access to suppliers and actors depends
- The competing messages in Flanders about waste managing are weather to recycle or to work on prevention of waste
SWOT
Belgium / Flanders
OPPORTUNITES
- Public procurement in Flanders is about three things; technology, cultural shift and finance
- PPI can make a difference in developing the waste management area in Flanders
- New activities are undertaken for eg 3D-printing as a way of designing products in a decentralized way
- Mindshift in waste companies - also give guidance to clients in changing their waste
- In Flanders they work with industrial symbiosis and also try to cooperate in industrial symbiosis with the Netherlands
THREATS
- More and more responsibilities are put at local level at the same time as the targets to reach are getting higher. This puts hard pressure on the municipalities and creates resistance.
- The main resistance for the development within the waste area is about costs

1.2 CROATIA

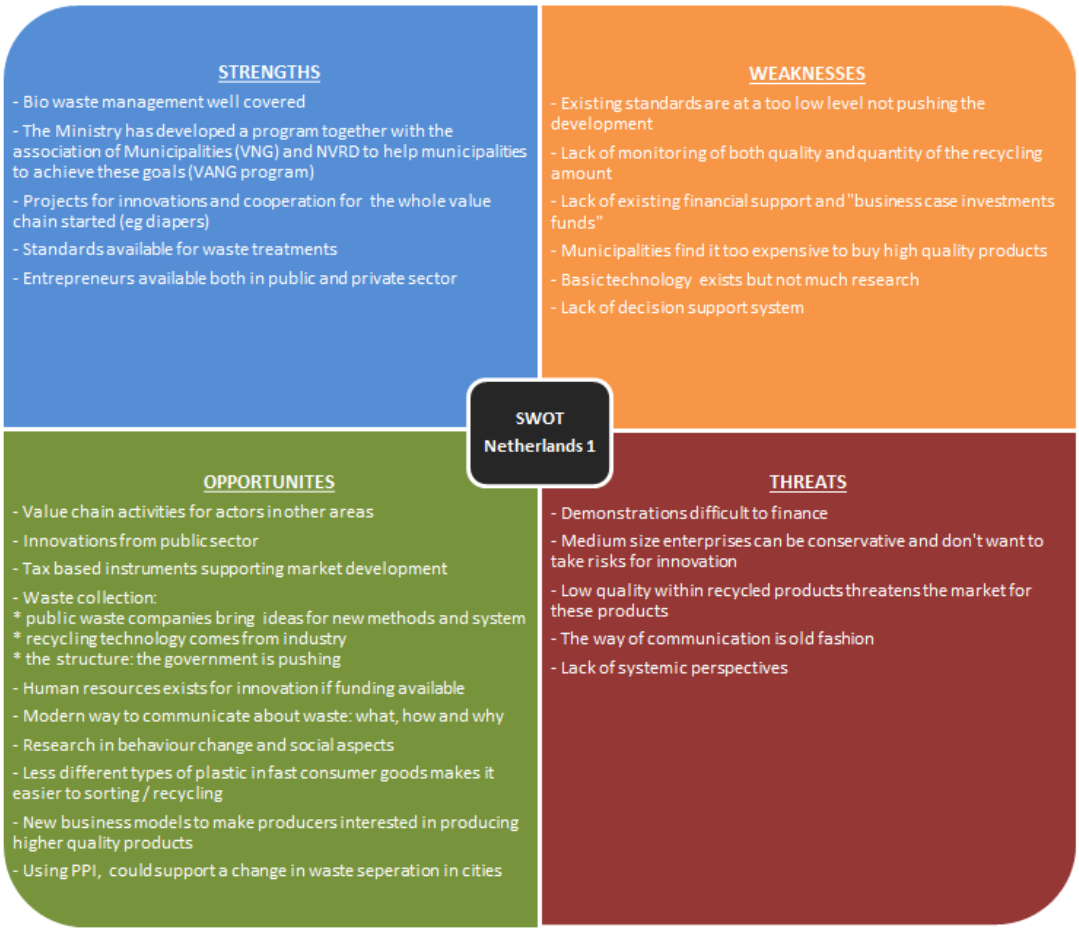
The situation in Croatia is explained by one representative from a company working with waste management plans, mostly with public companies and authorities and mostly in recycling.

1.3 IRELAND

The situation in Ireland is explained by one representative from Meath County Council.

1.4 THE NETHERLANDS

The situation in Netherlands is explained by two representatives; one from The NVRD, Dutch Solid Waste Association and one from International Cooperation RWS-WVL- Environment.



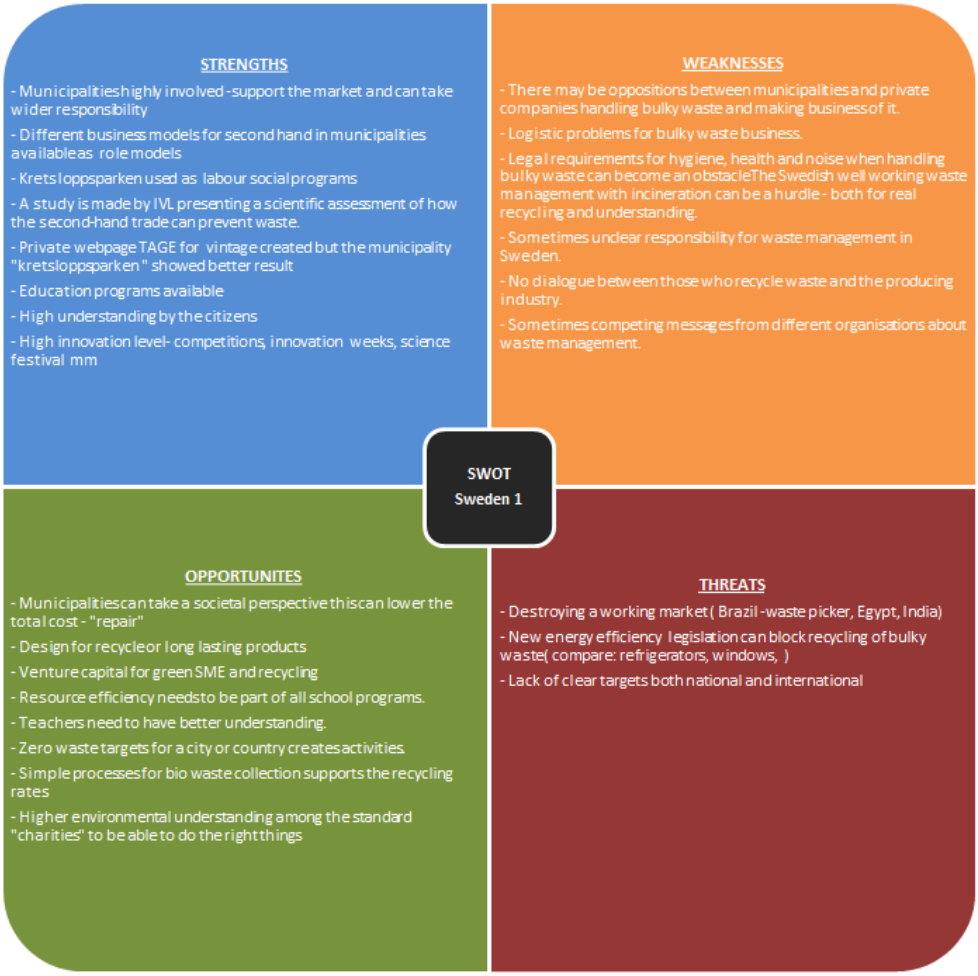

STRENGTHS
- Bio-waste management well covered
- Projects for innovations and cooperation for the whole value chain started (eg diapers)
- Standards available for waste treatments
entrepreneurs available both in public and private sector
WEAKNESSES
- Lack of decision support system
- Exisiting standards too low level not pushing the development
lack of monitoring of both quality and quantity of the recycling amount
- Lack of existing financial support and "business case investments funds"
- Municipalities find it too expensive to buy high quality products
basic technology excists but not much research
SWOT
Netherlands 2
OPPORTUNITES
- Value chain actitivites for actors in other areas
- Innovations from public sector
- Tax based instruments supporting market development
waste collection:
- public waste companies bring ideas for new methods and system
- recycling technology comes from industry
- the structure: the government is pushing
- Human resources exists for innovation if funding available
- Modern way to communicate about waste: what, how and why
- Research in behaviour change and social aspects
- Less different types of plastic in fast consumer goods makes it easier to sorting / recycling
- New business models to make producers interested in producing higher quality products
THREATS
- Lack of committment in the value chain
- Demonstrations difficult to finance
- Medium size enterprises can be conservative and don't want to take risks for innovation
- Low quality within recycled products threatens the market for these products
- The way of communication is old fashion
- Lack of systemic perspectives

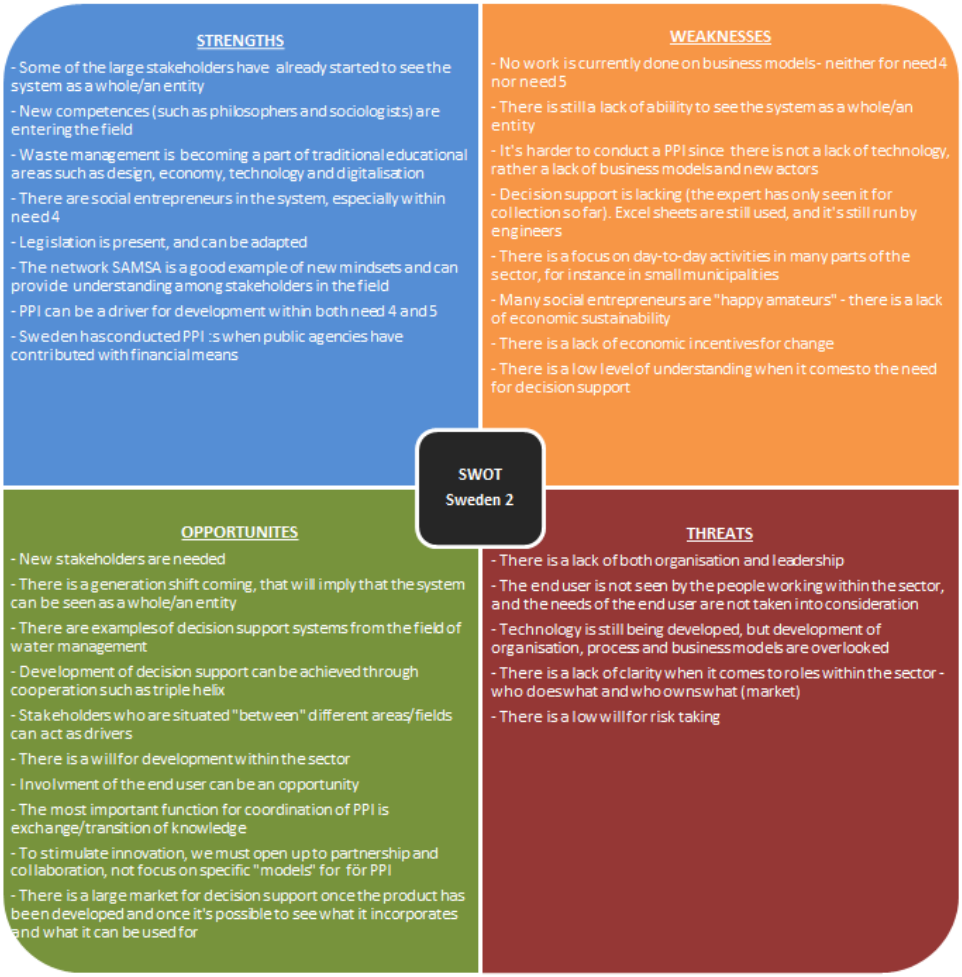
1.5 SPAIN

The situation in Spain is explained by one representative from Diputación de Granada – a local authority in charge of waste treatment for the Province of Granada.

1.6 SWEDEN

The situation in Sweden is explained by two representatives; one from the private consultancy company Rhetikfabriken and one from the public organization Kretsloppskontoret.




STRENGTHS
- Some of the large stakeholders have already started to see the system as a whole/an entity
- New competences (such as philosophers and sociologists) are entering the field
- Waste management is becoming a part of traditional educational areas such as design, economy, technology and digitalisation
- There are social entrepreneurs in the system, especially within need 4
- Legislation is present, and can be adapted
- The network SAMSA is a good example of new mindsets and can provide understanding among stakeholders in the field
- PPI can be a driver for development within both need 4 and 5
- Sweden has conducted PPI :s when public agencies have contributed with financial means
WEAKNESSES
- No work is currently done on business models - neither for need 4 nor need 5
- There is still a lack of abiility to see the system as a whole/an entity
- It's harder to conduct a PPI since there is not a lack of technology, rather a lack of business models and new actors
- Decision support is lacking (the expert has only seen it for collection so far). Excel sheets are still used, and it's still run by engineers
- There is a focus on day-to-day activities in many parts of the sector, for instance in small municipalities
- Many social entrepreneurs are "happy amateurs" - there is a lack of economic sustainability
- There is a lack of economic incentives for change
- There is a low level of understanding when it comes to the need for decision support
SWOT
Sweden 2
OPPORTUNITES
- New stakeholders are needed
- There is a generation shift coming, that will imply that the system can be seen as a whole/an entity
- There are examples of decision support systems from the field of water management
- Development of decision support can be achieved through cooperation such as triple helix
- Stakeholders who are situated "between" different areas/fields can act as drivers
- There is a will for development within the sector
- Involvment of the end user can be an opportunity
- The most important function for coordination of PPI is exchange/transition of knowledge
- To stimulate innovation, we must open up to partnership and collaboration, not focus on specific "models" for för PPI
- There is a large market for decision support once the product has been developed and once it's possible to see what it incorporates and what it can be used for
THREATS
- There is a lack of both organisation and leadership
- The end user is not seen by the people working within the sector, and the needs of the end user are not taken into consideration
- Technology is still being developed, but development of organisation, process and business models are overlooked
- There is a lack of clarity when it comes to roles within the sector - who does what and who owns what (market)
- There is a low will for risk taking

APPENDIX V

ALL LEVEL OF SYSTEM READINESS

1.1 BELGIUM

Level of system readiness for a PPI: Brussels region

	Impact on structure				Key innovation processes (the dynamics)							Public org. Influ-ence
	Actors	*Networks*	*Institutions*	*Technology*	*Entrepreneurial activities*	*Market*	*Guidance for search*	*Resource mobilization*	*Knowledge development and dissemination*	*Creation of legitimacy*	*Policy*	
Bulky waste												
Biowaste												
Plastic												
Collection points												
Decision support												

High level Medium level Low level

The most important activity to target to enable a PPI

In Brussels region it is obvious that the authorities have a possibility to influence the system by means of a PPI. A policy change needs to take place including setting clear targets for recycling and showing political willingness to facilitate a PPI and the changes needed to facilitate PPI implementation. The public knowledge within the area of waste management is good but there is a lack of entrepreneurs and low level of research.

Level of system readiness for a PPI: Flanders Belgium

	Impact on structure				Key innovation processes (the dynamics)							Public org. Influ-ence
	Actors	*Networks*	*Institutions*	*Technology*	*Entrepreneurial activities*	*Market*	*Guidance for search*	*Resource mobilization*	*Knowledge development and dissemination*	*Creation of legitimacy*	*Policy*	
Bulky waste												
Bio waste												
Plastic												
Collection points												
Decision support												
General												

High level Medium level Low level

The most important activity to target to enable a PPI

It looks like Flanders can quite easily work with PPI as an instrument to obtain a change. There are not enough actors available but the location close to the Netherlands can solve that problem. There is a clear understanding and willingness from regional level to work with circular economy and create a change. Since the municipalities are responsible for waste management performance there is a need for more financial resources and an active market. The universities in the region have high level research both for waste management and also for business development.

1.2 CROATIA

Level of system readiness for a PPI: Croatia

	Impact on structure				Key innovation processes (the dynamics)							Public org. Influence
	Actors	*Networks*	*Institutions*	*Technology*	*Entrepreneurial activities*	*Market*	*Guidance for search*	*Resource mobilization*	*Knowledge development and dissemination*	*Creation of legitimacy*	*Policy*	
Bulky waste												
Biowaste												
Plastic												
Collection points												
Decision support												

High level Medium level Low level

The most important activity to target to enable a PPI

To be able to perform a real PPI in Croatia, the waste management plan 2020 has to be fulfilled the year of 2020 instead of the year 2030 as stated in the Croatian waste management plan. A clear willingness and leadership from the politicians has to be in place. Resources are present and can be re-allocated for a test of a "PPI".

In a case like this in Croatia a PPI could probably be performed by scaffolding the procurement capacity and support the eco-innovators for a specific solution to a strong need. This could be done as a project, drawing all the actors, competences and resources together for a mission oriented PPI with support in the local policy and the EU waste challenges.

1.3 IRELAND

Level of system readiness for a PPI: Ireland

	Impact on structure				Key innovation processes (the dynamics)							Public org. Influ-ence
	Actors	*Networks*	*Institutions*	*Technology*	*Entrepreneurial activities*	*Market*	*Guidance for search*	*Resource mobilization*	*Knowledge development and dissemination*	*Creation of legitimacy*	*Policy*	
Bulky waste												
Biowaste												
Plastic												
Collection points												
Decision support												

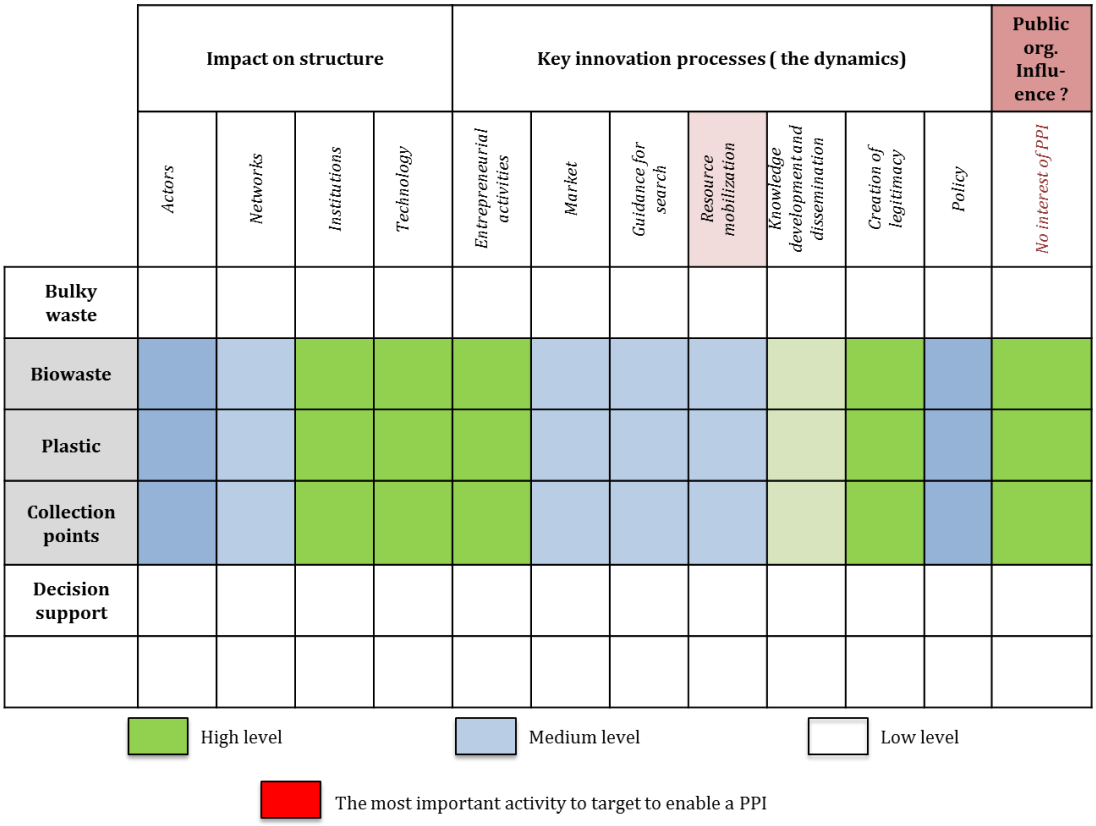
High level Medium level Low level

The most important activity to target to enable a PPI

In Ireland public organizations cannot use PPI as a tool for innovation, since their role within the waste management area is regulation, education and enforcing legislation. Local authorities have no role in the collection infrastructure and treatment. This is taken care of by the private infrastructure. If public organizations are to influence the change within waste management, they need to become an active part at the market of waste management.

1.4 THE NETHERLANDS

Level of system readiness for a PPI: Netherlands 1



The Netherland is a country acting as a frontrunner in general in waste management issues and has all important parts in the innovation system framework. The most important activity to obtain a change within the waste management sector in the Netherlands is to change attitudes and behaviors among citizens. That's why in this case there is no specific activity in the matrix above that can be pointed out as important to develop in order to use PPI as a tool for innovation.

Level of system readiness for a PPI: Netherlands 2

	Impact on structure				Key innovation processes (the dynamics)							Public org. Influ-ence
	Actors	*Networks / behaviour*	*Institutions*	*Technology*	*Entrepreneurial activities*	*Market*	*Guidance for search*	*Resource mobilization*	*Knowledge development and dissemination*	*Creation of legitimacy*	*Policy*	
Bulky waste												
Bio waste												
Plastic												
Collection points												
Decision support												
General												

High level Medium level Low level

The most important activity to target to enable a PPI

The knowledge among the citizens is high but there is a need to change behavior and attitudes. Institution consists of two different parts; hard legislation which is well in place in the Netherlands and soft legislation such as habits, routines, customs. In order to develop innovations further, the soft legations (institutions) need to get in focus.

1.5 SPAIN

Level of system readiness for a PPI: Spain

	Impact on structure				Key innovation processes (the dynamics)							Public org. Influ-ence
	Actors	*(Networks)*	*Institutions*	*Technology*	*Entrepreneurial activities*	*Market*	*Guidance for search*	*Resource mobilization*	*Knowledge development and dissemination*	*Creation of legitimacy*	*Policy*	
Bulky waste												
Biowaste												
Plastic												
Collection points												
Decision support												

High level Medium level Low level

The most important activity to target to enable a PPI

In Spain the possibility of public influence is low due to long-term tenders allocated to waste management organizations (in some cases up to 25 years' contract). Nevertheless there is a possibility to use PPI in order to develop the innovation solutions within the waste management. To be able to do this, the most important areas to focus on are finding financial resources and networks between triple helix actors. Spain also should focus on more entrepreneurial activities and get knowledge and confidence on waste recovery among citizens.

1.6 SWEDEN

Level of system readiness for a PPI: Sweden 1

	Impact on structure				Key innovation processes (the dynamics)							Public org. Influ-ence
	Actors	*Networks*	*Institutions*	*Technology*	*Entrepreneurial activities*	*Market*	*Guidance for search*	*Resource mobilization*	*Knowledge development and dissemination*	*Creation of legitimacy*	*Policy*	
Bulky waste												
Biowaste												
Plastic												
Collection points												
Decision support												

High level Medium level Low level

The most important activity to target to enable a PPI

Sweden has a long tradition and well developed understanding of waste management. There is a need to develop or find new technology for decision support systems. There is large market potential for decision support system, but there are few entrepreneurs and there is no developed market. The possibility uptake PPI has been tested for different needs within waste management and there is willingness to go further.

Level of system readiness for a PPI: Sweden 2

	Impact on structure				Key innovation processes (the dynamics)							Public org. Influ-ence
	Actors	*Networks*	*Institutions*	*Technology*	*Entrepreneurial activities*	*Market*	*Guidance for search*	*Resource mobilization*	*Knowledge development and dissemination*	*Creation of legitimacy*	*Policy*	
Bulky waste												
Biowaste												
Plastic												
Collection points												
Decision support												

High level Medium level Low level

The most important activity to target to enable a PPI

In order to make a PPI in the bulky waste area, there is a need to look more carefully at both the hard institutions e.g. legislation and the soft such as routines, habits and behavior. Some can be addressed within the framework of the producer's responsibilities. When dealing with bulky waste the public need to be engaged in order to make a change. This in turn requires new business models and entrepreneurial activities that can be supported by public procurement. In Sweden there is a fragmented market for bio-waste as there are different views on the best use of the bio-waste leading to different incentives.