JOINT ACTION PLAN

A WAY FORWARD FOR INNOVATIVE WASTE MANAGEMENT

WASTECOSMART

This brochure has been prepared by the WASTECOSMART consortium as Deliverable 6.4
"Joint Action Plan including common R&D and innovation agenda".

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INTRODUCTION

Many share the vision of a sustainable society. This could be more than a distant aspiration – but it needs action. Innovative waste management is a part of the solution but we will not succeed if the responsible actors work in isolation from one another. To succeed, actors all along the chain of waste management will have to cooperate. Only at that point will we achieve substantial positive sustainability impacts.

With a holistic perspective and collaboration between science, industry and the public sector, waste can be handled more efficiently and even prevented. Through cooperation, new business models and incentives can be developed to maximise value from waste, leading to expanded and robust markets for products and materials recovered from waste. Creating platforms for cooperation and knowledge transfer, best practices can be highlighted and implemented. This Joint Action Plan identifies a way forward for innovative waste management for municipal solid waste.

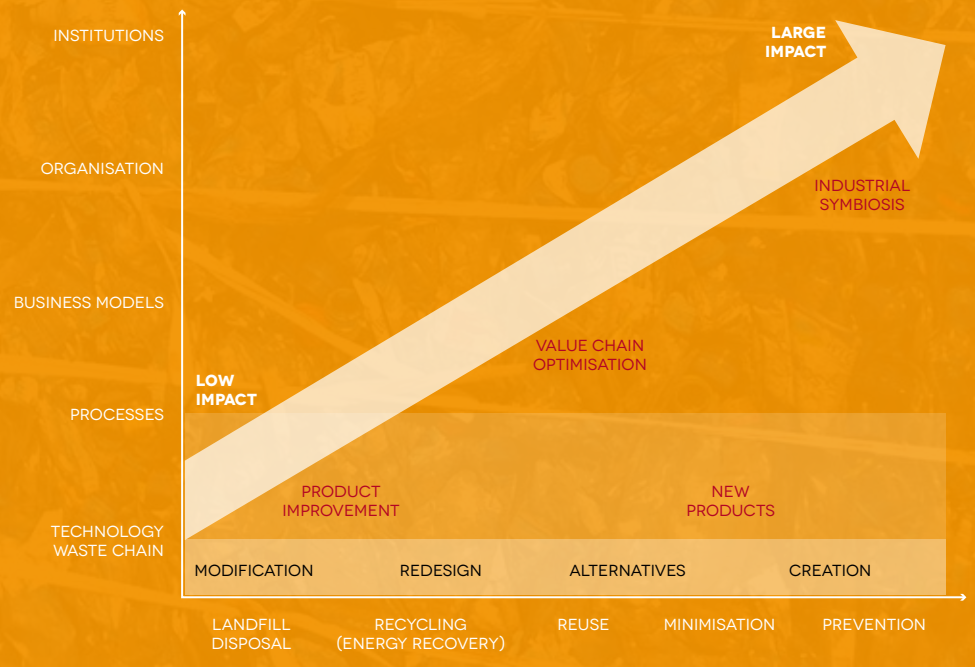


Figure 1: Impact of Innovation in the waste management chain, **Source:** OECD

WASTECOSMART

The overall objective of the project is to strengthen and increase the innovation capacity of regional research-driven clusters in resource efficiency through cooperation, research and technological development within the waste sector

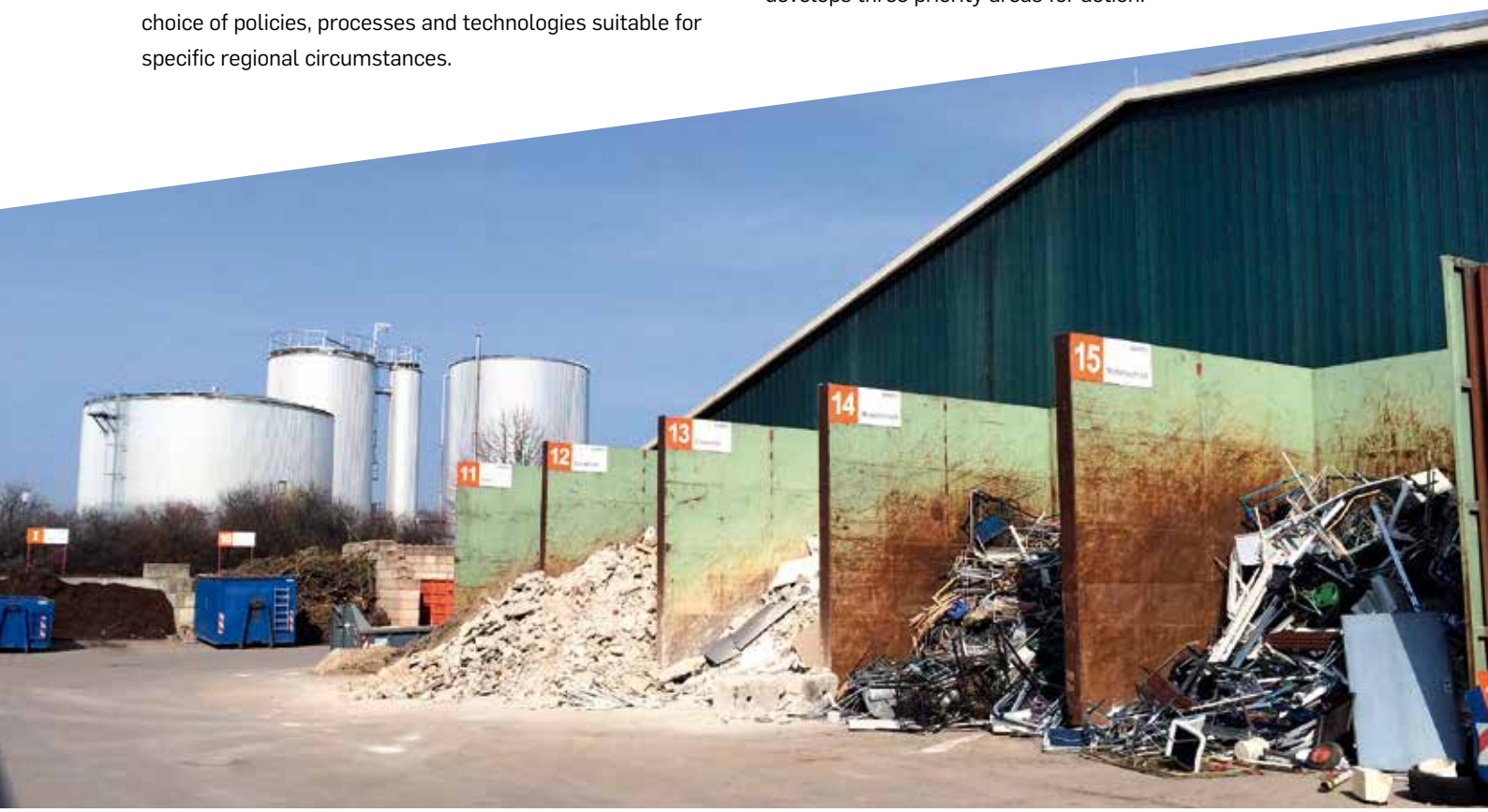
WASTECOSMART wants to pave the way ahead for innovative municipal solid waste management. For the project, six regional research-driven triple helix clusters (science, industry and public sector) have been formed in Amsterdam (NL), Budapest (HU), Liverpool (UK), Paphos (CY), Piedmont (IT) and Stockholm (SE).

The overall objective of the project is to strengthen and increase the innovation capacity of regional research-driven clusters in resource efficiency through cooperation, research and technological development within the waste sector, thus helping to introduce innovation to the market in the waste sector and, as a consequence, support economic growth and regional development.

The optimisation of integrated waste management is a key challenge for many European regions. It requires the formulation of comprehensive waste management strategies, the assessment of research and innovation needs and informed decision-making with regard to the choice of policies, processes and technologies suitable for specific regional circumstances.

The WASTECOSMART project intends to provide a contribution to the optimisation and integration of waste management strategies into the Europe 2020 Strategy, maximizing resource efficiency in priority areas of a "Resource Efficient Europe". This will be implemented by promoting innovation based on research and technology development in the field of integrated waste management of municipal solid waste.

The partners in the WASTECOSMART project have joined forces to elaborate a Joint Action Plan (JAP) for the coordination and strengthening of their complementary research and development (R&D) and innovation capacities. In close consultation with regional actors and stakeholders from the worlds of science, businesses and public authorities, the regions have produced a coordinated set of Regional Research and Innovation Agendas and a cross-regional Joint Action Plan, which lays out a common roadmap for future collaborative RTD activities and develops three priority areas for action.



EU AND RESOURCE EFFICIENCY

European legislation is a key driver for innovative waste management, with a strong emphasis on reducing the production of waste. In its Waste Framework Directive, the European Union has defined a five-step waste management hierarchy (see figure below), outlining prevention as the most favoured option, followed by re-use and recycling, to recover resources to a maximum level. Finally, disposal - such as landfilling - is considered the least favoured option, to be used only when other options are not possible.

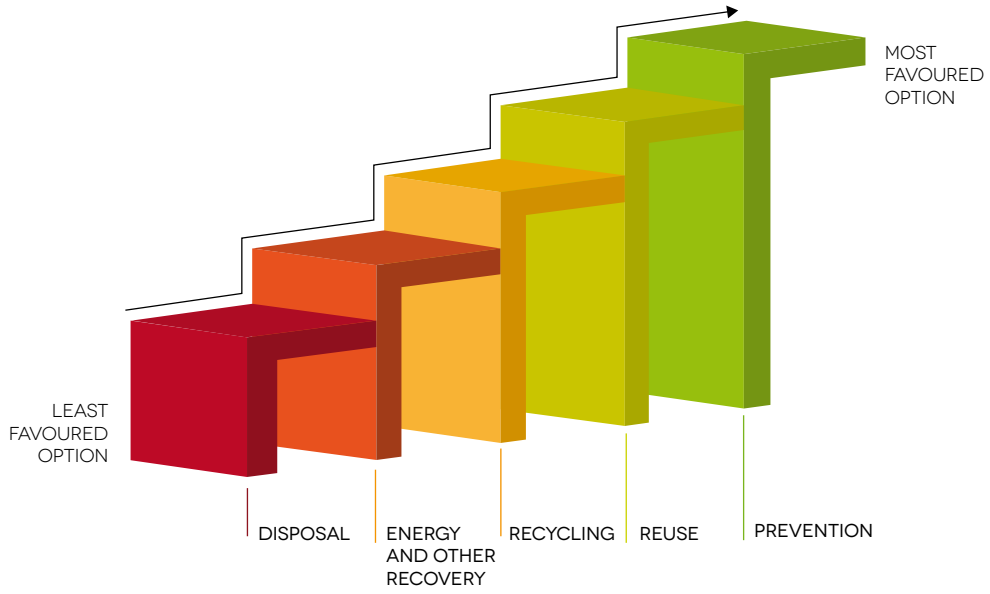


Figure 2: The Waste hierarchy

Currently, the the European economy relies heavily on the import of raw materials and resources from other parts of the world. Despite this, Europe loses about 60% of its three billion tonnesolid waste resource through landfilling and incineration each year. This has a harmful impact upon both the economy and the environment. From an economic and environmental point of view, it is high time for a paradigm shift away from dealing with waste to resource efficiency. With its 2011 Resource Efficient Europe flagship initiative [1], the European Union has laid out the political will to promote and implement innovative resource efficiency measures and to accelerate research and innovation in this area. Innovative solid waste management is a key driver for resource efficiency, impacting not only the supply of raw materials and energy, but also the quality of water, soils and ecosystems. In order for sustainable waste management to succeed at regional and local levels, a new wave of innovation will be required, ensuring "that residual waste is close to zero and that ecosystems have been restored".

60%

Europe loses about 60% of its three billion tonne solid waste resource through landfilling and incineration each year.

"The European Commission is currently working on a new, more ambitious circular economy strategy late in 2015, to transform Europe into a more competitive resource-efficient economy, addressing a range of economic sectors, including waste. The new strategy will include a new legislative proposal on waste targets. Circular Economy means ***re-using, repairing, refurbishing and recycling*** *existing materials and products. What used to be regarded as 'waste' can be turned into a resource. The aim is to look beyond waste and to close the loop of the circular economy. All resources need to be managed more efficiently throughout their life cycle." [2]*

The European Commission, 2015

BACKGROUND TO THE JOINT ACTION PLAN

THE REGIONAL DEVELOPMENT AREAS

LIVERPOOL REGION

Area: 724 Km²
Population: 1.5 million
%Y: 0.29% → 0.09%
GDP: 18.467 €
MSW per capita: 518 Kg

Regional development areas: waste management, material tracking, skills development in the community, waste prevention

STOCKHOLM REGION

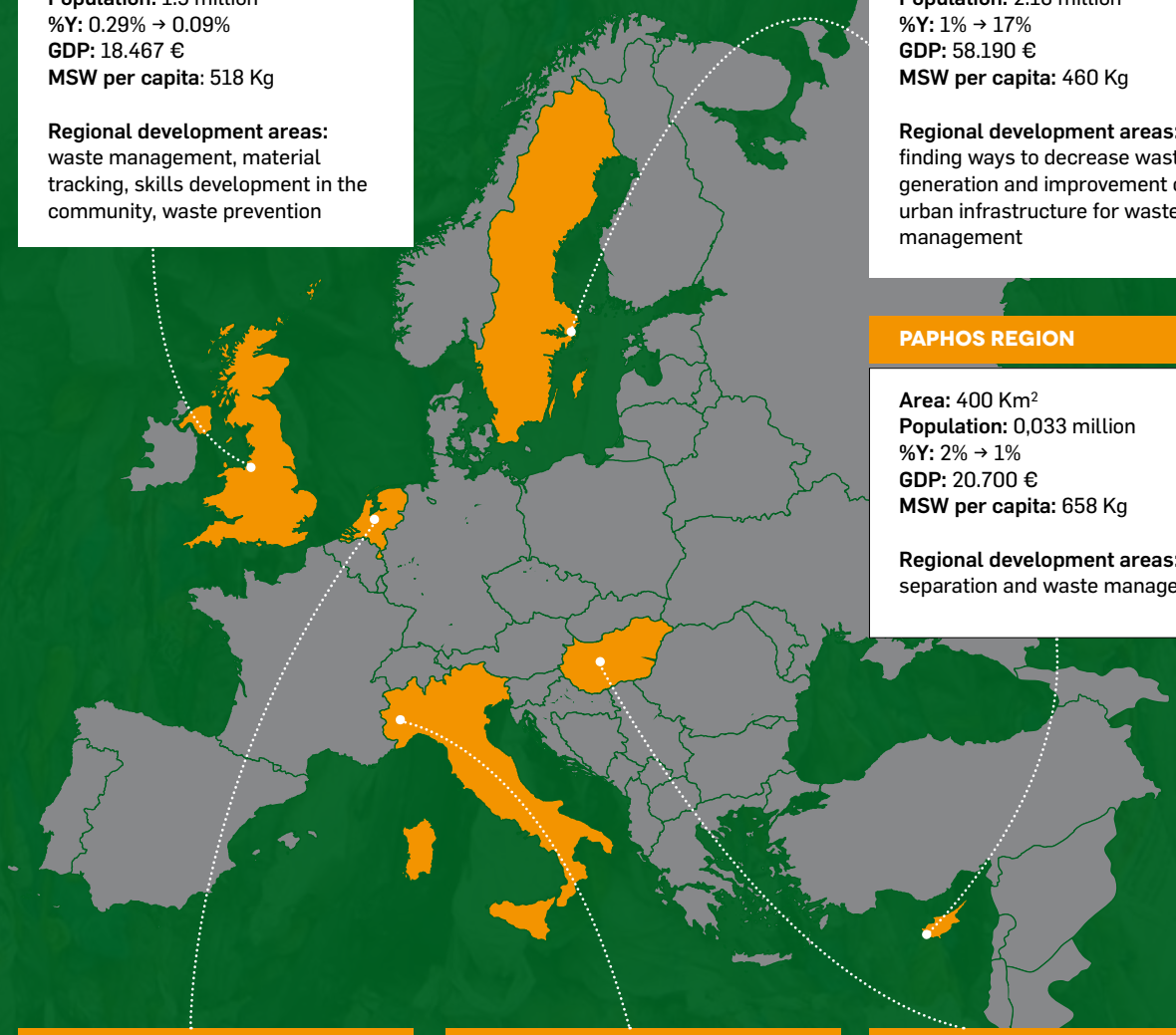
Area: 6519 Km²
Population: 2.16 million
%Y: 1% → 17%
GDP: 58.190 €
MSW per capita: 460 Kg

Regional development areas: finding ways to decrease waste generation and improvement of urban infrastructure for waste management

PAPHOS REGION

Area: 400 Km²
Population: 0,033 million
%Y: 2% → 1%
GDP: 20.700 €
MSW per capita: 658 Kg

Regional development areas: separation and waste management



AMSTERDAM REGION

Area: 219 Km²
Population: 2 million
%Y: 5% → 2%
GDP: 38.600 €
MSW per capita: 596 Kg

Regional development areas: source separation and green waste treatment

PIEDMONT REGION

Area: 25400 Km²
Population: 4.64 million
%Y: 5,8% → 5,8%
GDP: 12.357 €
MSW per capita: 535 Kg

Regional development areas: enhancing the organic fraction management

BUDAPEST REGION

Area: 6919 Km²
Population: 2.97 million
%Y: 1,96% → 0,1%
GDP: 0.032 per capita in €
MSW per capita: 382 Kg

Regional development areas: organic material management and raising of local people awareness

Figure 3: Some facts about the WASTECOSMART regions

UNDERSTANDING SOCIETAL CHANGE

To really pave the way for innovative waste management, we need to understand how society works and functions. With a broader understanding of societal change and the interactions between different actors, resources can be allocated efficiently. A shared vision is key to creating real change - actors all along the waste management chain should strive to move in the same direction. Clear and accomplishable goals need to be connected to that vision. Also, benchmarking best solutions and learning from them is crucial in order to convince stakeholders of the need for change and the way forward. The combination of a vision, clear goals and benchmarking together with a toolbox that contains policy measures, collaboration and innovation support is a way forward for innovating in waste management for municipal waste.

Figure 4: Visions and goals for innovative and optimised waste management

It is with this broader understanding of societal change in mind that the WASTECOSMART partners have developed concepts for various projects outlined in this JAP. Regional visions, goals and tools have been evaluated based on available information to get a greater understanding of the regional context, creating a better platform to develop strategic activities on. The different visions have then been evaluated by criteria such as whether the vision is region specific or more broadly formulated, if the vision is anchored among different actors in the region, and to what degree the vision has been communicated to this point. Goals have been assessed by how well they supportg the vision. Are they SMART *(Specific, Measurable, Attainable, Realistic, Timely)*, and are they communicated to and established with stakeholders?

REGIONAL ANALYSIS

The specific regional needs and challenges have been analysed using the WASTECOSMART Toolbox. With this background analysis prioritised topics for regional development have been created (*for more information about the toolbox visit wastecosmart.eu*). The analysis of regional research and innovation capacities and challenges are listed below.

AMSTERDAM REGION

Amsterdam considers that the lack of shared vision and the coordination of education system are two major weaknesses that need to be addressed. Promoting cultural change to see waste as a resource has been identified as key to moving forwards. Closing the cycles of food, raw materials, energy, water and phosphate has been identified as an opportunityto address weaknesses identified..

BUDAPEST REGION

Budapest believes that rapidly changing rules, strict standards, the fact that the innovations do not reach the market, weak cooperation with scientific institutions and weaknesses in the application of research initiatives and new research findings can be seen as threats. Budapest considers waste management innovation, innovative environmental technology, building strong cooperation between the municipality and the university, educating waste producers and encouraging behavioural/ cultural change in waste prevention as being potential opportunities to address these threats.

LIVERPOOL REGION

Liverpool considers the absence of business drive, limitation in funding resources, lack of regional structure/leadership and governance, and uncertain and weak markets (weak demand and initiatives) to be weaknesses. The strategies to address them are to maximize sustainable economic activity associated with waste management, promote waste prevention and resource efficiency, provide sufficient capacity for waste management activities and to achieve high recycling rates, among others.

PAPHOS REGION

The Paphos cluster has identified lack of separation at source, high cost to create facilities for waste

The consortium partners have proposed a set of possible joint actions for the implementation of the research innovation agenda as a joint action plan.

management, inadequate knowledge and no education on waste amongst citizens, and uncontrollable disposal in open secluded areas as some of the many problems in the region. They particularly point out that by not using the "pay as you throw system", many people produce great amount of waste without being charged accordingly. One solution could be remodelling and enhancing the concept of recycling at source in order for it to become more cost effective and efficient. The construction of modern waste management facilities and the minimization of landfill were also some of the opportunities identified.

PIEDMONT REGION

Piedmont highlights that citizens often do not follow the instructions given at municipality level which can be seen as a threat to the region. Furthermore Piedmont defines high costs as the biggest weakness in the region. The cluster also underline that industrial development relies on incentives provided at the national level. This and the high costs required to implement new technologies have thus been defined as weakness. They also point out that energetic valorisation of municipal solid waste might cause a threat of market distortion. Opportunities to address these weaknesses are achieving a high level of recycling, less waste production with techniques like pay as you throw, incentive to buy un-packaged goods, and education paths for schools and citizens, amongst others.

STOCKHOLM REGION

According to Stockholm, there are few incentives towards waste prevention in the region, which can be seen as a weakness. There is too much focus on separation at the expense of prevention and also there is a lack of market initiative and demand. Improvement strategies could be to further develop waste collection systems based on human needs and which are therefore readily adopted both by the user and the collector. Other problem-facing measures are zero tolerance on hazardous waste in garbage bags and to add waste management as a natural part of the municipal planning process.

THREE COMMON PRIORITY AREAS FOR ACTION

From these common challenges we have identified three main areas of priority:

1. Waste minimisation;
2. Maximisation of value from waste;
3. Knowledge transfer.

The consortium partners have proposed a set of possible joint actions for the implementation of the research innovation agenda as a joint action plan. The joint actions are described in more detail for each identified priority on page 19.

DEVELOPING THE JAP

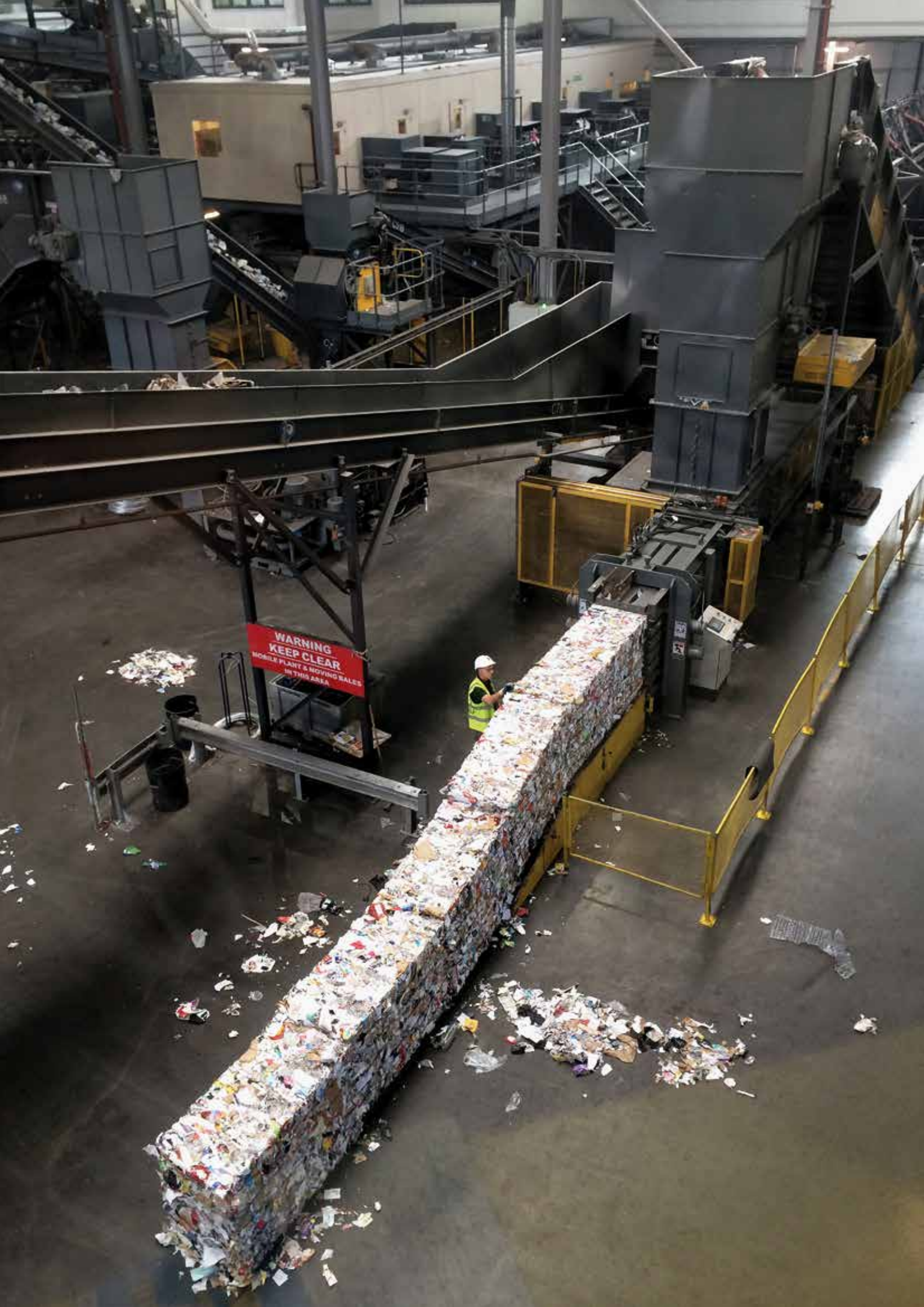
Developing Joint Action Plans is a popular way to strengthen and improve common visions and projects. The EU stimulates cooperation among heterogeneous actors in vertical fields and markets through the adoption of "joint action planning". This methodology is for instance increasingly adopted in healthcare, educational, societal, energy and security fields.

When developing the JAP, the WASTECOSMART partners have had an ambition to make the most of the triple-helix structure, trying to create projects with actors that complement each other, thus covering wider parts of the waste management chain.

The JAP relies on the pillars of a thorough investigation of:

1. WASTECOSMART partners' analysis conducted on the drivers of a SWOT analysis of the various cluster regions
2. Mapping of innovation capacities;
3. A wide study about sustainability and funding resources that can be committed to the development of the project outcomes.

After completing the Innovations Systems analysis of the six WASTECOSMART regions in 2014 the project conducted a series of workshops at local level for the implementation of a multi- criterion analysis Decision Support Framework (DSF) tool, with the support of the University of Amsterdam. These, with an in-depth conference held in Amsterdam in March 2015, are the basis of the WASTECOSMART JAP. The analysis has identified regional and common opportunities as well as threats. The regional innovation and research potential within each region was identified resulting in a common Research and Innovation agenda to be able to jointly turn opportunities and threats into a practical roadmap for filling the gaps and needs of each region.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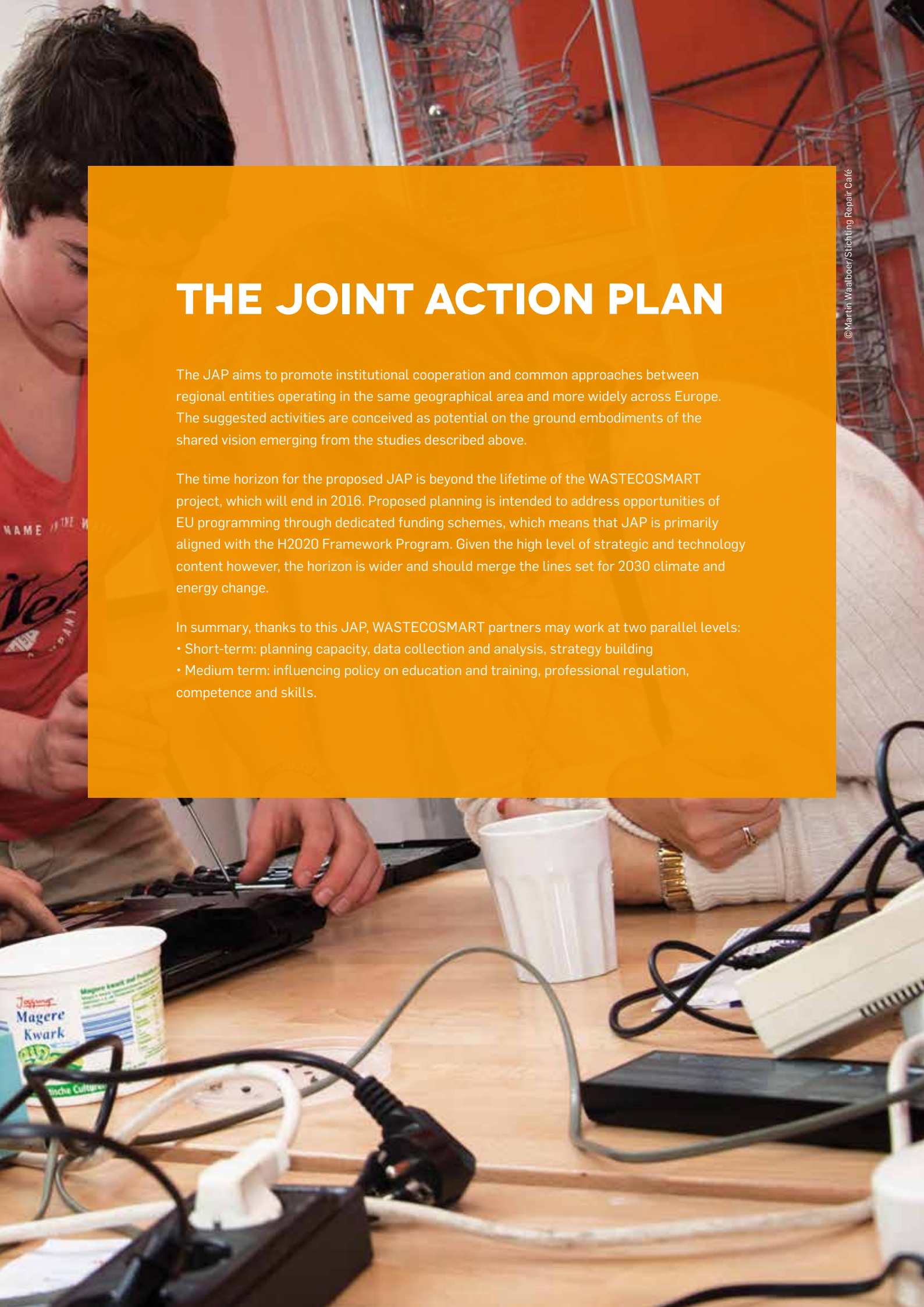

THE JOINT ACTION PLAN

The JAP aims to promote institutional cooperation and common approaches between regional entities operating in the same geographical area and more widely across Europe. The suggested activities are conceived as potential on the ground embodiments of the shared vision emerging from the studies described above.

The time horizon for the proposed JAP is beyond the lifetime of the WASTECOSMART project, which will end in 2016. Proposed planning is intended to address opportunities of EU programming through dedicated funding schemes, which means that JAP is primarily aligned with the H2020 Framework Program. Given the high level of strategic and technology content however, the horizon is wider and should merge the lines set for 2030 climate and energy change.

In summary, thanks to this JAP, WASTECOSMART partners may work at two parallel levels:
- Short-term: planning capacity, data collection and analysis, strategy building
- Medium term: influencing policy on education and training, professional regulation, competence and skills.

SWOT ANALYSIS AND DERIVED PRIORITIES

SWOT ANALYSIS AT WASTECOSMART PROJECT LEVEL

The aim of SWOT-analysis is to identify and recognize specific strengths (*positive, favourable and internal factor*), weaknesses (*negative, unfavourable and internal factor*), threats (*negative, unfavourable and external factor*) and opportunities (*positive, favourable and external factor*) for the JAP.

As part of the WASTECOSMART SWOT assessment, a number of interviews have been conducted with national stakeholders and experts from each region in order to obtain information related to the socio-political, legal and regulatory framework for waste management in each region and their current trends.

Comparing barriers identified across the SWOT analysis reveal that there are numerous weaknesses common to all or several regions. Amongst other things, results indicated that there are weak collaborations between different actors and many regions want to have better cooperation with universities, citizens, research institutes or other urban regions etc. The result also revealed a lack of knowledge about waste management in several regions and many of them were missing a common vision.

The result of this comparison provide information for strategies and priorities feeding into the JAP.

TABLE 1 : **SWOT ANALYSIS**

	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
POLICIES & REGULATION	International regulation thanks to EU Encourages waste prevention Landfill closure	Complicated regulations Lack of impact study before introducing new regulations Unclear market	Sector roadmap Laws about circular economy Promote common vision	Overregulation No market control No sufficient collection system
RESOURCES	Priority in green industrial developments Availability of materials	Funding and business support Scarcity of technical personnel	Increase EU financial funds Clean waste – more materials recoverable	Lack of resources and funds Business asymmetry
MARKETS	Circular economy Increase number of stakeholders	Lack of funds, incentives and legal tools Weak demand	Unused potential Changing attitudes and perceptions	Lobby, monopoly and lack of competitions Development of industry only interested in incentives
KNOWLEDGE DEVELOPMENT	Rise in eco-sustainable culture New jobs and research	Weak cooperation between public and private sectors Lack of coordination of developing programs	Start up International cooperation Develop new technologies and new solutions	Lack of funds and resources Market distortion
ENTREPRENEURIAL EXPERIMENTATION	Reuse projects Incubator labs Green initiatives Response to local needs	Market distortion Lack of money or ideas Lack of regulations	International relations Understand market Increase waste recycle Promote private sector and interest	Overregulation and restrictive laws Lack of funds Development of industry only interested in incentives
LEGITIMACY	Government involvement	Lack of management Risk aversion Polarized	Involvement of citizen Urban system Prevention	Weak social control NIMBY

The analysed parameters included policies and regulations, markets, resources, knowledge development, entrepreneurial experimentation, and creation of legitimacy. This analysis allows to better understanding the real needs of all EU Countries, creating the basis for a useful JAP.

POLICIES AND REGULATIONS

Strengths and opportunities: all clusters highlighted the importance of an super-national organisation that promotes and encourages waste minimization and valorisation. The EU produces laws and indications which encourage movement up the waste hierarchy and promote the move away from landfill. Policy moreover encourages waste prevention and reuse. Policy must promote a common vision and legal framework for the circular economy. A sector roadmap, with indications for maximised reuse and recycling is necessary.

Weaknesses and threats: Inadequate knowledge and education of waste was considered as a weakness, along with the complicated regulations due to EU and national level laws. Moreover, impacts on society are insufficiently studied before introducing new regulations. Finally, legal complexity works against a clear market. Excessive law-making presents a real threat which could stop the development of business and research in waste valorisation and minimization. Another threat is that collection systems, are not yet capable of correctly separating all the waste fractions we have.

RESOURCES

Strengths and opportunities: the most important strength is the availability of materials. Thanks to reuse and recycling it is possible to use materials that would be wasted in landfill. Moreover, this promotes the development of green industry with low environmental impact. Thematic alignment with EU strategy provides a real opportunity to increase the resources derived from wastes through the increase of EU financial funds. Production of clean wastes will generate more material recovery.

Weaknesses and threats: the first weakness is the lack of funds useful for promoting the use of new materials and resources as wastes. Similarly there is a lack in business support and a scarcity of technical personnel. Threats relevant to resources are the lack of funds usable to generate clean waste streams, in order to generate new materials.

MARKETS

Strengths and opportunities: the circular economy will make it possible to close the life cycle of goods, promoting and permitting the reuse of materials, and new life for

Opportunities for international cooperation are important to generate new knowledge and promote new start up, with new technologies and new solutions for waste management.

goods. This will promote and stimulate the market thanks to an increased involvement and commitment of actors and consumers. The real opportunity is the unused potential of the waste market, not only for reuse but for energy recovery too.

Weaknesses and threats: the principal weaknesses are weak demand, and lack of funds which promote new business in the waste market(ignoring moreover the potential value of waste). Uneven business conditions and shortcomings in the legal framework can create lobby and monopoly, where the few industries involved could be interested only in EU incentives.

KNOWLEDGE DEVELOPMENT

Strengths and opportunities: knowledge development will rise thanks to a more eco-sustainable culture, with the possibility of creating new jobs and new research opportunities. Opportunities for international cooperation are important to generate new knowledge and promote new start up, with new technologies and new solutions for waste management.

Weaknesses and threats: because of weak cooperation between public and private interests, there is a weakness in knowledge development, not helped by lack of coordination in development and research programmes. Lack of funds and market distortion because of EU incentives could be the threats for knowledge development.

ENTREPRENEURIAL EXPERIMENTATION

Strengths and opportunities: With the development of new green projects, on reuse and research, thanks to green initiatives from countries and citizens, there will be a real response to specific local and regional needs. The opportunity to promote private and public sectors and investments could create new international relationships and colonize a new market useful not only for the business but for environment and people.

Weaknesses and threats: Lacks of funds and innovation creates market distortion, as there no interest to invest, a situation not helped by lack of clear regulation. These factors along with over-regulation and restrictive laws could stop the development of entrepreneurial experimentation.

CREATION OF LEGITIMACY

Strengths and opportunities: strong involvement of the government can be seen as strength to create legitimacy. Involving citizens and developing a common sense of the value of prevention are opportunities to create legitimacy.

Weaknesses and threats: a weakness is the lack of support from citizens and countries. Risk aversion is inherent and companies are not involved, which risks polarization. NIMBY ("not in my back yard") syndrome and weak social control are also threats that could decrease legitimacy.

THREE PRIORITY AREAS FOR ACTION

The three priority areas and the suggested activities in the JAP are based on the SWOT-analysis and the analysis of the regions research and innovation capacities. A brief description of each area will be presented, followed by suggested activates within that area. The priority areas for action are:

1. Waste minimisation;
2. Maximisation of value from waste;
3. Knowledge transfer

WASTE MINIMISATION

Waste minimisation is the reduction of waste produced in all parts of society and the waste management chain. Waste minimisation can be achieved through waste recovery, recycling, reuse and or prevention, i.e. re-designing of products, changing social patterns and behaviour, waste-to-resource and innovative waste handling processes. The most favoured option is prevention. Policy and regulatory requirements have a crucial role to play in stimulating demand for waste minimisation through all parts of society. In addition, technological feasibility and economic viability are important factors, although many waste minimisation measures are no- or low-cost. However, the most important influence on waste minimisation is probably the attitude of all actors' throughout society. Waste minimisation is a corner stone of resource efficiency and contributes widely to the circular economy concept.

The main challenges for waste minimisation measures identified by the WASTECOSMART partners are:

- Lack of cooperation amongst stakeholders in the waste management chain
- Lack of clear visions and goals for waste minimisation
- Engagement and involvement of the general public
- Dissemination of best practice examples

PROPOSED ACTIVITIES TO **SUPPORT AND IMPROVE WASTE MINIMISATION**	
Practice what you preach *Project owner: NL*	Use the DSF tool to support the government of Jordan to translate a national waste management strategy into regional waste plans. Use of the DSF tool to support development of Solid Waste Master Plans for the region of Mafraq and the Zaa'tari refugee camp.
Reframing waste *Project owner: NL*	Develop strategies to transform the decision problem from waste as a burden to resources as an opportunity. Use good examples as in the social enterprises. The aim is to search for more socio -innovative solutions in order to influence the public awareness towards waste.
Increase public awareness *Project owner: NL*	Try to find uniform drivers in waste behaviour and use this information to jointly develop innovative new campaigns. In this case, we fully focus on the low value materials what only can be recycled at a large scale. For these materials, we only reach impact if we can change the behaviour of people's attitude in the moment they throw it away.
Development of integrated organic material management strategies for better utilization of bio-waste *Project owner: HU, Budapest Corvinus University*	Integrated management and utilization of bio-waste and organic by-products arising in households, public institutions, public places and food industry and minimization of its disposal.
Prevention of packaging waste, development of packaging materials. *Project owner: HU, Budapest Corvinus University*	Improvement of packaging materials of consumer goods, substitution of primary raw materials, development of degradable packaging materials.
Enhanced Reporting *Project owner: UK*	Better capture of the level of behavioural change towards reduced waste arising from public engagement activities. The difference between prevention and re-use will be monitored, with the emphasis to move to more prevention activities. Outcomes can be linked with other environmental benefits, such as carbon or GHG emission reductions, and improved social impacts.
Reallocation of goods with ex-offenders *Project owner: ENGIM San Paolo – European Research Institute ONLUS*	Reallocation of furniture and goods, from empty public houses to indigent people, and poor tenants. The idea intends to create new social enterprises closing the loop and creating circular economy. Ex-offenders, that will be in charge of repairing, moving, will run the social enterprise and reselling used goods.
Re-use of containers for honey services *Project owner: ENGIM San Paolo – European Research Institute ONLUS*	Re-use of containers to create a honey service centre for urban producers. The idea intends to create new social enterprises closing the loop and creating circular economy. The social enterprise run by ex-offenders, that will be in charge of support urban producer to transform primary resources to honey by-products

MAXIMISATION OF VALUE FROM WASTE

Maximisation of value from waste is the increased use of waste as resource and efficient use of materials, a key component of a circular economy and innovative waste management. One of the biggest challenges is to create value from waste in a sustainable manner. To do so, one has to extract valuable materials from municipal solid waste streams with sufficient purity for recovery, recycling and/or reuse. The defining characteristic of a circular economy is that products and goods remain within an economy for as long as possible. Within a circular economy there is still the need for waste management to facilitate the recovery of final value from products and materials. This can only be achieved by an efficient and innovative collection, recovery, and recycling system. To create efficient models and management for maximisation of value from waste various actors in the waste chain need to act together, and at the next level up decision and policy makers need to take their responsibility.

Maximising value from waste is aimed at the interactions that take place between consumers and the waste collection and management system to act to increase resource efficiency by retaining value in the waste stream after use. Maximizing value from waste is directly linked to collection sites that allow multiple functions. Positive or negative values can be assigned to waste streams in three categories: monetary, environmental, and societal value.

Main challenges for efficient recovery of value from waste identified by the WASTECOSMART partners are:

- Lack of efficient and innovative separation and collection models
- Lack off (innovative) business models,for example long term contracts to ensure economic viability
- Capital investment in waste handling facilities
- Lack of efficient cooperation between different organisations contracted for the collection of different waste streams
- Changes of composition in the waste stream may lead to removing potential value.

Regulation and legislation is inconsistent when it comes to economic incentives. The overall objective of the priority area is to link consumer behaviour with a sophisticated and innovative separation and collection system focusing on: data gathering and compositional analysis, innovative separation and treatment, consumer engagement and involvement, and linking long term contracts with short term variations.

PROPOSED ACTIVITIES TO **SUPPORT AND MAXIMISATION OF VALUE FROM WASTE**	
Green waste utilization generated at the households of the district *Project owner: Soroksár, HU*	Ambition to raise environmental awareness of local people in Soroksár. Specific aim is to educate waste producers and encourage behavioural/cultural change in waste prevention. Suggested actions are outsourcing composting containers and shaping public attitudes regarding the use of green waste.
Utilization of green waste arising in Soroksár public area and BCE Experimental farm *Project owner: Soroksár, HU*	The overall objective of the project is to improve the organic material management and to make better use of biodegradable waste. The specific objective is to make use of the green-waste generated on public spaces of Soroksár and on the territory of the Experimental and Research Farm and to build a strong cooperation between the University and the Municipality in order to carry out further research activities.
Development of energy production technologies based on municipal bio-waste *Project owner: Budapest Corvinus University, HU*	Research program to find the most efficient way to extract energy from, bio-waste and organic by-products arising in households, public institutions, public places and food industry and to develop technology.
Production of yield increasing and soil remediation materials from municipal bio-waste *Project owner: ATLANTIS Consulting Cyprus Ltd and Neapolis University Paphos, CY*	The goal is to tackle the serious problem of separation at source in concern to hazardous household wastes. Currently there is no policy or methodology regarding this in Cyprus.
Alternative organic waste management technologies *Project owner: ATLANTIS Consulting Cyprus Ltd and Neapolis University Paphos, CY*	Research on technologies and methodology for the alternative waste management of organic waste. So far, incineration, composting and preparation of RDF are the mainstream options. Additional research in other solutions such as protein recovery is proposed.
Skills Development in the Community *Project owner: UK*	Joint working groups across key stakeholders, in line with working together at the Council level, to identify and support education in the community and voluntary groups. Develop a clear set of objectives and priorities based on the findings of the DSF for increasing skills. Specific waste streams will be targeted initially (e.g. textiles, food, and furniture).
Optimisation of Collection Regimes *Project owner: UK*	Combined assessment of collection frequency, type, and route optimization to enhance recycling efficiency and reduce GHG emissions. Use advanced modelling systems to identify route planning, and efficiency of collection, with facilities and capabilities for collecting materials for recycling across boundaries to support the optimisation that has taken place within authorities.
Energy recovery and energy production (Upgrade technology for landfill biogas) *Project owner: AgoRen, IT*	The specific objective is developing new upgrading treatment scaled on landfill biogas; create an international research cluster to develop new technologies that could permit to use the landfill biogas to produce biomethane comparable with all the other biogases produced from anaerobic digestion. Furthermore, It is necessary to study new strategies and new materials usable to remove H2S and siloxane, with innovative processes and mostly with a low impact on environment.
mCHP, delocalized energy production and smart grid *Project owner: AgoRen, IT*	The aim is develop an efficient Combined Heat and Power Generation Plant (CHP) fuelled by biogas or biomethane produced and involve people to increase consciousness in the importance of delocalized energy production.
Valorisation practices to produce energy from agro-industry waste (energy recovery and energy production) *Project owner: Politecnico di Torino, IT*	The project is aimed at promoting environmental sustainability and the energy of food chain/agro-food industries. In other words, the goal of the project is the energetic valorisation of agro-industry by-products, via the pyrolysis process, reducing the agro-industry waste. The specific objective is develop new upgrading technology for syngas produced from pyrolysis of agro-industry biomass.

TRANSFER OF KNOWLEDGE

Resource efficiency is highlighted as being key for addressing the world's climate, environment, energy challenges and reducing Europe's exposure to materials dependency risks. Innovative waste management plays a key role in resource efficiency, however increased knowledge transfer is needed to accelerate the speed and consistency of direction of travel. Innovation can be defined as transformation of knowledge to money, going from idea to product, from researcher to entrepreneur, and laboratory to market.

Knowledge transfer can be facilitated between a large number of different actors along the waste chain in a number of ways. Examples include transfer of expertise from research actors or expert stakeholders, exchange of best practice between stakeholders across and/or within different parts of the waste management chain,information campaigns, and involvement of the general public. Knowledge transfer is a key component to transform waste management into a resource efficient and innovative sector (*See Appendix 1 for a deeper insight into different families of knowledge*).

WASTECOSMART proposes to boost knowledge transfer by:

- Enabling and enhancing dialogue between different stakeholders in the waste management chain and between regions
- Supporting the visibility and access of best practice examples for resource efficient and innovative waste management
- Increasing cooperation between triple helix actors
- Increasing involvement and engagement of the general public

PROPOSED ACTIVITIES TO **SUPPORT AND IMPROVE KNOWLEDGE TRANSFER**	
Social entrepreneurship in waste management industry *Project owner: NL*	This project aims for the goods that will not be sold on stock markets but needs additional refurbishment in order to add value. These business models are highly depending on subsidies or sponsored labour, this is where you need socio-innovative solutions. The best practices in each cluster will be shared and copied in the other clusters.
Development of graphics applications that support the process of cleaning contaminated sites *Project owner: Geoview Systems, HU*	The project idea includes a software development of a system available in any browsers that supports the geographical documentation of large-scale investments; recording documents and data; having a smart reporting and query interface. Creating 3D site visits (Google Earth QGIS), capable for recording not only line works; entering configuration with coordinate lists and hand drawing shapes, and is a great support for field visits with mobile application and GPS positioning.
Development of an IT system supporting the establishment of urban community gardens *Project owner: Geoview Systems, HU*	Development of an IT system supporting the establishment and operation of urban community gardens with map visualization, mobile application and e-Learning system. The system establishes a link among individuals taking care of community gardens, individuals, enterprises and municipalities. It supports the development of green and other waste collection chains, and the domestic use of waste on a micro level, with its e-Learning system it improves the environmental awareness of the population.
Development of a Waste Management Information System *Project owner: Budapest Corvinus University, HU*	Development of a database that provides an opportunity for political decision makers and research-developers to spatial and temporal query of the quantity, quality, origin, and management of arising and collected waste. The database has to be available to everyone, it should make monitoring of the impacts of legislation and its implementation possible, and based on it any R&D company should be able to plan its secondary material purchase.
Development of training program for waste management experts *Project owner: Budapest Corvinus University, HU*	Skilled experts are needed for the development of waste management, who are able to find the most efficient technologies and solutions at every level of the waste hierarchy. Special engineers, logistic experts and business professionals with international experience should be trained even at different levels (secondary, higher education, BSc, MSc).
Advanced Monitoring for Enhanced Segregation *Project owner: UK*	Improvements in technology and development of databases that track the materials and components used in products to enable enhanced segregation. Methods include - enhanced data capture and modelling (to better understand material arising), and advanced identification and segregation techniques (e.g. RFID tagging, optical, e-m spectrum, etc.). A consistent approach is required across the entire cycle of collection, segregation, and the determination of the value of collected waste.
Governance to Coordinate Resource Efficiency *Project owner: UK*	Coordination of activities to support resource efficiency measures is vital. Regional Resource Hubs would be developed, and potentially linked with national governance with the formation of a National Office for Resource Management.
WASTECOSMART Brazil 2.0 *Project owner: SP, SE*	To help decrease the amount of waste going to Landfill in Brazil and assist in creating a better integrated waste management. This would lead to lower environmental impact from waste management sector and be a step towards better resource management. Actions foreseen is workshops and knowledge exchange between WASTECOSMART partners and partners in Brazil. Particularly between universities and institutes.

Model of sustainability calculations for waste management actions and business opportunities from a system perspective *Project owner: Envac, SE*	To develop a model to determine the sustainability of different actions within the waste management system. The model should have focus on the costs/benefits/effects for the society. It should contain calculations for waste management actions and business opportunities from a system perspective.
Behavioural study *Project owner: Sundbyberg, SE*	Behavioural study, Why do people throw waste? Comparison between different regions and cultures. Are there cultural differences and could this increased knowledge of the behaviour help in designing the waste management system in a better way (together with other actions to prevent waste that is not allocated to the waste management system).
Social entrepreneurship transfer *Project owner: SE*	Start/transfer concept of RepairCafe, Instock, Pakhuis de Zwijger, E-Waste race, Bulky Bob's to Sweden.
Exploitation of big-data produced by a waste collector company, to provide meaningful advanced services *Project owner: moltosenso Srl – European Research Institute ONLUS*	Developing an App for citizens to foster their awareness of how they throw and separate waste, compared with the neighbours. Gamification to induce positive behaviours. Then, a not-point to signal issues on the territory, such as illegal waste disposal or reserving special collection on request. Finally, an info point on what is happening at waste collection company side, while performing the service: real-time showing of trucks route, future collections divided per fractions, where waste is sent, etc.

IMPLEMENTATION OF THE JAP

With this Joint Action Plan WASTECOSMART wants to pave the way for innovative waste management. Our holistic perspective will hopefully create real change within our three priority areas of waste management.

The WASTECOSMART project will run until August 2016. This JAP is the foundation for a process that goes beyond the project's end date. It creates possibilities for further cross-regional cooperation between actors throughout the entire chain of waste management, possibilities which will be updated continually with new joint actions where these are identified.

There have already been some early results of action from the WASTECOSMART partners, with two pilot tests of innovative waste management in the Amsterdam region, and the Stockholm region, but there is even more to come.

There are several opportunities for joint actions involving stakeholders outside the WASTECOSMART project. Please contact us to join the work for innovative waste management of municipal solid waste!

Visit us at http://wastecosmart.eu/
And follow @WASTECOSMART on Twitter

References

[1] A resource-efficient Europe – Flagship initiative of the Europe 2020 Strategy

[2] http://ec.europa.eu/environment/circular-economy/index_en.htm

[2] E. COMMISSION, *Taking the EU Resource Efficiency Agenda Forward: A policymaker and business perspective*, 2015.

APPENDIX 1

TABLE 2 : **TYPES OF KNOWLEDGE**

TYPE OF KNOWLEDGE		EXAMPLES
CODIFIED (EXPLICIT)	Protectable/formal intellectual property	Patents Copyright Registered/unregistered designs Trademarks
	'Soft' intellectual property	Un-copyrighted software Databases Materials (not patented or trademarked) Research questionnaires Research methodologies
	Publications	Referred journals and other academic publications such as books, monographs, conference proceedings (most of which are also covered By copyright)
	Open source publications	Publications/ online sources not covered by copyright
TACIT	Know-how	Skills Techniques Complex cumulative knowledge plus conceptual models and terminology
EMBEDDED	Physical manifestations of knowledge (artefacts)	Instrumentation Materials e.g. samples of new materials, cell lines

Above depicted categories trigger the following knowledge transfer mechanisms:

TABLE 3 : **KNOWLEDGE TRANSFER MECHANISMS** (adapted from *Knowledge Transfer from Public Research Organizations*, STOA - Science and Technology Options Assessment, EU PARLIAMENT Brussels, 2012).

	MECHANISM	DESCRIPTION
1	Publications	- Publications in referred journals / books - Other reports /publications - Open source publication - Presentations at conferences - Patent texts
2	Exploiting intellectual property	Disclosure of PRO generated IP and its commercialisation through: - Selling IP - Licensing IP (particularly patents) to companies for commercialisation - Creating spin-outs based on Research Organizations (RO) IP (typically licensed to the spin-out) and involving RO personnel/ faculty
3	Contract R&D and consultancy	- Contract R&D. formal contract between a company and a RO, for the RO to conduct novel research to create mew knowledge on behalf of a business - Consultancy: formal contract between a company and RO or RO personnel to apply existing knowledge to company's business (e.g. advice, written reports, technical adaptation) - Technical services: e.g. testing/characterization services etc. using PRO facilities to provide data/information
4	Formal collaboration/partnerships	- University-industry collaborative research partnerships typically encouraged and supported (in part) with public funds - Joint (research) ventures between RO and a company - Groups of companies and universities /ROs engaged in longer-term research partnerships of common interest such as competence centers
5	Informal interactions	Informal /personal exchanges with links made through a variety of means: - Personal contacts - Alumni organisations - Professional organisations - Participation in conferences /seminars
6	Accessing research skills	- Hiring higher-level graduates (Masters/ PhD) - Financing of PhD projects - Student internships in business - Temporary staff exchanges / visits - Staff holding joint positions in RO and industry
7	Other mechanism(s)	For example: - Training/continuing professional development - Sharing facilities - Exchange of research materials - Public events/open days

That, ultimately, defines a set of specific knowledge fostered by mechanisms of transfer themselves:

TABLE4 : **TYPES OF KNOWLEDGE TRANSFERRED BY EACH KT MECHANISM**
(adapted from *Knowledge Transfer from Public Research Organizations*, STOA - Science and Technology Options Assessment, EU PARLIAMENT Brussels, 2012, and Erik von Hippel, The dominant role of users in the scientific instrument innovation process, Research Policy 5 (3), 1976, 212-239 and Successful industrial products from customer ideas, Journal of Marketing, 42 (4), 1978, 39-49)

KNOWLEDGE TRANSFER MECHANISM	SUB–CATEGORY	TYPE OF KNOWLEDGE TRANSFERRED
Publications	n/a	(Existing) codified knowledge
Exploiting intellectual property	Selling / licensing IP	Codified knowledge
	Spin-outs	Codified and tacit knowledge
Contract R&D and consultancy	Contract R&D	(New) codified, embedded knowledge (tacit knowledge in some cases)
	Consultancy	(Existing) codified knowledge (tacit knowledge in some cases)
	Technical services	Codified and/or embedded knowledge
Formal collaboration/ partnerships	n/a	Tacit knowledge, codified knowledge (existing and new), embedded knowledge (if any created)
Informal interactions	n/a	Tacit knowledge
Accessing research skills	n/a	Tacit knowledge
Other mechanisms	e.g. training	Tacit knowledge

The European project WASTECOSMART "Optimisation of Integrated Solid Waste Management Strategies for the Maximisation of Resource Efficiency" has started in September 2013. Its overall objective is to strengthen and increase the innovation capacity of regional research-driven clusters in resource efficiency through cooperation, research and technological development within the waste sector.

Project coordinator:
SP Technical Research Institute of Sweden, Sweden

Project partners:
Greenovate! Sprl, Belgium
Neapolis University Pahos, Cyprus
Neapolis Innovation, Research & Development Centre, Cyprus
Atlantis Consulting Cyprus Ltd., Cyprus
Corvinus University of Budapest - Faculty of Horticultural Science, Hungary
Geoview Systems Ltd., Hungary
Municipality of the XXIII District of Budapest, Soroksár, Hungary
Politecnico di Torino, Italy
AGO Renewables SpA, Italy
ENGIM San Paolo Giuseppini del Murialdo, Italy
Institute for Environmental Studies (IVM), VU University, Netherlands
Amsterdam Economic Board, Netherlands
City of Amsterdam - Physical Planning Department, Netherlands
City of Amsterdam Waste to Energy Company, Netherlands
Envac AB, Sweden
Sundbybergs stad, Sweden
University of Central Lancashire - Centre for Waste Management (UCLAN - CWM), United Kingdom
The Environmental Sustainability Knowledge Transfer Network c/o C-Tech Innovation Ltd., United Kingdom
Merseyside Recycling and Waste Authority, United Kingdom

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