UrbanWINS Toolkit

A guide on urban metabolism and participatory processes for more efficient urban waste policies

Waste | Resources | Innovation

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Authors	Ecosistemi, Ecoteca, CTM (Eurecat), IUAV, Linea Gestioni, ISTAT, Metropolitan City of Rome, Chamber of Commerce of Cremona, Municipality of Cremona
Reviewers	Ecosistemi, Ecoteca, CTM (Eurecat), IUAV, Nova ID, Chalmers, ICLEI, COIMBRA, various stakeholders
Abstract	The aim of the toolkit is to provide decision makers with relevant tools to improve waste prevention and management policies and programs in their cities, based on UrbanWINS various researches and practical works. It also provides lessons learned and best practices that have been tested across the EU.
Keywords	Toolkit, waste prevention and management, Urban Metabolism, urban policies, waste targets, food waste
License	

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UrbanWINS framework

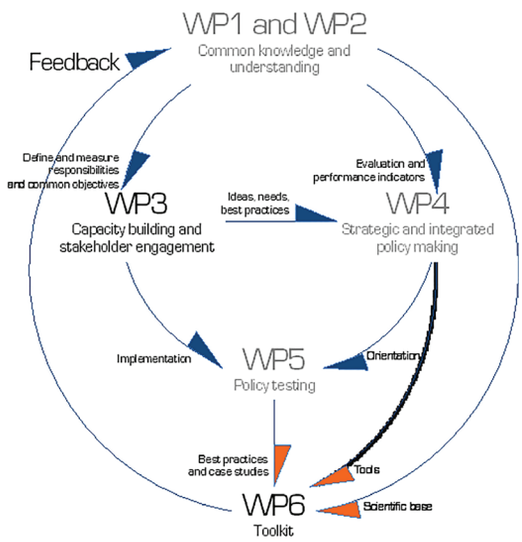
UrbanWINS objective

UrbanWINS – "Urban metabolism accounts for building Waste Management Innovative Networks and Strategies" – is a European project funded by the Research and Innovation Program Horizon 2020, between 2016 and 2019.

UrbanWINS studies how cities consume resources and products, and how they eliminate the waste produced, following an urban metabolism approach. The results have been used to develop and test innovative policy tools aimed at improving waste prevention and management in general and in eight EU cities that have been directly involved in the project, in particular. The first added value and innovative approach of UrbanWINS is to use an urban metabolism based framework to address the policy making process in the waste field, with a perspective that places waste prevention and management activities in the wider context of urban development, based on sustainable and circular production and consumption choices. In fact, urban metabolism has been used in the project as a qualitative and quantitative approach to address decision-making processes on urban development in a complex and systemic way. UrbanWINS activities also piloted urban metabolism from a quantitative perspective to develop indicators to support decision-making processes and strategic planning for waste prevention and management.

The design and implementation of the policy tools is realized with an active participation of stakeholders - citizens, governments, organizations, suppliers, research institutes and educational centres from the cities. In fact, the participatory approach is a second added value of UrbanWINS, besides the urban metabolism approach, as the vision of all relevant players for waste production and management at an urban level is taken into account to co-develop new strategies, co-test innovative solutions, integrate different types of knowledge and articulate different points of view, thus contributing to a more representative and holistic approach.

It is important to highlight the fact that the engagement of stakeholders in waste policies from an urban metabolism perspective is a very recent and innovative political approach. It aims at overcoming the sectoral approach and at shifting the debate from single waste issues to a broader vision where waste prevention and management become part of a comprehensive strategy for the management of urban flows and resources. In fact, it has not been consistently tested nor analysed previously to the UrbanWINS project, - context in which this Toolkit was developed. Decision makers and other organizations that would like to test such innovative social processes when designing and implementing their urban waste or urban waste-related policies can learn from the experience of UrbanWINS pilot cities and further contribute to the creation of a virtuous circle of good practices of stakeholder engagement for sustainability policies placed in the context of urban metabolism.



The technical work carried out in UrbanWINS can be summarised in six steps that in the project are called Work Packages (WPs):
-> Steps 1 and 2 aimed to create a common understanding of the state-of-the-art of urban waste prevention and management strategies and policies at EU level and to elaborate the methodological and operational framework for adopting the urban metabolism approach for waste policies, based on urban quantitative analysis of 29 EU cities;
-> Step 3 sets the framework for stakeholder engagement by implementing capacity building programs and participatory processes through physical and virtual activities and contexts, called agoras, which result in knowledge sharing, creation of communities of practices, cross fertilization of ideas and actions;
-> Step 4 is fed by the technical results from Steps 1 and 2 and the inputs of stakeholders from Step 3 and it facilitates the elaboration of innovative urban policy tools - Strategic Planning Frameworks and Local Strategic Action Plans - for waste prevention and management;
-> Step 5 opens the way to action testing and evaluation of the urban policy tools with the purpose of boosting eco-innovative strategies also at the ground level and defining roadmaps to make them sustainable and replicable;
-> Last, Step 6 ensures that collectively built solutions by project partners can be transferred to other urban contexts and EU waste stakeholders through the present Toolkit that tells the story of UrbanWINS experiences.

UrbanWINS consortium and key actors

UrbanWINS project has been implemented by a multidisciplinary and complex team of 27 partners: 7 local authorities, 2 CSOs and 1 cooperative, 5 universities and research bodies, 4 communications, consulting and waste management companies, 4 waste professional associations, 1 association of local authorities, 1 regional public body in charge of waste management, 1 national institute of statistics and 1 chamber of commerce. The partners come from 6 EU member countries - Italy, Romania, Spain, Portugal, Austria and Sweden - highlighting the pan-European dimension that allowed a wider impact of the project.
The project started from the in-depth experience of the project coordinator – Comune di Cremona - in waste prevention and management policies, mainly deriving from the application of systems for the recovery of materials, a Reuse Center and a participative separated waste collection systems, as well as from the interaction between various urban related policies and tools linked to Local Agenda21, Green Public Procurement, Sustainable

Energy Action Plan, Soil consumption charter, an agro-market for local producers. The experience of the construction of the Reuse Center – that serves over 70.000 inhabitants from Cremona - represented a starting point for UrbanWINS as it promotes the diffusion of a reuse culture, the prolongation of the lifecycle and the access of disadvantaged groups to various goods.

Other six public administrations, representing in total seven European piloting cities, have joined Cremona with the goal of adopting an urban metabolism approach for the development of their waste prevention and management strategies: Bucharest, Torino, Sabadell, Manresa, Leiria, Albano Laziale and Pomezia (the last two under coordination of the Metropolitan City of Capital Rome). Moreover, besides the operational experience of the pilot cities, the know-how of Cremona has been complemented by the complex and diverse expertise of the other project partners: urban metabolism / material flows analysis - MFA (University of Coimbra, Chalmers University of Technology, CEIFACOOP, ISTAT, SERI); urban planning (University of Venice IAUV); MFA for buildings sector and building stock modelling tools (SERI, RoGBC, Cree); LCA approaches in the context of urban metabolism (CTM-Eurecat Manresa); sustainable consumption and production policies, especially green public procurement (ICLEI, Ecosistemi); stakeholder engagement in public policies (Nova.id.FCT, ICLEI, Ecosistemi); waste environmental considerations and impacts on health (Global Innovation); waste regulation policies (Ecoteca); bulbs waste management (Ecoteca); WEEE management (ECOTIC, Environ); sustainable building solutions (Cree, RoGBC); waste prevention and management educational initiatives (ECOTIC); elaboration and implementation of waste prevention and management policies (LGH S.p.A, Consorci del Bages); SMEs engagement (Chambers of Commerce of Cremona); urban data statistics and environmental accounting (ISTAT); online communication on societal issues (Marraiafura Comunicazione).

You can found out more about UrbanWINS partners and their work at this link: https://www.urbanwins.eu/the-consortium/

UrbanWINS impact

Through its complex, interdisciplinary and collective work over the last three years, UrbanWINS brought several significant contributions to the advancement of urban metabolism and stakeholder engagement uses in urban waste policies that contribute to increased environmental resilience in urban areas and quality of life in Europe through:

- ✓ **improved knowledge of the EU state-of-the-artin the urban waste prevention and management policies**

Various reports from Steps 1 and 2 of the project analyse the state of the art, the explanatory variables, impact, flows, processes, shortcomings and key indicators for waste prevention and management strategies based on the in-depth analysis of the 6 EU countries involved in the project and 27 cities. These reports also enable the clarification of the field of intervention of the urban metabolism approach and its feasibility and accuracy thanks to the continuous dialogue and cooperation between „developers" of the implementation

methodology (scientists and researchers) and end-users (urban decision-makers), making the UM approach more useful for decision-making processes.

FOCUS: SOME PRELIMINARY RESEARCH FINDINGS FROM URBANWINS

UrbanWINS preliminary research was focused among others on mapping the innovative waste prevention and management policies and regulations and included:

- Desk analysis that presents the state-of-the-artin the waste prevention and management policies and strategies of 6 countries and 29 of their municipalities involved in UrbanWINS. The policies and strategies compiled were collected through: (i) analysis of relevant EU projects, (ii) country and municipality factsheets, and (iii) an online questionnaire sent to stakeholders. The identified policies, regulations and strategies were categorized in three areas, according the European Commission Waste Prevention Handbook (2012): informational, promotional and regulatory. Based on desk analysis and contact with stakeholders, 354 strategies – 189 at national/regional level and 165 at municipality level (50 from the eight UrbanWINS pilot cities) were compiled in national and municipality factsheets. About 30% of the strategies addressed waste prevention, 20% focused on separate collection, and 17% encompassed multiple management operations. The domestic sector was the sector addressed by more strategies (46%), followed by the public sector (20%). Strategies directed to the domestic sector were very diverse as regards the type of strategy and management operation; the ones focusing on the public sector were mostly focused on waste prevention, particularly at municipal level. Strategies covered mainly municipal solid waste (MSW) (20%), organic waste (mostly food waste) (17%), and packaging (14%), and 28% of the reported strategies addressed various types of waste.

- An analysis of the determinants of waste prevention and management strategies and polices . The determinants, grouped into economic, socio-demographic, geophysical, technology development, urbanization and infrastructure variables, have been interpreted in order to establish how economic, environmental, health and social issues can be examined in the context of urban metabolism, and how the connections to policy and urban design could be addressed in the definition of new prevention and management waste plans. The main output is an overall assessment of how different urban features (socio-political, architectural, cultural, technological and gender factors) impact on the urban metabolism and if and how they affect waste prevention

[1] Deliverable available at https://www.urbanwins.eu/wp-content/uploads/2018/02/UrbanWins_D1-1_State-of-the-art-of-waste-prevention-and-management.pdf

[2] Deliverable available at https://www.urbanwins.eu/wp-content/uploads/2018/02/UrbanWins_D1-2_Assessment-of-determinants-and-effects-of-waste-prevention-and-policies.pdf

and management policies. The analysis highlighted that the number of determinants for explaining the urban metabolism can be quite extensive and may depend on a variety of factors like - the development of industrial sector, waste prevention and management policies and such strategies set at country or city level, the availability of a proper waste management system infrastructure, environmental budget, environmental awareness, available living area in households, the time of staying at home, etc.

✓ **advancements in the participatory and science-based decision-making and planning for waste prevention and management**

In Step 3, innovative engagement processes and tools have been deployed in the project 8 pilot cities whose results – that can be consulted in part three of the present toolkit – bring useful contributions in participatory decision-making processes for waste policies. A physical urban agora with at least 40 stakeholders has been created in each EU pilot city. The eight physical agoras have been complemented by online urban agoras – created with a user-centric approach to facilitate participation – that reunite representatives of waste stakeholders from various countries and sectors. The agoras are built on the collaborative governance model that requires the development of an active participatory process engaging the stakeholders directly to assure not only the building up of a collective awareness of what is at stake, but also the building up of a collective identity supporting a co-management process. 8 Strategic Planning Frameworks and 8 Urban Strategic Action Plans have been developed for the pilot cities based on urban metabolism approach and with the contribution of urban stakeholders from the physical and online agoras. To ensure that advancements can also go beyond project lifetime, 8 Roadmaps for medium and long term action planning are also defined.

✓ **contribution to the European research and innovation leadership in urban waste prevention and management based on urban metabolism approaches**

The contribution has been triggered by the cooperation between scientific and research bodies from the six EU countries with long and recognised knowledge and experience in key fields that resulted in a unique combination of skills and capacity. Within Steps 4 and 5, UrbanWINS enabled the participative piloting of strategy frameworks based on urban metabolism and MFA analysis undertaken within the previous steps in 8 heterogeneous European cities for which personalised urban metabolism data, indicators and accounts have been developed and deployed. The operationalisation of the urban metabolism and MFA approaches in such a large number of areas has expanded the number of cities where these methodologies have been tested. Also, important indications emerged on the differences in the availability and accessibility of relevant official datasets and statistics across countries. This will allow for governments at different levels (national, regional, local) and relevant institutions to reflect on what adjustments and innovation should be brought about to facilitate the quantification of urban metabolism indicators.

- ✓ **improvement of the innovation capacity and the integration of new knowledge for urban waste stakeholders**

Through its activities, UrbanWINS deployed a set of approaches and tools that enhanced the innovation capacities of: the researchers that undertook innovative and multi-disciplinary work in the analysis and operationalization of urban metabolism approach; urban decision makers who adopted urban metabolism approach and related indicators to develop a new perspective in the way the waste issues have to be dealt with and to evaluate alternative policy options; civil servants and key actors involved in stakeholder consultation and engagement from the online and physical agoras. Finally, waste management companies and companies operating in the field of material reuse and recycling, waste treatment, buildings directly or indirectly involved in the project activities had the opportunity to revise their operational objectives in the light of urban metabolism approaches and to improve their planning and operations with the goal of making them more sustainable from an economic, environmental and social point of view.

UrbanWINS Toolkit - a strategic tool to valorise and capitalise the project results

Why and who should read the Toolkit?

The Toolkit represents the final outcome of the UrbanWINS project. It is gathering all the relevant technical and political approaches and tools that have been used throughout the project and valorises the heterogeneous experiences of the partners in order to inspire innovative urban waste prevention and management strategies able to contribute to the shift to more sustainable and circular urban economies.

UrbanWINS Toolkit addresses various audiences that can find in the current document sources of inspiration and action in order to act on the improvement of the sustainability of their cities from an innovative perspective and interpretation of waste issues and policies. In order to inspire the action, the Toolkit story tells UrbanWINS experiences in an easy to understand manner, explaining both the theoretical considerations behind the activities and the practical, deployment side. Moreover, the Toolkit includes various testimonials, case studies, resources and sectoral/thematic focuses that are relevant for the understanding and replication of the approaches, as well as to get to know the persons and actors behind UrbanWINS approaches.

For local decision makers, the Toolkit mainly offers ...

- inspiration from different EU urban waste prevention and management policies and Best Practices
- an understanding of the metabolism of your city and the role of stakeholder engagement and the way waste policies may use these approaches for optimised results

For research actors, the Toolkit provides...

- detailed explanations of the various technical tools used within UrbanWINS and the way they can be applied in different practices
- an understanding and potential use of results in further research activities dedicated to waste policies from urban metabolism and stakeholder engagement perspectives

Urban stakeholders such as CSOs, companies, citizens will find in the Toolkit...

- ideas to develop projects / commercial consulting services / Best Practices/new waste technologies for decision makers / local authorities in the area of innovative waste policies;
- considerations and paths for stakeholder engagement in urban waste policies that enable the direct involvement of the interested actors

How to use the Toolkit?

The Toolkit is composed of three sections that can be consulted in a sequential order or independently, depending on activities and interests of the reader. Systematic cross-references are made between the sections, chapters and sub-chapters, especially through key words, in order to facilitate the consultation of various contents.

The Table 1 below represents a summary of the Toolkit contents to facilitate the user in the selection of the most appropriate sections:

Short name of the Part	You may want to read it if you…
1 - UrbanWINS Corpus of best practices	Want to get inspired from other experiences in waste prevention and management policies and tools! This part encompasses a list of 70 best practices relevant for cities that have been implemented across the EU, covering relevant waste streams. Their description highlights innovatory elements such as the use of urban metabolism and stakeholder engagement and facilitates an easy replication.

2 - Urban metabolism approaches	Are keen to get informed about urban metabolism approach and its application and support tools! This part encompasses detailed descriptions of urban metabolism theoretical approaches and various tools for its implementation, such as UMAn, Material Flow Analysis, Life Cycle Assessment, urban accounts and indicators, as well as various sectoral / thematic case studies and focuses that can be used across the lifecycle of waste policies.
3 - Stakeholder engagement process	Want to find out more about how and why to engage stakeholders in the design and implementation of your waste policies! This part includes a theoretical description of the stakeholder identification and engagement processes with a focus on urban waste actors, as well as detailed explanations of the participatory processes that have been carried out within UrbanWINS project within the physical agoras.

TESTIMONIAL COMUNE DI CREMONA, URBANWINS PROJECT COORDINATOR

Mara Pesaro, UrbanWINS project coordinator and Director of the Department of Labour/Development/Territory of Cremona:

"The Municipality of Cremona is both the project coordinator and one of the 8 pilot cites of UrbanWINS. This double role has helped us to obtain a broader perspective of the technical process overall at the partnership level and to test the tools with the support of our local community. "The Municipality of Cremona is both the project coordinator and one of the 8 pilot cites of UrbanWINS. This double role has helped us to obtain a broader perspective of the technical process overall at the partnership level and to test the tools developed in the project with the support of our local community. The use of the tools that are presented in this toolkit as support for other local decision-makers are some examples that all 8 pilot cities have implemented, they all had specific results driven from the local context that nevertheless were indeed useful in the both participatory process and the scientific decision making process.

UrbanWINS has helped the Municipality of Cremona in the decision-making process and had a double impact: on one hand we have successfully involved citizens and relevant

stakeholders in the evaluation of the overall waste cycle, not only focusing the attention on urban waste disposal; on the other hand, we have obtained a higher awareness-raising and attention on policies for tackling food waste.

We recommend the use of the tools promoted in UrbanWINS for local decision-makers that understand the need to move from a linear economy to a circular one. In fact, during face-to-face agoras there has been the possibility to transfer these scientific and technical concepts to the local community.

Our Municipality already knew the general approach of urban metabolism, but participating in the UrbanWINS project helped deepening the knowledge both sharing the information to the citizens and with the learning of the most technical parts with the help of the universities collaborating to the project. This helped both the technical offices and the policy makers to have a holistic approach about the waste topic, beyond mere managerial aspects of collecting and separating waste.

UrbanWINS boosted our approaches towards a more circular economy and also persuaded us that further steps have to be taken to improve and reinforce the cooperation between decision-makers, local authorities, research institutions and statistical offices at EU and national level as urban metabolism accounts and indicators should become a standard guidance for urban policies that aim at creating and measuring real shifts in the way city actors use the resources they have at our disposal“.

Glossary and list of abbreviations

Circular Economy - “The circular economy[3] is a new way of thinking about our growth model in the face of global competition for resources and the environmental impact of their use.” “Circular economy systems keep the added value in products for as long as possible and eliminates -to the maximum extent- waste. Resources are kept within the economy when a product has reached the end of its life so that they can be productively used again and again and hence create further value. Transition to a more circular economy requires changes throughout value chains, from product design to new businesses and market models, from new ways of turning waste into a resource to new modes of consumption behaviour. This implies full systemic change and innovation not only in technologies, but also in the organisation, society, finance methods and policies. Even in a highly circular economy, there will remain some element of linearity as virgin resources are required and residual waste is disposed of” (EU, 2016).

UM - Urban Metabolism - “Urban metabolism might be defined as the total sum of the technical and socioeconomic processes that occur in cities, resulting in growth, production of energy and elimination of waste”, “the metabolism of cities will be analysed in terms of four fundamental flows or cycles—those of water, materials, energy, and nutrients” (Kennedy

[3] More info available at https://ec.europa.eu/regional_policy/en/information/publications/factsheets/2016/cohesion-policy-support-for-the-circular-economy

et al. 2007, pp 44-45). In practical terms, the urban metabolism is a holistic framework that quantifies resource flows in an urban system and assigns them to different stakeholders in the society, from producers (e.g., agriculture, forestry, fishery, mining and industrial sectors), to consumers (e.g., services, households, public administration), and decomposers (e.g., waste sector). This allows the identification of each sector's needs, as well as their outputs. Using this information, it will be possible to identify solutions to prevent and manage waste. MFA - Material Flow Analysis is a systematic assessment of the flows and stocks of materials within a system defined in space and time." (Brunner and Rechberger, 2004). This model takes into consideration physical inputs and outputs into and from an economy, respectively, its accumulation within boundaries and emissions to nature. Set initially to analyse material flows at national level, the Eurostat principles were adopted by researchers (often with methodology adaptation and modification) to accomplish the MFA for urban areas.

UMAn Model - refers to the methodology defined by Eurostat in Economy-wide material flow accounts (EW-MFA) (Eurostat, 2001) and utilises the main principles of the EW-MFA model. The UMAn model allows accounting of material flows at urban level, and additionally, it exploits a set of "plug-in" databases allowing more detailed analysis of those flows, which include a product life cycle phase, material composition of products and lifespan (Rosado, 2012; Rosado et al., 2014). Supplemented with other methods, such as life cycle assessment (LCA), the UMAn model can become a powerful tool for urban metabolism analysis (Lavers et al., 2017).

LCA - Life Cycle Assessment According to the ILCD Handbook[4] published by the European Commission, it represents a scientific approach behind modern environmental policies and business decision support related to Sustainable Consumption and Production (SCP is a structured, comprehensive and internationally standardised method to quantify all relevant resource requirements, emissions, wastes and the related environmental and health impacts associated with a product, system or service. Life Cycle Assessment takes into account a product's full life cycle: from the extraction of resources, through production, use, and recycling, up to its end-of-life.

DPSIR - Drivers, Pressures, State, Impact, Response model of Intervention is a causal framework for describing the interactions between society and the environment: Human impact on the environment and vice versa because of the interdependence of the components. DPSIR framework was developed by the European Environmental Agency (EEA, 2009) and has been used by the United Nations, (UNEP, 2007). It is an extension of the pressure-state-response model developed by OECD, which is defined as a causal framework describing the interactions between society and the environment.

SPF - Strategic Planning Framework is an exhaustive description of the city's strategy. It organizes and defines the role of every actor involved, his or her responsibilities and tasks. It provides clear recommendations on the way actors are connected and how they should cooperate in order to achieve the best results and how to share them. The main function

[4] http://eplca.jrc.ec.europa.eu/uploads/ILCD-Handbook-General-guide-for-LCA-DETAILED-GUIDANCE-12March2010-ISBN-fin-v1.0-EN.pdf

of an SPF is to give a clear direction of a process or work from the beginning to the end, it clearly explains the path to take in order to get to the final objective, it explains how things should work and it leads users through a step by step experience. An SPF is designed to provide structure to the process in all its components, and it determines intermediate steps and a sequence of activities that are essential to eventually implement the strategy.

LSAP - Local Strategic Action Plan is the practical operationalization of the city strategy, which results from the Strategic Planning Framework process. The cities have their own Local Strategic Action Plan tailored to city's characteristics and SPF outputs. It consists of a first part with the current situation of the city (A), followed by a synthesis of the city priorities (B). The Local Strategic Action Plan explains how the city will move from (A) to (B) and supports the city strategy providing a way to reach (B), i.e. through the implementation of identified key actions. The LSAP details how city priorities are converted into concrete actions. It describes in detail how actions will be implemented to accomplish the objectives developed earlier in the process.

SWOT analysis - is a strategic planning technique used to help a person or organization identify the Strengths, Weaknesses, Opportunities, and Threats related to business competition or project planning. In addition, TOWS analysis is a variant of a SWOT analysis and is an acronym for Threats, Opportunities, Weaknesses and Strengths.

Setting the context – an overview of EU state-of-the-art waste prevention and policies

In 2018 the European Commission launched the Circular Economy Package[5] aiming to transform Europe's economy into a more sustainable one and to implement the ambitious Circular Economy Action Plan, thus adopting a set of measures that include:

- EU Strategy for Plastics in the Circular Economy[6] to transform the way plastics and plastic products are designed, produced, used and recycled. It states clearly that by 2030, all plastic packaging should be recyclable. To achieve its goal, the Strategy foresees actions to "improve the economics and quality of plastic recycling; to curb plastic waste and littering; to drive investments and innovation and to harness global action". In order to reduce the leakage of plastics into the environment, the EU Commission has also adopted a new proposal on Port Reception Facilities, to tackle sea-based marine litter and published a report on the impact of the use of oxo-degradable plastic, including oxo-degradable plastic carrier bags, on the environment.

[5] More info available at http://ec.europa.eu/environment/circular-economy/index_en.htm
[6] Document available at https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN

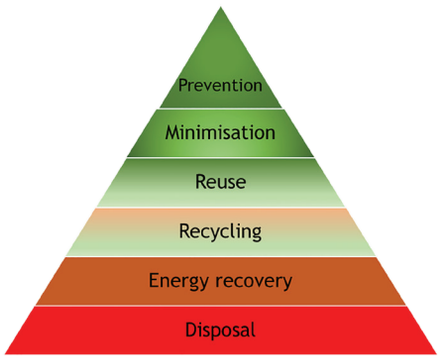
- A Communication on options to address the interface between chemical, product and waste legislation[7] that assesses how the rules on waste, products and chemicals relate to each other.

- A Monitoring Framework on progress towards a circular economy[8] at EU and national level composed of a set of ten key indicators which cover each phase – i.e. production, consumption, waste management and secondary raw materials – as well as economic aspects – investments and jobs - and innovation.

- A Report on Critical Raw Materials and the circular economy[9] that highlights the potential to make the use of the 27 critical materials in our economy more circular.

Moreover, another focus was on developing a Directive on the reduction of the impact of certain plastic products on the environment[10] - implementation of the EU Strategy for Plastics in the Circular Economy. The Directive proposes different measures for specific items made of single-use plastics taking into account the consumer behaviour as well as consumer needs and opportunities for businesses. When alternatives are clearly available – both single-use and multi-use ones – market restrictions are proposed. Other measures include appropriate labelling, awareness raising, voluntary actions and the establishment of Extended Producer Responsibility schemes that would also cover the costs for the clean-up of litter. The commission also made a proposal for a Regulation setting a minimum requirement to boost the efficient, safe and cost-effective reuse of water for irrigation[11] as part of the Circular Economy Action Plan.

Each year in the European Union, 2.7 billion tons of waste are produced, of which 98 million tons (4 %) are hazardous. In 2011, per capita municipal waste generation averaged 503 kg throughout the Union but ranges from 298 to 718 kg across each Member State. On average, only 40% of solid waste is prepared for reuse or recycling, whereas some Member States achieve a rate of 70%, showing how waste could be used as one of the Union's key resources. At the same time, many Member States landfill over 75% of their municipal waste[12]. This not only causes „Energy recovery environmental problems, but also represents a significant economic loss.



Waste prevention is at the heart of European Union waste policy, and Member States have a legal obligation to adopt and implement waste prevention programs.

[7] https://ec.europa.eu/transport/sites/transport/files/legislation/com2018-0033-port-reception-facilities.pdf
[8] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:29:FIN
[9] https://ec.europa.eu/docsroom/documents/27327
[10] http://ec.europa.eu/environment/circular-economy/pdf/single-use_plastics_proposal.pdf
[11] http://ec.europa.eu/environment/water/pdf/water_reuse_regulation.pdf
[12] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32013D1386&from=EN (Art. 39 accessed in December 2018)

The general principle behind EU and national waste policies is the „waste hierarchy". Waste prevention has the highest priority in the hierarchy followed by (preparation for) reuse, recycling, other recovery and disposal operations as the least desirable option.

The EU Waste Framework Directive[13] has set the obligation for Member States to adopt waste prevention programs by the end of 2013; however, at the end of 2018, there were a few European states that have not implemented the program. The European Environment Agency (EEA) reviews each year the report on the progress of program implementation and completion.

A new report from the EEA, „Waste prevention in Europe — policies, status and trends in reuse in 2017"[14] released in June 2018 focuses on reuse and covers 33 national and regional waste prevention programmes that had been adopted by the end of 2017. This is the fourth EEA report in a series of annual reviews of waste prevention programmes in Europe as stipulated in the European Union (EU) Waste Framework Directive (EU, 2008).

Article 29[15] of the Waste Framework Directive states that the Member States should take appropriate measures to promote reuse and preparation for reuse, such as encouraging the establishment and support of reuse and repair networks. EEA report describes how reuse is addressed in the waste prevention programmes and provides data on the status and trends in reuse systems in Europe. The report shows that 18 of the 33 reviewed waste prevention programmes have explicit objectives for the reuse of products. However, most frequently cited measures to promote reuse are voluntary. Only 10% of the programmes include regulatory measures, and 8% cite economic instruments. Moreover, only two of the reviewed waste prevention programmes have quantitative targets for reuse.

Promoting reuse often requires detailed technical insight into production processes and consumption patterns. Measures include setting standards for eco-design[16] aimed at easy disassembly and reuse of components, subsidizing repair facilities to balance labour costs, eco-labelling and green public procurement to influence consumption patterns. These measures often address specific types of products and activities, including construction and demolition, electrical and electronic equipment, packaging, or other products, such as vehicles.

Overall, reuse remains a niche activity for most products, EEA report notes. Upscaling is hampered by the increasing complexity of products and shorter innovation cycles, which lead to a rapid loss of product value. In contrast, reuse businesses and consumer-to-consumer trade of products such as clothing, children's toys, furniture, are increasing due to new

[13] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0851&rid=5 (accessed in December 2018)
[14] https://www.eea.europa.eu/publications/waste-prevention-in-europe-2017 (accessed in December 2018)
[15] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32013D1386&from=EN (Art. 29 accessed in December 2018)
[16] Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of eco-design requirements for energy-related products to be found at https://eur-lex.europa.eu/eli/dir/2009/125/oj (accessed December 2018)

technologies and better marketing channels on the internet and social media. Although total waste generated in Europe declined between 2004 and 2012, partly due to the economic crisis, with more than 1% in absolute terms and more than 3% per person, 2.5 billion tons of waste - almost 5 tons per person - was discarded in the European Union in 2012.

The past trend (2010-2016) shows an increase in waste generation. The outlook towards 2020 remains, however, uncertain since the examined past time series is short and the increase relates mostly to just one data point (2014-2016)[17]. Reducing this waste would bring many environmental, economic and social benefits.

The 7th Environmental Action Program[18], the program that will guide EU environmental policy by 2020, also calls for a reduction in the generated waste. Article 39 states that there is also considerable potential for improving waste prevention and management in the Union to make better use of resources, open up new markets, create new jobs and reduce dependence on imports of raw materials, while having lower impacts on the environment. The action plan is also focused on turning waste into a resource (the Roadmap to a Resource Efficient Europe) and requires the full implementation of Union waste legislation throughout the Union.

The EU highlights that additional efforts are needed to reduce per capita and in absolute terms waste generation, while limiting energy recovery to non-recyclable materials, phasing out landfilling of recyclable or recoverable waste, ensuring high-quality recycling where the use of recycled material does not lead to overall adverse environmental or human health impacts and developing markets for secondary raw materials are also necessary to achieve resource efficiency objectives. As tools to achieve the objectives, are worth being mentioned the market-based instruments and measures that privilege prevention, recycling and re-use that should be applied much more systematically throughout the Union, including extended producer responsibility, while the development of non-toxic material cycles should be supported. EU calls for action against the barriers facing recycling activities in the Union internal market and to rethink the existing prevention, reuse, recycling, recovery and landfill diversion targets in order to move towards a lifecycle-driven ‘circular’ economy, with a cascading use of resources and residual waste that is close to zero.

In this political context, UrbanWINS project is bringing a significant added value as it contributes to the improvement of the efficiency of urban waste policies, by gaining the support and involvement of the citizens and other relevant stakeholders and by linking waste policies to urban metabolism and circular economy principles, thus contributing to the achievement of EU waste objectives.

[17] https://www.eea.europa.eu/airs/2018/resource-efficiency-and-low-carbon-economy/waste-generation (accessed in December 2018)

[18] https://www.eea.europa.eu/policy-documents/7th-environmental-action-programme (accessed in December 2018)

TESTIMONIAL ON URBANWINS DESK ANALISYS

Frederic Clarens - Head of Industrial Ecology at Eurecat - Centro Tecnológico de Catalunya (CTM-Eurecat Manresa)

„As a starting point of the project, a comprehensive analysis of the best waste management strategies, policies and regulations around Europe and specially, in 24 EU cities and 6 countries (Italy, Romania, Sweden, Spain, Portugal and Austria), has been developed. The in-depth compendium and analysis of the most important awareness raising, promotional and regulatory waste prevention and management strategies have allowed to understand the key insights and challenges concerning waste management that have been traditionally addressed in Europe. The assessment allowed inferring that participatory approaches must be a key factor to improve the success of any waste management strategy. At the same time, they must allow understanding the consumer's perception in order to obtain simple and clearer waste regulations where traditional legal developments sometimes seem to be a limiting factor for the efficient implementation of new strategies. Moreover, the WMSP must deploy the right balance between social and economic priorities, as the sector represents a bridge between public and private operators. UrbanWINS experiences highlighted that the implementation of innovative solutions at real scale, tested with the close cooperation of citizens, will necessarily trigger better results; Green Public Procurement (GPP) and Circular Economy (CE) were identified as right approaches in all countries to support such real scale implementation."

Part 1 - Corpus of urban waste prevention and management recommended practices for different scenarios

1.1 Purpose of the Best Practices Corpus

The Corpus is composed of a palette of Best Practices (BP) in the field of urban waste prevention and management that cities and other stakeholders have adopted across Europe at local or regional level over the last years. It was developed through a collective work of the project partners and various stakeholders along the deployment of UrbanWINS activities.

The aim is to provide local decision-makers with a selection of tested practices in waste prevention and management that they can replicate and/or be inspired from. The Corpus of best practices is aimed to be heterogeneous, it focuses on present and future waste flows relevant for cities, covers different EU countries, waste hierarchy areas, tools, policy types and economic sectors. Moreover, it focuses on hands-on actions that reached results using innovative and participatory approaches.

EUROPEAN ADVISORY BOARD - EAB, A KEY ACTOR IN URBANWINS

UrbanWINS has been deployed with significant political and operational support of the European Advisory Board (EAB), an advisory, informal structure comprised of 20 high-level representatives from EU decision-making bodies, regulatory bodies and other stakeholders from the waste sector.

The EAB is supporting UrbanWINS by providing feedback for the technical developments and results of the project and by disseminating the project outcomes to gain a broader outreach among various stakeholders, including within newer EU Member States. EAB will furthermore represent a key actor in UrbanWINS Alliance that has been created towards the end of the project to ensure the capitalization and further uptake of the project results.

More info on EAB members can be found at: https://www.urbanwins.eu/eab.

When developing the classification and assessment criteria for the collection and analysis of BPs, a number of key elements were taken into account: the needs of the municipalities, the context research results of the project, European Union Tools - European Commission Directives and handbooks. In building the Corpus, specific focuses have been put on criteria such as potential for replicability for municipalities, innovation, and sustainability. Furthermore, the two values added of UrbanWINS approach for the development of urban waste prevention and management policies - relevance for urban metabolism and stakeholders' engagement - have been specifically analysed for each BP.

Therefore, rather than providing a standardized solution, the Corpus provides a modular, flexible and inspiring source of information concerning different EU urban waste practices that will support decision-makers in finding and building personalized solutions for waste prevention and management, for different waste streams, in different scenarios and for various urban contexts. The Corpus represents a source of information and inspires local decision-makers to use the listed practices, by adapting them to the specificity of each urban context. For this purpose, we aimed to analyse the success factors and took into consideration key aspects for implementation, so that various stakeholders can take the best decisions to deploy the best practices taken into account all the relevant factors.

TESTIMONIAL ON BEST PRACTICES CORPUS

Alexandra C. Ghenea, Vice-President Ecoteca, coordinator for the UrbanWINS Toolkit development

The concept of Best Practices in waste prevention and management is not new in the EU, but is highly recommended as a source of research for the organizations interested in the subject. Why not learn from other experiences in the field? Why not contact others who have dealt with the same kind of problems? Why not involve all relevant stakeholders in the process of building solutions for local communities?

What is different in our approach from the other EU already promoted ones, is that we focused on covering the waste steams relevant for the local decision-makers (municipalities) that are aiming at a circular approach (closing the loop) in the relationship with the urban metabolism, taking into account an easy replicability while promoting the partnerships for implementation (participatory approach). The 70 best practices are addressed to cities with different levels of progress when it comes to waste prevention and management, from separate collection of municipal waste at the source, to waste prevention policies and tax reduction, Green Public Procurement etc.

I highly recommend to the interested stakeholders to take a look at the best practices that are on the market before making decisions in the field of waste prevention and management or trying to reinvent the wheel.

1.2 Development and organisation

The main data from which the Corpus of BPs has been developed comes from the research results derived from previous work packages of UrbanWINS. In the preliminary research work carried out at the beginning of the project, a set of approximately 350 case studies focused on the state-of-the-art of waste prevention and management policies and strategies from 29 EU municipalities and 6 countries involved in UrbanWINS was identified through desk research and a stakeholder surveys. In the selection, priority was given to the following elements: the most relevant waste streams for municipalities; at least a medium level of innovation; a balanced coverage of all the countries and pilot cities involved in the project and of all the types of tools proposed by the EC Waste Prevention Handbook (educational, informational, regulatory, voluntary, promotional). Other Best practices resulted from the map of tools of strategic planning identified in the agoras or from the experiences of UrbanWINS partners. The European Advisory Board who revised the initial list of best practices and supported with necessary data for publication also significantly contributed to the creation of the Corpus.

Moreover, an extended list of EU projects concerning waste prevention and management was analysed and used for the development of the Corpus. Other EU initiatives in best practice assessment and collection, that have similar/complementary approaches with UrbanWINS project, such as stakeholder involvement or dissemination of Circular Economy in Europe, were comparatively analysed. Alongside with the EU Circular Economy Package of measures and the Good Practices[19] hosted by the European Circular Economy Stakeholder Platform, the analysed initiatives have been useful tools for guiding stakeholders to drive their practices towards a circular model when focusing on waste management. In the process of building the Corpus of BPs, an extended number of related actions that focused on the similar objectives has been identified, among which we can mention: the EC Background Report on Best Environmental Management Practice in the Waste Management Sector[20] or the EC factsheets on the selected waste prevention best practices[21].

In the process, a large number of waste management good practices have been identified. However, certain aspects such as the lack of available information, or the difficulty in finding relevant data for the purpose of the Corpus, have led to downgrading some strategies in favour of others. In other cases, it was difficult to identify quantifiable results or appropriate/reachable goals, or inconsistencies in implementation have been identified, elements that could create major problems for the implementation of the respective waste prevention and management activity.

Last, the initial list of practices will be supplemented with the actions implemented by the 8 pilot cities from UrbanWINS project that meet the selection criteria – out of the 26. Therefore, the corpus of best practices was updated with the actions resulted from the implementation of the pilot actions from the 8 UrbanWINS cities and their Local Strategic Action Plans.

[19] https://circulareconomy.europa.eu/platform/en/good-practices (Accessed December 2018)
[20] http://susproc.jrc.ec.europa.eu/activities/emas/documents/WasteManagementBackgroundReport.pdf (Accessed December 2018)
[21] http://ec.europa.eu/environment/waste/prevention/practices.htm (Accessed December 2018)

1.3 Best practices classification and assessment criteria

Classification criteria

The classification criteria mainly take into account different EU tools and instruments, relevant for waste prevention and management sectors. The aim is to have a clear understanding and approach on the most relevant waste streams for decision-makers, especially at municipality level. The classification criteria therefore include:

- Waste management hierarchy (accordingly to the EU Waste Framework Directive[22]):
  - Prevention: replacement and reduction
  - Preparation for reuse
  - Recycling: Reuse – Reprocessing
  - Other form of recovery
  - Disposal: Rectification - Return - Waste Export.

Around 40 innovative BPs that focused on prevention practices were aimed to be analysed together with the complementary, management ones. Disposal actions were avoided, as they do not follow the circular approach that was considered as a key aspect of assessment.

- The type of instrument (according to the EC Waste prevention Handbook[23]) was used in all the previous WPs of the UrbanWINS project and was considered a focal point in the in the elaboration of the Strategic Planning Frameworks and Local Strategic Action Plans[24] developed in the project for each of the 8 pilot cities. According to the EC, the types of instruments for prevention strategies are:
  - Education, information, awareness raising;
  - Regulatory / normative and
  - Voluntary / promotional (e.g.: business support schemes, green public procurement, infrastructure, fiscal measures).

The research on waste prevention and management was focused on 16-targeted economic sectors, from agriculture to NGOs. The classification criteria also focused on 26 Waste streams identified according to EU Waste Catalogue[25] linked to EU Waste Framework Directive[26].

In 2018, a list of 59 Best Practices was initially published within an UrbanWINS deliverable[27]. Afterwards, the list was enlarged, the practices were further simplified, updated, and

[22] http://ec.europa.eu/environment/waste/framework/ (accessed in January 2019)
[23] http://ec.europa.eu/environment/waste/prevention/pdf/Waste%20Prevention_Handbook.pdf (Accessed December 2018)
[24] https://www.urbanwins.eu/wp-content/uploads/2018/06/URBAN_WINS_D61_00_10-ECOTECA_GIS.pdf (accessed in January 2019)
[25] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000D0532 (Accessed December 2018)
[26] http://ec.europa.eu/environment/waste/framework/list.htm (Accessed December 2018)
[27] https://www.urbanwins.eu/wp-content/uploads/2018/06/URBAN_WINS_D61_00_10-ECOTECA_GIS.pdf (Accessed December 2018)

published online[28] on the project website. The online section of BPs also offers to the reader the possibility to download them using a search tool according to the waste management hierarchy, type of instrument and/or waste streams.

Assessment criteria

The Corpus of BPs emerged as a result of a joint work, engaging the 27 project partners from UrbanWINS, including EU municipalities, as well as urban waste stakeholders - environmental protection authorities, NGOs, private companies, the research environment, sanitary companies, etc. - that transversally contributed to the BPs identification and development within the online and face-to-face agoras and through surveys and interviews. Therefore, the BPs are oriented towards the real needs of decision-makers in the waste prevention and management field and reflect waste management needs of European cities that have different levels of development and different priorities.

The following criteria were used for the selection of Best Practices:

a) a set of standard assessment criteria of best practices derived from the literature review, as well as from the EUs waste prevention best practice catalogue (Table 2):

Replicability	You may want to read it if you…	Short name of the Part
The practice can be easily reproduced by local public authorities and is relevant for other regions across Europe	The practice uses original or resourceful techniques: - technological (product / process) - organizational (for example, based on the cooperation of various departments, with new stakeholders ...) - social (based on new types of engagement, with a clear social focus / impact) - economic (derived from new types of business models and approaches)	**The practice continues to have effect and be functional once the funding/ organisational support ended**

b) two additional assessment criteria specific to the UrbanWINS approach that brought an added value to the existing work of best practice analysis previously carried out:

i) urban metabolism relevance – it is the core of UrbanWINS project and offers a holistic approach to decision-making, a circular approach to the use of resources.

In order to analyse the relevance of the BP for urban metabolism, the following check list has been used:

✓ The practice has been implemented in a broader policy context than the one of the urban waste policy (for example, it is integrated in a climate change policy that aims to reduce CH4 emissions of the city)

[28] https://www.urbanwins.eu/best-practices/ (accessed in January 2019)

- ✓ The results of the practice make reference to outcomes going beyond waste prevention and management, for example: improving air quality within the city (by reducing the bio-waste disposed in landfills, encouraging product sharing solutions etc.), reducing the use of natural resources (by encouraging bulk acquisitions, repair initiatives etc.)
- ✓ The practice has been elaborated / implemented / evaluated in connection with various urban material flows and / or analysed the connection within various urban material flows
- ✓ The practice has used various tools related to urban metabolism such as MFA (material flows analysis), UMAn model ... Data origin is clearly mentioned (EU or national databases, Eurostat etc.)
- ✓ The practice encompasses LCC (life cycle costing) / LCA (life cycle assessment) / S-LCA (social LCA) / PEF (product environmental footprint) approaches. Data origin is clearly mentioned (EU or national databases, Eurostat etc.)
- ✓ The practice is contributing to circular economy approaches by enhancing the circularity of materials (via upcycle, remanufacture, resale, repair actions) and / or by aiming to "close the loop" and / or by showing the valorisation approaches of the waste
- ✓ The practice is enhancing dematerialization

ii) use of participatory approaches – it is another key aspect of the UrbanWINS project and takes into account the involvement of stakeholders in the entire decision making process from the problem formulation, to the implementation and evaluation of the action. The criteria were also used to update the corpus with the experiences from pilot cities in the last year of project implementation.

In order to analyse the relevance of the BP for stakeholder engagement, the following check list has been used:

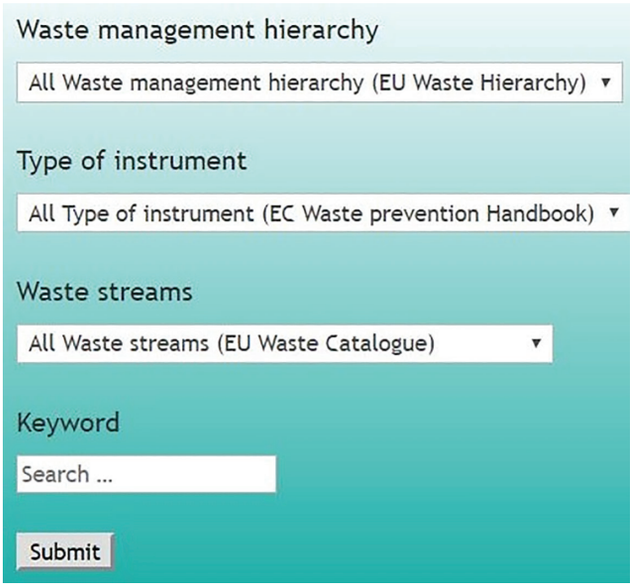
- ✓ The practice has been elaborated / implemented / evaluated with the engagement of at least two types of urban stakeholders - citizens, consumers, waste companies, NGOs, professional associations, policy makers, start-ups etc.
- ✓ The engagement tools of stakeholders include face to face events (such as interviews, round tables, workshops) and / or online tools (such as pools, social media / website consultations, questionnaires ...)
- ✓ The engagement processes go beyond a simple consultation of stakeholders and deal with:
  - i) consultation (through questionnaires, focus groups, forums etc.) and / or
  - ii) participation (joint initiatives, expertise valorisation etc.) and / or
  - iii) co-construction (inclusion of stakeholders in the team, PPP etc.)
- ✓ The practice is showing the ways in which stakeholders contributions have been integrated in the design / implementation / evaluation / follow up stages

c) other elements that enable the assessment of the best practice: success factors, key challenges and contact details of the action that will support decision-makers in the identification of the most relevant practices;
d) transversally, all the practices, independently of their level of application – starting from innovative to mature ones - have been required to have clear objectives, consisting results, and represent a solution for solving waste management pressing issues.

The online list of BP Corpus

As mentioned above, the online Corpus of BPs is hosted by UrbanWINS website[29]. The Corpus includes a list of 68 practices that can be accessed using the search tool for one or all of the three following criteria:

1. Waste management hierarchy:
    a. Multiple: 6
    b. Disposal: 5
    c. Other recovery (e.g. energy/ biogas):2
    d. Preparing for reuse: 20
    e. Prevention: 38
    f. Recycling (separate collection/ reprocessing): 47
    g. Reuse/repair/refurbishment: 9 Best Practices



2. Type of instrument (according to EU waste prevention handbook):
a. Multiple: 24
b. Awareness raising (educational/ informational): 42
c. Regulatory/normative: 15
d. Promotional/voluntary: 48

3. EU waste streams (according to EU catalogue), some examples (out of the list of 30 waste streams):
    - Municipal waste/multiple: 37 BP
    - Paper and cardboard: 15
    - Packaging waste: 14
    - Construction and demolition: 9
    - Plastics: 13
    - Textiles and batteries: 6 each
    - Waste Electrical and Electronic Equipment: 11
    - Food and organic waste: 24
    - Used oils: 5

[29] https://www.urbanwins.eu/best-practices/ (accessed in January 2019)

Part 2 - Guidelines and tools for a better management of urban resources and flows

2.1 Introduction

Currently, the number of people living in urban areas amounts to over a half of the total world population. In Europe and Central Asia, this figure has already exceeded the 70% threshold, and the growth of urban population still goes on (World Bank, 2016). As it was stated in the Brundtland Report on urban economy, "this system, with its flows of information, energy, capital, commerce, and people, provides the backbone for national development" (UN, 1987), but, at the same time, it causes direct and indirect impacts on the environment and on human health. UrbanWINS addressed the challenge of investigating these impacts and put together a set of analytical and operational tools to enhance a better understanding and management of urban resources.

UrbanWINS rethought urban systems as natural ones by applying the concept of urban metabolism. This allowed rethinking also waste prevention and management policies in terms of policies that have to deal with material resources and flows that characterize various activities within the cities. As a result, the set of strategies, recommendations, tools and pilot actions that were developed within UrbanWINS cover a wide range of economic sectors and activities, are multi-sectoral and, most important, stem from a cross-cutting political and multi-stakeholder approach.

These guidelines contain an overview of the methodologies, approaches and tools that were applied across the project with the aim to guide users to replicate part or all of the UrbanWINS experience. Urban metabolism thinking and approaches, indicators frameworks and LCA applications, strategic planning frameworks, action plans and pilot actions do represent the core contents of them and will be included in the second part of the UrbanWINS toolkit.

Some thematic focuses are also included to facilitate the understanding of the need of holistic, complex approaches of urban policies from the urban metabolism perspective. Food prevention was a key aspect to be analysed as it resulted as a key element to be further investigated from the research done in the first part of UrbanWINS. Buildings were chosen as sectors of focus as they are associated with a significant share of resource consumption in urban areas and pose significant challenges (they represent more than 25% of the total waste generated), on one side, and meaningful opportunities for improvement in terms of reduction of waste production and circularity, on the other.

Third, this section also includes some transversal focuses on various approaches and practices that have been developed and tested by the project partners and that might be useful for other decision-makers and urban policy stakeholders.

Toolkit users will be able to either follow the entire UrbanWINS approach or select and use the information on a specific tool/step of the process. For each tool/step, a general

description is given, scope and objectives are illustrated and practical advice and references are provided. Also “attention points” are included in the text to highlight additional sources, provide suggestions and/or highlight key lessons learned.

Table . Summary of contents of these guidelines to facilitate the user in the selection

WHAT?	WHERE?	PARTICULARLY RELEVANT FOR
If you want to know more about urban metabolism and policies for urban resource management, waste prevention and circular economy	2.2.1	**Policy makers**
If you want to know how urban metabolism indicators have been calculated in UrbanWINS	2.2.2 and 2.2.3	**Researchers, environmental accounting experts and policy makers**
If you want to know how urban metabolism accounts were used to inform the decision-making process of UrbanWINS pilot cities	2.2.3	**Policy makers and researchers**
If you want to have an overview of useful indicators to orientate policies for waste prevention and management within an urban metabolism approach	2.3	**Decision-makers and public officials**
If you want to know more about the use of Life Cycle Assessment (LCA) in UrbanWINS	2.3	**Researchers, environmental experts and decision-makers**
If you want to know how to build a strategic framework for the development of urban policies	2.4	**Decision-makers and public officials**
If you want to know more about the elaboration and implementation of Local Strategic Action Plans within UrbanWINS	2.5	**Decision-makers and public officials**
If you want to have an overview of tools that can be adopted for cross-sectoral strategies addressing waste prevention and management	2.6	**Decision-makers, public officials, sector experts**

2.2 Urban metabolism thinking and approaches

SUGGESTION

For a quick and visual explanation of what urban metabolism is, watch the UrbanWINS first video at: https://www.youtube.com/watch?v=cL0qX1oXOMg

2.2.1 Urban metabolism, resource (waste) policies and circular economy

Urban Metabolism (UM) is defined as an approach to understand the transformations that happen in a complex urban system, in other words, what cities eat, digest and discard. The concept emerges as a framework that defines the "… consumption, transformation, accumulation and discard of materials and energy, which flows are interconnected and predefined by a variety of factors …". According to Musango et al[30], UM allows identifying "those complex socio-technical and socio-ecological processes which determine all these flows and shape the city, service the needs of its populace and impact the surrounding hinterland".

TESTIMONIAL

Xan Duro, Member of Council of environment from Santiago de Compostela "Santiago de Compostela municipality is leading an URBACT Transfer Network based on the good practice "Tropa Verde, rewarding recycling", a platform to encourage environmentally responsible behaviour, that empowers citizens to reuse and recycle. Combining web platform and low cost campaigns, it is considered as a "civic movement fully committed to sustainability and circular economy". Citizens get vouchers and exchange them for rewards from the City Council and local retailers. It connects places where disposing waste (green points, civic and social centres etc.) with local businesses providing gifts or discounts.

We are interested in the approach of urban metabolism, to apply public policies based on data is always a good approach. However, data gathering is precisely the main challenge of using urban metabolism in urban waste policies."

CONCELLO DE SANTIAGO

[30] Musango, J.K., Currie, P. & Robinson, B. (2017) Urban metabolism for resource efficient cities: from theory to implementation. Paris: UN Environment

Looking at cities from an urban metabolism perspective implies reasoning on how resources and waste enter and leave the city boundaries. This affects the design of waste prevention and urban planning policies as it gives back to decision makers a picture that shows how preventing and managing waste is not a matter of the environment/waste department only: it requires broad and strategic thinking and a coordinated approach that aims at changing urban production and consumption activities and citizens' lifestyles.

TESTIMONIAL

Thierry Mareschal, Chargé du développement de l'économie circulaire, Division Énergies Climat Économie Circulaire/ Agence d'Écologie Urbaine, Ville de Paris:" I would say that an urban metabolism approach only gives you a global (macro) view of the main flows on which to work with priority in an action plan. The study on Urban Metabolism started in 2014 with the aim of engaging economic actors to lower the environmental impact or make the city flows more circular trough a call for projects and a tool (website) for urban flows explaining the impact on the environment".

For more about the urban Metabolism in Paris, follow the link: https://metabolismofcities.org/videos/53-from-an-urban-metabolism-study-to-a-circular-economy-plan-lessons-from-paris

Within the urban metabolism framework and in order to guarantee the sustainability of urban areas and the improvement of the living conditions and of the social, cultural and economic opportunities of the actors that live and operate in a city, waste prevention must be an integral part of urban plans and policies that shall aim to:
- maintain and increase the stock of resources within a specific territory;
- optimise and make more efficient the use of resources to produce goods and services;
- minimise the loss of resources in the form of waste.

In fact, besides improving the understanding of the qualitative links between waste and various urban flows and policies, the measurement of urban metabolism indicators (as further illustrated in paragraph 2.1.2 below) shall also help to overpass the principle by which what we cannot measure, cannot be improved. The analysis of urban metabolism can provide decision makers with relevant information for the design of waste prevention and management strategies as it can:
- Confirm the key material streams which should be addressed at the urban level;
- Identify "hidden" flows which are often disregarded;
- Support building future waste scenarios;
- Support communication actions for their implementation, thus enhancing the stakeholder and citizen engagement process.

This approach can be of significant support also for the transition towards a circular economy, "where the value of products, materials and resources is maintained in the economy for as long as possible and the generation of waste minimized" (COM(2015)614).

OFFICIAL SOURCES

The COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Closing the loop - An EU action plan for the Circular Economy COM/2015/0614 can be consulted here: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0614

Picturing the urban metabolism of a city implies considering the products and materials that go through the urban system as potential sources of future outputs: in other words, they will become waste that can either be prevented by reducing those products and materials at the source or transformed into new products and materials. Reduction, remanufacture, repair, reuse, recycling and recovery are the set of mandatory options that allow to put in place the EU waste hierarchy at all levels and to respect the paradigm of the circular economy.

TESTIMONIAL ON URBAN METABOLISM APPROACH AT LOCAL LEVEL

Ann-Louise Eliasson, EAB Member, Strategist, MSC civil engineering, Division of Strategic planning, Department of Sustainable Waste and Water, City of Gothenburg "The city of Gothenburg has started thinking about using an urban metabolism approach regarding our local environmental targets, namely our target regarding climate change. The idea has been that the approach could be used as one tool among others when prioritizing between different actions. The environmental office started with Chalmers, a project about the flow of goods, materials and services within the boundaries of a municipality. We have these results for Gothenburg. The subsequent environmental impact could be calculated with LCA for these goods and materials. Different policies and strategies for reducing the environmental impact of purchasing goods and materials could be studied, as well as simulations of the effects if these policies regarding procurement were to be implemented. The progress on this matter has been slow, initiatives where taken some years ago but have not been put to work or implemented.

Another project where the city has been involved is a collaboration with IVL where an urban metabolism approach has been applied with focus on building materials is “Beyond the Urban Mine”. Another idea that has come up is to use an urban metabolism approach to communicate with inhabitants what goods and products to avoid when shopping on one of our communication platforms “Greenhack”.

As by now we don’t have any results and can´t say if the approach could be useful or not. We have not used it in our work with a new waste management plan, where we instead have focused on the contents in the waste streams that the city is responsible for. A main challenge is that most materials in an urban metabolism analysis would not end up in a waste stream within the cities responsibilities (according to Swedish law)”.

In case of cities, waste reduction at the source can be the result of changed consumption choices put in place by individual households, local administrations and other urban organizations that will go hand in hand with innovative urban production activities. On the other hand, the way in which waste is collected and managed will determine the rates of recycling and the number of valuable materials that can find their way back into the urban economy.

Overall, the adoption of an urban metabolism perspective can therefore have a significant role in supporting the integration of circular economy objectives in the design of waste prevention and management strategies and, even more, in transforming them into policies for the management of urban resources.

TO BETTER UNDERSTAND HOW URBAN METABOLISM AND CIRCULAR APPROACHES CAN AFFECT SECTORAL POLICIES AND SPECIFIC WASTE STREAMS

Read the Thematic Focus on Buildings and on Food Waste

As each city has a specific consumption model of material and energy resources, an urban policy that intends to enhance the sustainable and circular use of resources should:

- identify the actors or centres for consumption and transformation of resources and waste at urban level (Institutions, public actors, organizations of self-employed individuals, enterprises, non-profit organizations, research centres, training organizations and schools, citizens as individuals or as organizations);

- identify the sectors where these actors operate and define their roles with respect to the use and transformation of material and energy resources as well as to the waste production

TO GO DEEPER

Part III of this toolkit contains all the details of the participatory process put in place by UrbanWINS pilot cities.

For details on how the stakeholders were identified and selected, see Deliverable 3.1 Thematic, actor and country-oriented waste stakeholder matrixes at: https://www.urbanwins.eu/wp-content/uploads/2017/06/UrbanWINS-D3.1.-Stakeholder-matrixes.pdf

Furthermore, in order to define effective and efficient targeted policies able to affect cross-cutting areas, public administrations have to take into account the following critical factors:
- availability of specialized and very different technical skills
- programming for wide and cross-cutting objectives
- involvement and coordination of different actors
- interdependence of policy effects
- continuous assessment and rearrangement of the processes according to the context changes, also as a consequence of the actions implemented.

All these factors were acknowledged in the design of UrbanWINS activities, that can therefore represent an example for other local decision makers that aim to innovate their current waste prevention and management strategies or that want to define urban strategies aimed at improving resource use and efficiency and to boost circularity.

POINTS OF ATTENTION

Based on UrbanWINS general research concerning the state-of-the-art of waste prevention and management policies, as well as their determinants, general recommendations for a better waste management include the following:

- *Participatory approaches are a key factor to improve the success of waste management strategies (WMS) in order to analyze needs, provide and debate ideas, and finally, to increase the level of awareness of the current/future WMS.*
- *Priorities must be matched to obtain win-win situations. Public agencies often consider the WMS as a balance between social and economic aspects. Meanwhile, private operators are focused in economic aspects as key drivers and their profits may be directly related to the amount of waste they treat.*
- *The power of the citizens as consumers and hence in prevention can change the order of priorities. Around Europe and especially in Austria, this power has shown to be enough to change the set of priorities, making environmental aspects increasingly more relevant for the selection of WMS.*
- *Design simple and more homogeneous regulations to enhance the results of the WM, limiting the bureaucratic, technical or economic (through taxes) restrictions for the implementation of the innovative waste management practices and strategies.*
- *Support innovative WMS that can be implemented at real scale. Green public procurement can be a right element to support this point.*
- *Circular economy (CE) practices and regulations are seen as an opportunity to enhance the current WMS. WM must be converted to resource management in order to create new opportunities, involving all value chain and life stage of products: design, production, use, reuse, recycling … CE can be a key element to find the right answer to: How to produce and consume with less waste?*

TESTIMONIAL

Patrick VAN DEN ABEELE - Project manager, Bruxelles Environnement, Div. Information, Coordination générale, Economie circulaire et Ville durable, Dpt. Economie en transition:" In 2015, the region of Brussels commissioned an urban metabolism study from the consulting firm Ecores and the Free University of Brussels. The goal of this study for us was triple: assess Brussels Region economy's level of circularity, identify priority strategic flows on which to act and finally interact with different (public and private) stakeholders to engage them in a potential roadmap towards Circular Economy.

The results of the study were helpful in pointing out the need of transitioning from a relative linearity in the Brussels economic system to a Circular Economy. It also allowed identifying potential relevant urban flow loops, such as for the construction and demolition waste. The information was a valuable input to select the key sectors and key actions that later shaped our regional programme for Circular Economy "Be Circular" adopted by the Brussels region government in 2016 for a duration of 4 years.

The Lessons learned during the process of conducting the urban metabolism study were that such analysis requires also a long term approach. Not all data was immediately available. We had to make a compromise between the exhaustive character and the robustness of data. The material stock (representing potential future waste) for instance was very difficult to determine and many hypotheses had to be made in order to get estimations for some flows. This should not be seen as an insurmountable obstacle and you have to accept starting with the data you have at your disposal. These gaps in data once identified can be worked upon with a longer term approach.

Another important challenge is to go beyond quantitative data and interact with stakeholders that deal with the flows to collect qualitative data in order to have a better understanding of the narrative behind the flows movements".

be circular
be.brussels

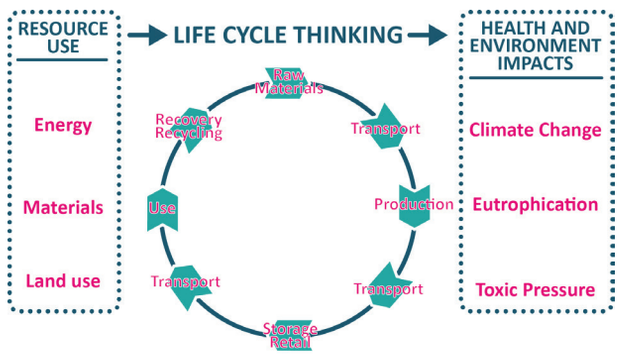
Thematic focus: buildings

Construction and demolition waste (CDW)[31] is one of the heaviest and most voluminous waste streams generated in the EU and it is a sector within which the application of LCA can lead to significant environmental benefits. CDW accounts for approximately 25% - 30% of all waste generated in the EU and consists of numerous materials, including concrete, bricks, gypsum, wood, glass, metals, plastic, solvents, asbestos and excavated soil, many of which can be recycled. CDW arises from activities such as the construction of buildings and civil infrastructure, total or partial demolition of buildings and civil infrastructure, road planning and maintenance.

The waste hierarchy, established in article 4(1) of the Waste Framework Directive (2008/98/EC)[32], sets the legally binding order of management preference: prevention, preparation for re-use, recycling, other recovery and disposal as the least desirable option.

Generally, applying the waste hierarchy should lead to the waste being dealt with in the most resource-efficient way. However, as supported by Article 4(2) of the Waste Framework Directive, Life Cycle Thinking (LCT) – detailed in the following sections – can be used to complement the waste hierarchy in order to make sure that the best overall environmental option is identified. Life Cycle Thinking is a conceptual approach that seeks to identify improvements and to lower the total impacts of goods or services (products) at all stages of associated life cycles, from raw material extraction and conversion, product manufacture, through distribution, use and eventual fate at end-of-life.

Analysis of the different types of circular economy tools that could be applied to optimise the different stages of the buildings' life cycle



The concept of Life Cycle Thinking[33] helps to avoid the situation of resolving one problem while creating another. LCT avoids the so-called "shifting of burdens", e.g., from one stage in the life cycle to another, from one region to another, from one generation to the next or amongst different types of impacts. CT can be quantified in a structured, comprehensive manner through Life Cycle Assessment, which can provide a rigorous approach for improving decision support in environmental management.

[31] EU Construction and Demolition Waste Management Protocol - https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en

[32] Directive 2008/98/EC of the European Parliament and of the Council - https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0098&from=EN

[33,4] Supporting Environmentally Sound Decisions for Construction and Demolition (C&D) Waste Management - http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/22585/2/d4b%20-%20guide%20to%20lctlca%20for%20c%26d%20waste%20management%20-%20final%20-%20on%20line.pdf

The main goals of LCT are to reduce a product's resource use and emissions to the environment as well as improve its socio-economic performance through its life cycle. This may facilitate links between the economic, social and environmental dimensions within an organization and through its entire value chain.

The interaction of the buildings sector with other urban sectors and policies

LCT highlights the fact that CDW not only affects the built environment but also other urban sectors, thus representing an important tool for addressing CDW within the urban metabolism context. The way waste is analysed and processed affects the natural environment, biodiversity and human health (through air quality), but also energy policies, urban resource management, air quality.

For example, in the developed world, human beings spend approximately 90% of their lives within buildings[34]. Since humans are exposed to a range of chemicals arising from furnishing and finishes, health has become an increasing concern related to the indoor environment. Other practices, which take place within the buildings, also affect physiological and psychological reactions. Increasingly, the design and layout of buildings necessitate active measures to maintain conditions, which ensure the health and general well-being of their occupants.

Furthermore, construction has a major impact on the environment in its consumption of energy, both directly and embodied in the materials that it uses. The large bulk of used materials consume a great deal of energy for transport, which produces CO_2, acid gases and oxides of nitrogen (NO^2), contributing to acid rain and photochemical smog production. Also, the use of fossil-fuel-derived energy in the production of materials, the construction process, and by the users of the building throughout its lifetime is another source of significant quantities of CO_2[35]. Also, materials are derived from numerous sources and suppliers, and minimization of waste is a significant problem. Although many of the materials in use are common to most sites, the fragmented nature of development limits the practical extent of recycling. Furthermore, despite the long life of its products, their eventual demolition or redevelopment can produce significant waste for land disposal unless re-used.

In terms of the natural habitat, there is a wide range of environmental issues concerned with the interaction of the land use, planning system and the construction industry. For example, biodiversity on sites can be devastated by developments and through mineral extraction for the construction industry. However, a wide range of nature conservation initiatives and area designations can be developed to sustainably benefit from habitats, while also protecting them.

Also, construction-related activity has a significant impact on transport movements. Considerable pressure can be placed on the local road network and neighbouring uses by

[34] Clements-Croome D. Creating the productive workplace. London: Taylor&Francis; 2000.
[35] Willmott Dixon, The Impacts of Construction and the Built Environment - https://www.willmottdixon.co.uk/asset/9462/download

quarrying operations. In addition, completed developments and their interrelationship with other land uses can influence the propensity to travel and modal choice. The interaction between the built environment and the natural environment also has a significant impact on the hydrological system. The combined effect of urban expansion and agricultural intensification has exceeded the capacity of the land to absorb exceptional levels of rainfall. At the same time, rainfall has become more intensive, concentrated and erratic. The spatial planning system and the design of buildings and landscapes therefore has a role to play in absorbing the new rainfall peaks, and thereby reducing stress on the drainage and river systems.

While the above categorization provides a convenient framework to discuss the issues, few of the issues can be considered in isolation, and due consideration must be given to the numerous interactions and interdependencies, which exist between:
- the media of land, water and air;
- the internal and external environment;
- the local, regional and global consequences arising from certain activities;
- behavioural changes (e.g. traffic patterns) and other secondary impacts.

Recommendations for an integrated approach of the construction policies with other urban policies

Taking into account the interaction of CDW with other urban environmental, social and economic sectors, the following criteria provide a guide to help select the best environmental options for typical CDWs using the EU was hierarchy and LCT approach:

• Waste reduction

Construction waste can be reduced significantly. This is mainly due to the reduction of initial non-renewable resource input (such as concrete) by 60%[36]. Furthermore, the structure of a timber-hybrid building weighs 30% less, which leads to less material usage for foundation purposes. 1 m^3 of wood saves approximately 1 ton of CO2, so buildings using timber-hybrid construction act as a temporary carbon sink, and further avoid the CO2 emissions and primary energy consumption of conventional building materials. The entire life cycle of the building forms the focus of the planning, starting with the raw materials and resources used, to the construction, use and conversion of the building, all the way to its dismantling and reuse. Even guidance on dismantling shouldn't be missed out. The design of the façade is also part of sustainable, intelligent planning and is based on the direction the building is facing in terms of the proportion of window surfaces and shading. When it reaches the end of its lifespan, the façade can be partially or entirely replaced without damaging the structural framework of the building.

With each building application, a list of materials used in the building should be provided from the building owner for the authorities. This ensures that the authorities and owners of a building know which materials and how many materials are installed in a new building.

[36] Research Project (program responsibility BMVIT "Haus der Zukunft"), "LifeCycle Tower- energy-efficient high-rise buildings made of wood with modular construction type", Rhomberg Bau GmbH Austria, 2009-2010

• Re-using Materials and Components
Wherever possible, real estate developers should seek opportunities to separate and directly to re-use materials - on or off-site. Where mineral-based products are re-used off-site, some attention should be given to the distance that they might be transported. An LCA may be needed to understand the real extent to which transport influences the overall environmental outcome.

• Materials in the waste stream with high 'embodied' impacts
Where metals (e.g. aluminium, steel, copper) are present in sufficient quantities in a mixed CDW stream, separation for recycling is likely to be the best environmental option. WRAP's reviews of LCA studies comparing waste management routes for different materials (WRAP 2007, 2010)[37] support this. The materials are relatively easy to separate (often manually on site, or centrally through physical separation techniques). By separating them, they can be melted down and used in place of primary materials, which are energy-intensive to produce. The same principle is applicable to plastics and glass, provided that they are readily separable from the waste stream and are not contaminated. Plastics and glass recycling has been shown to be most environmentally beneficial where they are recycled back into their original form, with no loss of quality/performance. Hence, it is important that their final recycling fate is considered.

• Open floor plans
Also, open floor plans allow for interchangeable occupations, which translates in a longer building lifespan.

Interchangeable Occupations: Hotel - Housing - Office, Cree GmbH

• Remaining inert fraction
It is generally beneficial to recycle mineral materials that contain low levels of contamination. For example, re-use of the aggregate (bricks, etc.) on site is the preferred option wherever possible, since transport impacts are not incurred. Off-site crushing, grading and cleaning of aggregate and its subsequent transport and recycling will incur an environmental burden which may need to be considered carefully from a life cycle perspective. If it is not possible to reprocess/recycle/re-use the inert fraction locally, other waste disposal options that will minimize transport impacts should be considered for the remaining waste.

European case studies that showcase the use of urban metabolism approaches in the buildings sector

1) Re-use of construction materials in a temporary construction site-example of the London 2012 Olympic Park

[37] WRAP (2010) Environmental Benefits of Recycling - 2010 Update. WRAP, Banbury, UK

The Olympic Delivery Authority (ODA) set demanding sustainability targets for the Olympic Park demolition, including an overall target of at least 90% by weight of demolition material to be re-used or recycled. The ODA's overall target was exceeded by 8.5%, with less than 7,000 tonnes landfilled. The key lessons learned from this project include the contributions and linkages of the building sector with other urban issues/policies:

1. Undertake a pre-demolition audit and include a reclamation survey.
2. Use this data, and consultations with reclamation specialists, to set headline targets for re-use and reclamation for key materials before issuing tenders, ideally linked to carbon targets.
3. Include clear reclamation and re-use targets as separate and additional to the overall recycling target and state them clearly in the tendering process and in contracts. Make explicit the responsibility for demolition.
4. Incentivize use of specialist contractors and achieving of re-use targets.
5. Require the project to measure the total carbon impact of the demolition process and the new construction on the site.
6. Require re-use to be entered into a materials database and included in Site Waste Management Plans.
7. Design team workshops and communication with other local regeneration projects are recommended; regular site visits are vital.
8. Include use of site-won re-used materials in the design and construction contracts for the new build.
9. Sufficient storage space is vital to enable re-use of construction products.

A detailed report of the initiative can be found in the Reuse and Recycling on the London 2012 Olympic Park report[38].

2) Tracimat – a Belgian example of CDW tracking[39]

Tracimat[40] is a non-profit, independent demolition management organisation recognised by the Belgian public authorities that issue a „certificate of selective demolition" for a specific C&D material that has been collected separately at the demolition site and subsequently gone through a tracing system.

Tracimat does not issue a certificate of selective demolition until the waste has gone through the traceability system. The tracing process starts with the preparation of a demolition inventory and waste management plan prepared by an expert prior to the selective demolition and dismantling work. Tracimat will check the quality of the demolition inventory and waste management plan and issue a declaration on its conformity. 'Clean input gives clean output' is the general motto of this policy. It also explains the distinction between streams with a Low Environmental Risk Profile (LERP) and streams with a High Environmental Risk Profile (HERP). Tracimat is a type of tracing system for debris derived from separate demolition.

[38] Reuse and Recycling on the London 2012 Olympic Park, https://www.bioregional.com/wp-content/uploads/2015/05/Reuse-and-recycling-on-London-2012-olympic-park-Oct-2011.pdf

[39] Flemish Construction Confederation, 2016, http://hiserproject.eu/index.php/news/80-news/116-tracimat-tracing-construction-and-demolition-waste-materials

[40] This project has received funding from the European Union's Horizon 2020 research and innovation programme, https://ec.europa.eu/programmes/horizon2020/, under grant agreement No. 642085

Thematic focus: Food waste

Food waste represents a major environmental, social and economic concern. A study realised at the request of the EU and published in Environmental Research Letters shows that residents in 6 European countries waste an average of 123 kg of food per capita[41]. Almost 80% of scattered food (about 97 kg) is edible and should be recovered. Relative to the EU average, it means that 47 million tons of food waste could be avoided annually. Scientists who conducted the study took into account the water and nitrogen resources used to prepare the food for better data accuracy. The study, based on data from 6 countries - the UK, the Netherlands, Denmark, Finland, Germany and Romania - was based on data from EU consumer food waste. It looked at both food waste from households and the catering sector (restaurants, schools). With no surprise, the most scattered foods are fruits, vegetables, cereals and meat. By associating the data, the researchers were able to find out that a British citizen is squandering on average the equivalent of a tin can on a daily basis. The Romanians, who are the least wasting among the residents of the studied states, waste the equivalent of an apple per day per person. By extrapolating data to other EU states, researchers have concluded that Europeans spend 22 million tons of food a year, which corresponds to a loss of water (needed to produce these foods) of 57 cubic kilometres per year. A complementary worldwide study of the United Nations highlights that by reducing global food wastage by 25%, the whole population that is currently suffering from hunger, i.e. 795 million people can be fed[42]. Worldwide, according to The Food and Agriculture Organization (FAO) key facts[43] 1.3 billion food tones is scattered every year, almost a quarter of the total food production, fruits and vegetables, plus roots and tubers have the highest wastage rates of any food. Global quantitative food losses and waste per year are roughly 30% for cereals, 40-50% for root crops, fruits and vegetables, 20% for oilseeds, meat and dairy plus 35% for fish (see table 4 below).

Table 4. Key facts on food loss and waste identified by the FAO

Statistics[44] concern 5 food industry chains[45] (agriculture, post-harvest, processing, distribution, consumption)		
CEREALS	30% of cereals food losses	**In industrialized countries, consumers throw away 286 million tonnes of cereal products. 763 billion boxes of pasta are thrown away. More information here -http://www.fao.org/save-food/resources/keyfindings/infographics/cereals/en/**

[41] https://ec.europa.eu/jrc/en/news/average-eu-consumer-wastes-16-food-most-which-could-be-avoided?r=mm (accessed in December 2018)
[42] https://www.theguardian.com/environment/2015/aug/12/cutting-food-waste-enough-for-everyone-says-un (accessed in December 2018)
[43] Info available at http://www.fao.org/save-food/resources/keyfindings/en/ (accessed in January 2019)
[44] Acording to FAO http://www.fao.org/save-food/resources/keyfindings/infographics/cereals/en/
[45] Research has considered the most important 7 regions around the globe: Europe; North America and Oceania; Industrialized Asia; Sub-Saharan Africa; North Africa, West and Central Asia; South and Southeast Asia; Latin America.

DAIRY	20% of dairy food losses	**In Europe alone, 29 million tonnes of dairy products are lost or wasted every year. This is the same as 574 billion eggs. More information here - http://www.fao.org/save-food/resources/keyfindings/infographics/dairy/en/**
FISH & SEAFOOD	35% of fish and seafood losses	**8% of fish caught globally is thrown back into the sea. In most cases they are dead, dying or badly damaged. This is equal to almost 3 billion Atlantic Salmons. More information here - http://www.fao.org/save-food/resources/keyfindings/infographics/fish/en/**
FRUIT & VEGETABLES	45% of fruit and vegetable losses	**Along with roots and tubers, fruits and vegetables have the highest wastage rates of any food products; almost half of all the fruit and vegetables produced are wasted. An example: 3.7 trillion apples More information here -http://www.fao.org/save-food/resources/keyfindings/infographics/fruit/en/**
MEAT	20% of meat food losses	**Of the 263 million tonnes of meat produced globally, over 20% is lost or wasted. This is equivalent to 75 million cows. More information here -http://www.fao.org/save-food/resources/keyfindings/infographics/meat/en/**
OILSEEDS & PULSES	20% oilseeds & pulses food losses	**Every year, 22% of the global production of oilseeds and pulses is lost or wasted. This is the same as the olives needed to produce enough olive oil to fill nearly 11000 Olympic-sized swimming pools. More information here -http://www.fao.org/save-food/resources/keyfindings/infographics/oilseeds/en/**
ROOTS & TUBERS	45% of roots and tubers food losses	**In North America and Oceania alone, 5 814 000 tonnes of roots and tubers are wasted at the consumption stage alone. This equates to just over 1 billion bags of potatoes More information here - http://www.fao.org/save-food/resources/keyfindings/infographics/roots/en/**

The newly adopted EU waste legislation[46] (of 22 May 2018) stipulates the monitoring of waste prevention measures in the EU Member States and establishes new reporting obligations on reuse and food waste, which will be instrumental in achieving harmonised data collection and reporting mechanisms. Food waste is also included in the monitoring framework for the circular economy (COM/2018/029 final).

Some countries have specific national or regional policies and plans addressing food waste reduction. Strategies and projects seek to identify the drivers of food waste generation and best practices prevention, develop methodologies for quantification and foster agreements between governments, business and local stakeholders. Furthermore, there are projects focused on developing innovative technologies or solutions for increasing the efficiency of separation.

At urban level, the most common strategy for food waste prevention is the promotion of domestic composting or the reduction of avoidable food waste, i.e. unsold products still suitable for consumption.

In general, home composting is done on a voluntary basis, without any financial reward or direct incentive, and the number of households with a composter is still reduced. Free-of-charge, door-to-door collection of green and garden waste provided in some municipalities also does not incentivise home composting. A reduction of the waste tax for householders that actually deliver less residual waste for treatment could promote citizens' participation in this type of actions. Home composting is also an activity that has not been widely explained (e.g. in schools; institutions), therefore citizens have little practical knowledge on how to treat organic waste.

There are also private sector initiatives for preventing food waste, which are mainly socially orientated. Prevention of food waste in restaurants and canteens has also been the goal of several actions. Successful initiatives include socially-oriented actions to divert food goods still proper for consumption from being disposed of to feed low-income people. Despite these actions, food waste avoidance is still entangled with cultural habits and lack of real incentives to reduce waste. Residual waste from restaurants is mixed with domestic waste and tariffs are very low, which does not incentivise these businesses to act on waste reduction or separation. Additionally, the bio-waste collection is still a niche activity lacking scale economy.

The most common measures to reduce food waste (measures that are often „at hand" and do not require major investment) include: selling ugly vegetables and fruits, selling low-priced foods, donating food left in restaurants to social canteens, student hostels, legislative measures to encourage food waste reduction, intelligent applications that teach us to prevent and reduce waste.

[46] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0851&from=EN (accessed December 2018)

POINT OF ATTENTION:
19 Best Practices on Food waste prevention were collected within UrbanWINS

Read the Best Practices at using the search tools provided on the website at-> https://www.urbanwins.eu/best-practices/

Some examples of food waste prevention that are available on UrbanWINS website are listed below:

- „Tenga il Resto„ (Keep What's Left)[47] from Cremona Municipality consists on the distribution of 100.000 aluminium trays that the Aluminium Packaging Consortium (CIAL) provided to public establishments joining the initiative against food waste;
- Incentives (E.G. PAYT Schemes) for those commercial and productive activities which are actively engaged in limiting food waste[48] - The Metropolitan City of Rome published a tender for calls to award contributions to those municipalities willing to undertake projects aimed at reducing food waste and rescuing unsold food for charities or animal feed;
- "Fruta Feia" (Ugly Fruit) Cooperative[49] is a non-profit consumer's cooperative, established to reduce food waste due to its appearance, channelling directly from the region's farmers to consumers part of the production of fruits and vegetables currently rejected for mere aesthetic reasons – shape, size or colour;
- Sustainable Public Procurement of School Catering Services[50] - school catering represents a significant part of the procurement budget for the City of Turin. On average 8 million meals are delivered each year, with an annual cost of approximately 40 million EUR. One specific area of focus in the Smart City Master Plan of Turin was to achieve low carbon school catering service: in their most recent catering tender, Turin (Italy) introduced several measures and included various criteria into their current school catering contract aiming to reduce the associated carbon footprint;
- As part of the work placement area, Last Minute Market[51] is a service to combat poverty and discomfort in the territories of Monterotondo (RM), Mentana (RM) and Fara in Sabina (RI). The aim is to recover unused food from local schools and redistribute it to people in difficulty identified by Social Services. The program also organizes awareness-raising activities within schools to explain the importance of food recovery and the need to avoid food waste to the smallest and the entire population;
- „Zero Waste" Island – Sardinia[52] Sardinia was until 2003 in the rearguard of Italy and Europe in terms of waste management. With a separate collection rate of 3.8%, this popular tourist island used to send all the remaining waste to landfills and incineration. However, a strategy based on the promotion of separate collection with particular attention to bio-waste, and a carefully designed system of incentives in combination with several

[47] BP available at https://www.urbanwins.eu/tenga-il-resto/
[48] BP available at https://www.urbanwins.eu/incentives-for-those-commercial-and-productive-activities-which-are-actively-engaged-in-limiting-food-waste/
[49] BP available at https://www.urbanwins.eu/fruta-feia-ugly-fruits/
[50] BP available at https://www.urbanwins.eu/sustainable-public-procurement-of-school-catering-services/
[51] BP available at https://www.urbanwins.eu/last-minute-market/
[52] BP available at https://www.urbanwins.eu/zero-waste-island/

municipalities championing the transition towards zero waste, is delivering results. In 2016 Sardinia collected separately 56% of its waste, and plans to reach 80% by 2022 over the whole island.

Voluntary tool focus – food waste in Cremona, Italy

In order to overcome the major problems that we are facing today, such as energy transition, urban mobility, air quality, climate adaptation, sustainable land use and natural solutions, it is essential to know act simultaneously at all levels of government: from international agreements to the commitment of municipal administrations through the adoption of voluntary tools and mitigation policies directly related to social life. The adoption of voluntary tools and mitigation policies directly related to the social life contributes to the use, dissemination and exchange of good practices and the creation of „networks" that through a multi-level approach will allow cities, member states, EU institutions and stakeholders to work together on an equal footing, identifying „expert" cities and territories that are able to share and support other communities to enable the replicability of their best practices. Particular attention must be paid to those voluntary instruments promoted by local authorities which, given their flexible nature, have shown great applicability in many fields, as it is the case of the voluntary food waste prevention approaches of Cremona.

The municipality of Cremona – the project coordinator of UrbanWINS project - has implemented a series of voluntary actions with the aim of reducing the amount of food waste and increasing the percentage of waste recovery, encouraging agreements with different organizations such as NGOs, public and private companies operating in the production, distribution and marketing of goods and services, vulnerable groups. These actions included environmental awareness campaigns, as well as training and information events. In particular, the Municipality of Cremona has set the objective of fighting food waste through the development and testing of methods for research and innovation, and the implementation of interdisciplinary and participatory approaches.

The Municipality of Cremona's approach on food waste prevention consists in, on one side, reducing waste for each phase of the food chain (production, processing, distribution and administration) and recovering the unsold food for solidarity purposes, and, on the other side, in increasing the awareness of citizens, businesses, government agencies and the whole society concerning food waste prevention.

The approach of Cremona concerning food waste has been based on the involvement of the highest number of stakeholders. The voluntary nature of the food waste prevention instruments facilitates the creation of synergies among the various players of the food supply chain (farmers, businesses, associations, consumers, local bodies, etc.), which, in turn, allows public authorities to use collective actions to better address most of the issues linked to food waste (e.g., food poverty, the promotion of sustainable diets, food waste recovery; organic waste recycling to produce compost or renewable energy; and the conversion towards a diversified food economy).

With the support of various stakeholders, a virtuous territorial network of producers and distributors (small and large stores), restaurateurs and non-profit organizations has been created that is deploying various initiatives:

- the adoption of memorandums of understanding (MOUs) with the large scale retail trade for tracking food waste and unsold goods, and with non-profit associations for the distribution of the recovered food, for example „NO SPRECO" project agreement between the Municipality of Cremona and a non-profit association that undertakes to collect unsold food products and distribute them to needy subjects,
- the dissemination and support in the implementation of good practices for food catering in schools, with regards to the choice and preparation of food, and the management of food waste - the City has equipped the students from primary schools with a diary to write the good actions taken in the management of food products,
- the promotion of farmers' markets with local, organic, zero-kilometre products,
- the promotion of urban allotments in order to increase the amount of organic waste used for composting purposes,
- storage of the recovered products and goods in view of a subsequent redistribution (through web platforms, apps and other interactive tools),
- the dissemination of guidelines for a correct and sustainable organization of public events Decalogue for EcoFeste), with a focus on the following aspects: the use of public water, tableware in biodegradable material, proper separation of waste, the devolution of unsold food to non-profit organizations,
- encouragement of citizens to practice domestic composting,
- agreement between municipality and groups of citizens to implement the management of gardens that revitalize abandoned green areas.

All the previous tools have emerged from the active participation of the citizens from Cremona, both as producers, distributors and consumers, who, through constant consultation and cooperation, have helped to identify priorities, methods, and solutions to reduce the amount of food waste produced to limit environmental impact and combat social and economic inequalities.

The actions adopted or in the process of being adopted concern not only the food supply chain, but also the municipal administration, the operators of waste collection services, citizens, schools, NGOs, control bodies. The role of the actors involved is determined by the project to which they choose to participate and by the agreement signed with the municipal administration.

Resources:

- For more information, please consult the following link: www.comune.cremona.it
- http://www.regione.lombardia.it/wps/portal/istituzionale/HP/DettaglioRedazionale/servizi-e-informazioni/cittadini/Tutela-ambientale/Gestione-dei-rifiuti/reti-territoriali-virtuose-contro-spreco-alimentare/reti-territoriali-virtuose-contro-spreco-alimentare
- http://www.gazzettaufficiale.it/eli/id/2016/08/30/16G00179/sg
- http://www.camera.it/parlam/leggi/03155l.htm

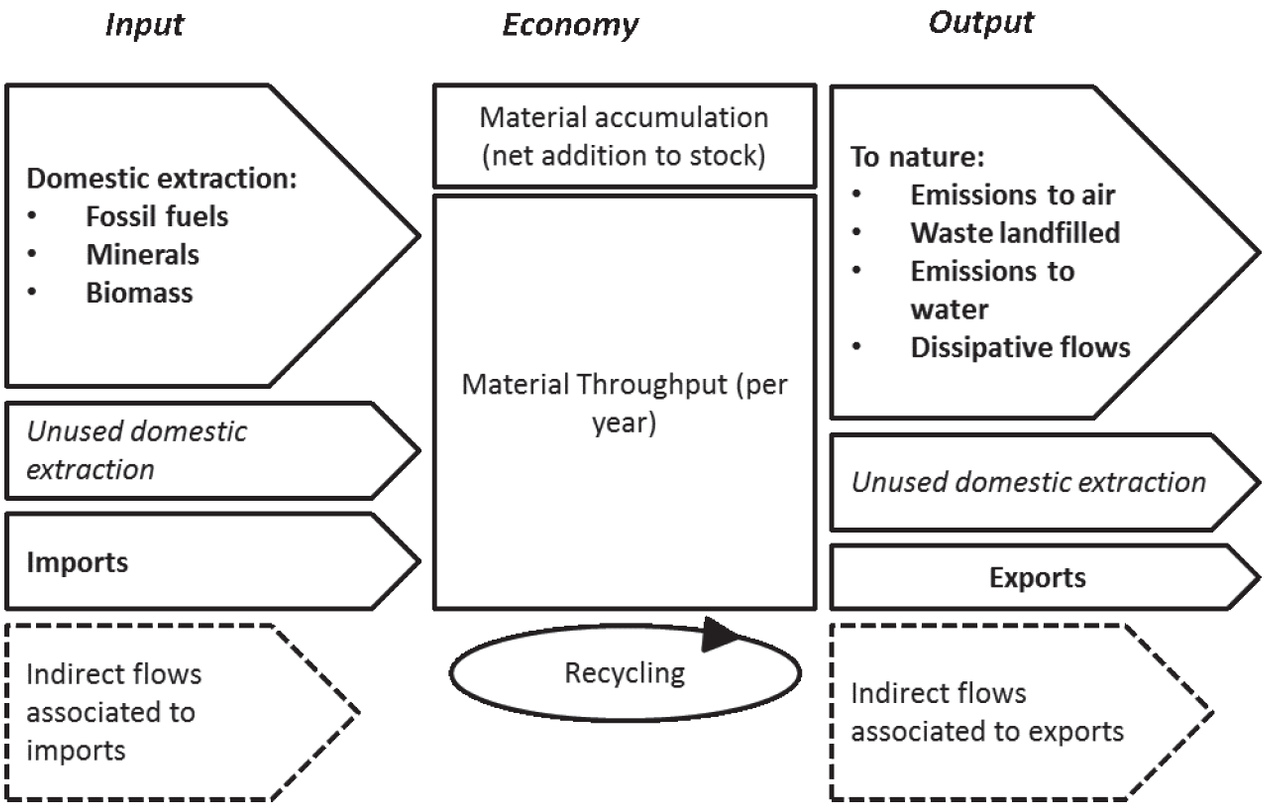
2.2.2 Urban metabolism analysis and accounts

If we want to describe a city in terms of its urban metabolism, we need to identify all the material and resource flows that enter and leave that city, in order to guarantee and sustain the capacities of the people to produce and consume the goods and services they need as well as to maintain the built environment. In general, raw materials, products and energy enter the urban system, while waste and emissions leave the system. All these elements can be broken down into further categories starting from basic questions: what kind of raw materials, what type of products and waste and so on. But most important at this stage is to understand the factors that determine the quantity and quality of these flows: socio-political aspects, architecture and planning elements, people's knowledge, available information and technologies, values, cultural and gender issues.

In principle, if a city aims to be more sustainable, it needs to reduce the quantity of material and energy flows and to improve their quality from an environmental point of view, i.e., to make them less harmful for human health and ecosystems. This approach provides an immediate orientation to waste prevention and management policies. Reducing at source the amount of material flows that enter the urban system is the first step for waste prevention: in fact, according to the first law of thermodynamics, what exists in a system can neither be created nor destroyed, but it may be transformed. On the other hand, managing waste streams means managing material flows that have entered the urban system in a way that they can hold them in the system as long as possible, because they are still useful (hence they can be matter to reuse, repair, recycle). As a result, the overall waste generation is reduced.

The driving forces listed above (socio-political aspects, planning, knowledge, etc.) will become drivers of the shift towards sustainability by influencing the material flows, hence the production and consumption activities that characterize the urban system. If we look at it from an economic perspective, this will imply shifting from a linear and highly material dependent system, to a more circular and less material and energy intensive one.

Urban metabolism accounts can accompany and drive the necessary changes by providing quantitative information and indicators on the materials that have to be reduced and managed over time. Material Flow Analysis or Accounting (MFA) principles and techniques do represent the starting point for the construction of relevant indicators, as they aim at representing economic systems (territorial or industrial/productive ones) from a material point of view.



The balance scheme of EW-MFA (Eurostat, 2001)

TO GO DEEPER

Read BOX 1 for further details on Material Flow Accounting (MFA)

At the EU level, the use of MFA has been standardized for the realization of Economy-wide material accounts (see Eurostat 2001, Economy-wide Material Flow Accounts and Derived Indicators-A Methodological Guide). Experiences of regional and urban MFAs have also been developed following these standards.

OTHER SOURCES

The website metabolismofcities.org contains a review of studies, initiatives and publications on urban metabolism across the world.

OFFICIAL SOURCES AND CASE STUDIES

Eurostat's Methodological Guide for EW-MFA is available here: https://ec.europa.eu/eurostat/web/environment/material-flows-and-resource-productivity

The 2013 compilation guide can be consulted here: https://ec.europa.eu/eurostat/documents/1798247/6191533/2013-EW-MFA-Guide-10Sep2013.pdf/54087dfb-1fb0-40f2-b1e4-64ed22ae3f4c

TESTIMONIAL ON CATALONIA MFA

Carme Saborit, Responsible for the Business and Employment Area, Sub-director of Production and Coordination Idescat (Statistical Institute of Catalonia): "The Statistical Institute of Catalonia is conducting a statistical project on the material flow accounts with the aim of facilitating a detailed description of the interactions between economy and environment, providing information on the sustainability of our economic model. This project is also justified by the need for data and indicators derived from the circular economy policies for which the material flow accounts is a fundamental pillar.

Material flow accounts show the physical inputs of materials which enter the economic system and the outputs generated in terms of physical units. These accounts enable us to obtain a set of aggregate indicators on the use of natural resources, from which productivity indicators can be derived.

The methodology used is an adaptation to the sub-state scope (NUTS 2) of the methodology defined by Eurostat for Member States (national economies), as there is no comparable standardized, harmonized and generalized methodology at a regional level. The main innovation with respect to the methodology defined by Eurostat consists in the inclusion of interregional trade, which constitutes a methodological challenge owing to the difficulty of comprehensively quantifying the inputs and outputs of materials without having a systematic register of physical exchanges.

The Regional Government's 2017 approval of the drawing up of the National Plan for the implementation of the 2030 Agenda for sustainable development and the National Pact for Industry, which has an axis devoted to sustainability and the circular economy, have helped to promote the project. The Statistical Institute of Catalonia is also part of the working group of the CITE[53] (Interterritorial Statistics Committee) on indicators of the 2030 Agenda for sustainable development, with the purpose of exchanging methodological experiences on the preparation of the SDGs and is promoting the integration of these results into an articulated information system, in cooperation with entities linked to the management of environmental and sustainability policies and establishing synergies with Eurecat in relation to the UrbanWINS project".

The analysis of urban metabolism of UrbanWINS pilot cities was carried out using the UMAn model (see section 2.2.3), which is based on the methodology defined by Eurostat, but attempts to downscale the analysis at urban level and to complement it with a more detailed analysis of the individual material flows so as to provide also information on the material composition of products and their lifespan.

BOX1- MFA

Purpose of MFA and relation to waste management

Material Flow Analysis or Material Flow Accounting (MFA) is an applied method that allows for a systemic view of interlinked processes and material flows. Those of particular interest are flows in the areas of environmental and chemical engineering. The scale of MFA is variable as it can stretch from a global to a regional perspective. MFA has been used in different fields starting as early as the 1860s, with a significant number of MFAs being performed starting in the 1990s. This is also when MFA-results on a national level were published.

Generally, MFA supports in giving an overview of the chosen material system (i.e. goods and/or substances) and its interaction with the surroundings, for example by showing

[53] CITE: collegiate body currently assigned to the Ministry of Economy, Industry and Competitiveness through the National Statistical Institute, whose main purpose is to enhance cooperation between the statistical services of the State and autonomous communities.

the effects of anthropogenic activities on the natural environment. Specifically, MFAs for waste management are carried out to help understand how metabolic processes are structured and function. The basic goal of an MFA is to show the turnover of mass in a given system in a defined time frame. This can also be seen as the establishment of a mass balance for a given system. This means that all input flows into the system and the changes of stocks within the system need to be balanced by all outputs from the system. Thus, data for stocks are given in the basic unit kilograms or tons. The time frame is variable, but for static systems typically one year. In case of dynamic systems that allows following time-trends, the time frame can be much longer. Consequently, in both cases data for flows are given in kilograms or tons per year then.

There are methodological standards available to harmonize the way MFAs are performed (e.g. by EUROSTAT and the OECD). MFA became an official part of the reporting of environmental statistics, e.g. in the EU and Japan. On the product level, an MFA-based approach was developed that is called “MIPS” (Material Input per Service unit). It aims to show material input along the whole life-cycle of a product in order to produce the good at hand. This amount of material is also called the “ecological rucksack”. It quantifies the total amount of material “moved” except for the weight of the very product itself (i.e. the tax weight).

Objectives of MFA

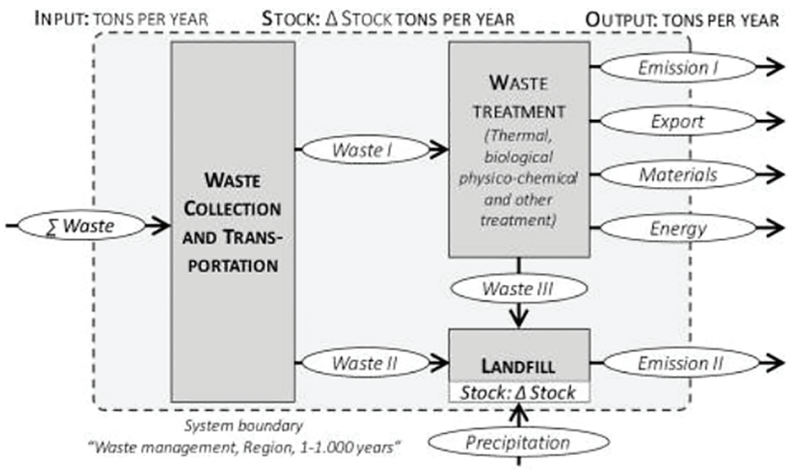
MFA-studies allow a “bird’s eye view” of industrial processes. Hence, they support decision-making processes with respect to strategic questions and priority-orientation.

In addition, MFA allows to check and improve the effectiveness of measures taken and to design more effective strategies for material management.

Regarding waste management, an MFA can support the design of waste management systems and decision-making processes in this particular field. MFA-results can be “translated” into monetary values of considered goods and can help to assess different risks associated with industrial processes.

Scope

An MFA-system “is the actual object of investigation. It connects flows and stocks of materials […] by processes, and is limited by system boundaries defined in space and time” (figure 2; Allesch, 2017). It is delineated by a system boundary to be defined by the analyst. There are inputs into the system, changes of stocks and outputs from the system. In addition, within the system boundary, materials like goods and substances are processed (e.g. transformed, stored and transported). There are material flows between different stocks. Sometimes, not all materials go the same way, so transfer coefficients are useful in describing the partitioning of materials in a given process.



Simple generalised scheme of a Material Flow Analysis in the sector of waste management (Allesch, 2017)

Especially regarding the application in waste management, Allesch (2017) states that "The mass-balance based approach provides a well-founded, reproducible and transparent database for evaluating waste management systems. The choice of thematic and spatial boundaries of the investigated system is crucial for impartial assessment, and for interpreting the data and results generating transparent information for stakeholders and the public."

Early on, a choice has to be made regarding the materials of investigation: "goods" only or "substances" only or "goods and substances" simultaneously. Employing the perspective "goods" facilitates the understanding of how waste management functions as a whole (i.e. looking at processes and connections between them). Also, "goods" can easily allow the consideration of economic aspects, i.e. their monetary value. They thus help to analyze and manage flows in the whole waste hierarchy, e.g. refurbished and recycled products as well as residues.

Taking on the perspective "substances" allows concentrating on the quality of material flows (e.g. resources, solid wastes, gaseous and liquid emissions). This way, valuable, unwanted and even hazardous substances can be evaluated with regard to transformation, storage and transport. In the field of waste management, these terms translate into sources, pathways, intermediate and final sinks. This approach permits to assess resource potentials and reveal risks for our environment and also human health. This type of MFA is also called SFA, short for "substance flow analysis".

For the most comprehensive perspective on a given waste management system, not only a broad range of flows is taken into account: e.g. collection, transport, treatment/ recycling/landfilling and emissions. Also, the individual levels of goods and substances are not just assessed separately, but both levels are (intricately) interlinked with each other. This way, goal-oriented waste management can optimally be supported.

Relationship with urban metabolism

MFAs in theory are flexible regarding the "size of the circumference" of their system boundaries as stated before (typically regional to global size). Hence, the system boundary can well be established to be the city limits of an urban centre of interest.

However, in order to successfully carry out an MFA, data availability needs to be considered as well. Naturally, the scientific group itself could make data measurements. They could also be collected by literature reviews or expert interviews. Yet, a lot of data are taken from statistical databases made available by statistical offices, e.g. EUROSTAT. Data typically are gathered with respect to statistically officially defined regions. Hence, regarding a geographical delineation of a city to be analysed, the so-called "NUTS" system should be considered. NUTS is short for "Nomenclature des unités territoriales statistiques" - Nomenclature of territorial units for statistics. There are three levels with NUTS-1 being the largest, NUTS-2 medium sized and NUTS-3 the smallest. For larger cities, NUTS-2 or NUTS-3 qualify as applicable regions. For smaller cities NUTS-3 and even smaller-scale regions need to be considered.

Regarding the focus on a good or substance of interest, a variety of data sources can be considered. One nomenclature was of particular interest for data gathering within the UrbanWINS-project. It is standardised by the UN and called "NST", short for "classification system for transport statistics".

Literature

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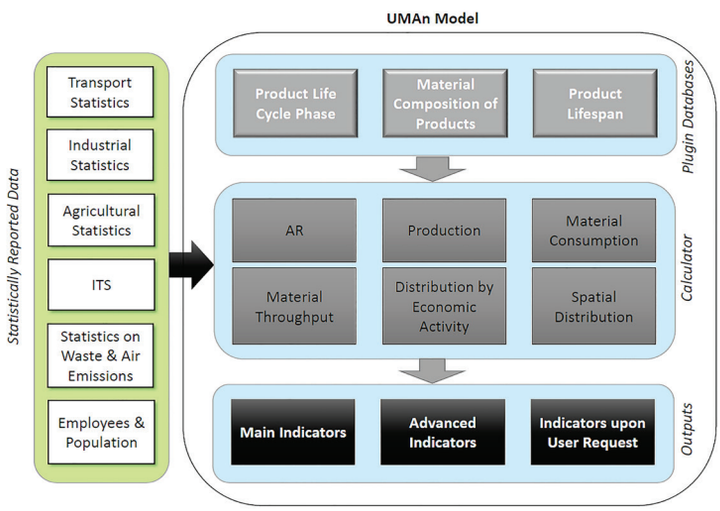
2.2.3 UMAn model

The tool

The UMAn – Urban Metabolism Analyst - model is a tool that can quantify the flows of urban materials to characterize the urban environment. The information on the origin and destination of flows within urban limits can be obtained in an efficient way through material flow accounting (MFA) as the underlying method (see BOX 1). The UMAn tool has four main components that process available data to produce a detailed map of material resources and performance for different economic activities.



In fact, the results of the UMAn model allow to:

- understand the balance of the flows that enter and leave the city.
- obtain an overview of consumption patterns and highlight the most important category of products consumed in cities in terms of origin and destination;
- understand the material needs of cities and the dependence on raw materials.

Technically speaking, UMAn takes into account different aspects that appear in the flows of materials at urban level, such as:
- movement of matter (export and import),
- extraction and production of materials and goods,
- the consumption of cities,
- the remaining stocks,
- emissions to nature.

TO GO DEEPER

See UrbanWINS Deliverable 2.1 Model Architecture available at: https://www.urbanwins.eu/wp-content/uploads/2019/02/D2.1-report.pdf

The results of the UMAn model help decision-makers and other stakeholders to associate the flows of materials with economic activities and their spatial location within the urban area, including identifying the materials extracted locally and transformed by the local industry and their destination. Moreover, the possibility to have a specific focus on „products and materials consumed by households" allows having insights on „lifestyles" and tendencies of citizens in terms of use of products and services. Annual obsolescence projections of material or products consumed by cities can be made. The dynamics of future waste streams in cities can thus be analysed and policies can be planned accordingly, both by looking at waste prevention opportunities and in terms of waste collection and recycling needs for specific material categories (plastic, paper, glass, metals, composites, etc.).

As it is the case of most accounting tools, the quality and reliability of final results are highly dependent on the availability of primary data that are used as inputs to run the model. The UMAn model is particularly suited to conduct urban metabolism studies within the European Union (EU) because it relies on Eurostat standard statistical data for products. However, there are some challenges related to the collection and processing of data for the quantification of urban metabolism indicators that cannot be disregarded and that should be taken into consideration for future improvements and possible attempts of standardization. Criticalities are mainly related to:

1. Data sources useful for the application of the analysis model, in particular:
    a. territorial and sectoral data disaggregation;
    b. data privacy issues;
    c. consistency between metadata of the sources available for different EU countries, in order to ensure comparability in the interpretation of results.

2. Definition of the spatial entity which the analysis has to be applied to, in particular:
    a. outlining of the territory and relative population (inhabitants and enterprises) of reference;
    b. harmonizing urban metabolism analyses with those applied to higher territorial levels (regional or national), already implemented using metrics developed on the basis of international regulations (in particular Regulation 691/2011 on European Environmental-Economic Accounts, Regional Accounts)[54].

TO GO DEEPER

Read BOX 2 Challenges in quantifying urban metabolism indicators containing the indications of the UrbanWINS team of the National Italian Statistics Institute (ISTAT)

[54] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:02011R0691-20140616&from=EN

BOX 2: Challenges in quantifying urban metabolism indicators

Data sources useful for the application of the analysis model

One of the most onerous activities to implement for the measurement of urban metabolism is the collection of the dataset necessary for the urban metabolism analysis . This is generally based on:
- review of available statistical sources (NSIs - National Statistical Institutes and local archives) and
- computation/estimation of those indicators which are not immediately available (at territorial level and/or interest sector) starting from micro-data and/or integration of the existing statistical sources.

The step, which regards the inventory of the necessary data and of the sources from which they come from, should be very thorough so as to avoid approximation (not consistent proxy indicators) that can introduce high margins of error in the methodology of computation. On this last point two types of problems arise linked to the methodological warnings which refer to the building up of coherent measurements starting from non-homogeneous sources for the different territorial contexts and to the selection of estimation methodologies which can be applied to local territorial areas (small areas). Ideally, the analysis of Urban metabolism requires data on Input, Throughput and Output of materials that apply exactly to the specific spatial or functional entity defined as „urban unit" on which the analysis focuses. Moreover, the data sources should provide the analyst with details on the kind of materials crossing the borders of the entity. As data sources at the urban level are quite scarce, it is necessary to make reference to data available for higher levels of aggregation and to appropriate downscale the observed flows (top-down approach), i.e. to use modelling exercises aimed at overcoming the lack of data that are fit for the purpose of urban metabolism „ex-ante" analysis. Available data, in fact, are more likely to be found for larger spatial units containing the considered urban entity. Moreover, to add a new challenge, the smallest spatial unit for which data are available is often different for different kinds of flows (e.g. different materials, or transport modalities).

Considering the restrictions above, a second approach to take into account to make data for urban areas (or for parts of them) available is of small area estimates, using surveys enhanced with administrative auxiliary data, such as data from administrative registers. Also with respect to this approach, statistical literature suggests a series of instruments and procedures to implement estimation models. This is not the place to look technically more deeply into the methodological construct but, in any case, it is important to draw the attention on the possibility to approach the issue about data availability at local levels that are coherent with those already available at aggregate level (NUTS2 or higher), just changing the perspective. The objective to stick to is applying a bottom-up process,

[55] The content of the dataset results from the conceptual framework and from the selected model to be applied for the measurement of the urban metabolism. To have a deeper overview of these factors it is suggested to see Deliverable D2.1 Model architecture and D2.2 Urban Metabolism guide.

selecting proxy measurements available or estimable directly at the local level and that can be aggregated only at a later stage to rebuild larger area datasets.

By applying both of these approaches in the downscaling/modelling of the data, it is important to pay attention to:

- the functional relationship between the different kinds of flows, so as to avoid possible double-counting. The issue derives from capturing twice the same stream of materials, as it crosses borders at different geographical levels and at different levels of transformation of the matter. This danger is avoided altogether only by referring to a (complete) dataset related at an univocal geographical level;
- the opportunity of the data resulting from small area estimations as well as the integration of administrative data at local levels. Both data sources could be aggregated again in a coherent way with the dataset already available or in an advanced phase of definition at higher territorial levels, reckoned through metrics developed according to international regulations (Regulation No 691/2011 on European Environmental-Economic Accounts, Regional Accounts)[56]. This level, for Italy, can currently be identified as the NUTS2 level and, only partially for NUTS3 level. All partners from UrbanWINS project reported problems in the complete retrieval of data for the NUTS3 level.

Specific challenges in relation to the need to comply with the rules on data confidentiality (Privacy issues)

One of the challenges in quantifying urban metabolism indicators in cities relates to data privacy issues that may arise with respect to the data required to feed the various tools used in the design of urban waste policies. The implementation of tools and methodologies for waste prevention and management policies may generate data protection issues that can be classified according to the following two frameworks:
-the general personal data protection framework which applies every time information about individual persons is collected no matter for what purpose,
- the specific framework for the protection of data collected for statistical purposes.

The general data protection framework applies to personal data collected for all kinds of purposes: administrative, commercial, statistical or any other. The principal EU legal instrument on data protection is the New General Data Protection Regulation No 2016/679 that entered into force on 24 May 2016 and applies since 25 May 2018 in all European countries, repealing Directive 95/46/EC (General Data Protection Regulation)[57]. The General Data Protection Regulation strengthens the rights of data subjects and obligations of data controllers (data controllers: the organizations that collect and process the data), regulating the protection of natural persons with regard to the processing of personal data and on the free movement of such data. Thus, according to this regulation, data protection aspects (data security, data traceability, data access) should be an essential element of the design of any data collection, stating that personal data must be processed in accordance with certain principles and conditions that aim to limit the impact on the

[56] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02011R0691-20140616&from=EN
[57] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1532348683434&uri=CELEX:02016R0679-20160504

persons concerned and ensure data quality and confidentiality.

Concerning the protection of data collected for statistical purposes, statistical confidentiality is a fundamental principle of official statistics as stated by the EU Regulation 223/2009 on European statistics[58]. The Regulation defines confidential data as „…data which allow statistical units to be identified, either directly or indirectly[59] thereby disclosing individual information". Statistical confidentiality means that data on individual persons (or business entities) may be used only for statistical purposes and that rules and measures shall be applied to prevent the disclosure of information concerning an individual person or business entity. It defines principles, concepts and procedures that keep data confidential while still permitting its use for statistical purposes. Individual data collected by statistical offices for statistical compilation, whether they refer to natural or legal persons, has to be strictly confidential and used exclusively for statistical purposes. Statistical confidentiality is ensured through:

- physical protection - the data is securely stored and not accessible to anyone without explicit authorization;
- statistical disclosure control (SDC) – it includes methods for reducing the risk that statistical units are identified when the statistical data is being published, including tabular data protection – for aggregated information on respondents presented in tables – and micro-data protection – for information on statistical units.

At the EU level, access to confidential data (micro-data) for scientific purposes is the only exception to the rule that confidential data can only be used to produce European statistics. Several statistical agencies provide access to their micro-data (e.g. for scientific purposes), and there are different modes of access, such as the release of anonymised micro-data files, onsite access (safe centres), remote access systems, remote program execution and remote analysis servers.

For the purpose of the UMAn model that has been tested in UrbanWINS and in general for the use of other urban metabolism tools, the need for statistical data at a deeper level of spatial and product disaggregation that allow relevant information for waste management decision-making modelling may imply the request for micro-data whose access is restricted to protect the anonymity of individual persons or businesses. The analysis may also involve collecting or processing personal data or may involve further processing of previously collected personal data ("secondary use"). Thus, in implementing various urban metabolism analyses, decision-makers and other stakeholders have to take measures to ensure compliance with the confidentiality requirements and personal data protection stated by the EU legislation.

[58] The Regulation (EC) No. 223/2009 on European statistics (European Statistics Regulation) contains essential rules for data protection in official statistics and may, therefore, also be considered relevant for provisions on official statistics at the national level. Within this legal framework are also included the Eurostat's Code of Practice the Commission Regulation (EU) No 557/2013 of 17 June 2013 implementing Regulation (EC) No 223/2009 of the European Parliament and of the Council on European Statistics as regards access to confidential data for scientific purposes. Finally, statistical confidentiality, and protection of respondents' privacy, is included in the Fundamental Principles of Official Statistics, which were endorsed by the United Nations General Assembly in 2014.

[59] Direct identification means identification of the respondent (statistical unit) by their formal identifiers (name, address, identification number); indirect identification means inferring a respondent's identity by a combination of variables or characteristics (e.g. age, gender, education etc.).

Within UrbanWINS project experience, the application of the UMAn model to quantify the urban metabolism of the 8 pilot cities has been done by gathering datasets relevant to waste management and urban metabolism, followed by modelling of national/regional data at the city/regional level and complemented with data at the urban level. For this purpose, a manual for data gathering was disseminated to the partners in the 8 pilot cities in order to undertake the data gathering activities. In particular, the manual for data collection contains the description of the 23 main datasets that are needed to perform an urban Material Flow Analysis – MFA - for each city. Concerning the Italian cities - Cremona, Torino, Albano Laziale and Pomezia - ISTAT, as National Statistical Office and partner in UrbanWINS, was involved in the data gathering process and was able to provide 60% of the necessary data, at the regional level (NUTS 2). However, some items of the Italian industrial production dataset couldn't be made available due to some privacy issues. The lack of these data has reduced the precision of the model in estimating material flows. Several approaches have been made to identify proxy data that could replace the data with a low level of disaggregation but further work needs to be conducted to understand the feasibility of applying the MFA model.

The Italian experience with respect to the use and transfer of data relevant to waste management and urban metabolism, as well as the experiences incurred by other partners in the project countries, highlight the need to pay attention to the European legislation on privacy requirements and data confidentiality that decision-makers and other stakeholders have to take into account when the tools are going to be used in building strategies for waste prevention and management.

Definition of the spatial entity to whom the analysis has to be applied to

In order to lead to a delineation of datasets that are robust and consistent with the territorial area where the urban metabolism analysis could be applied, it is necessary first of all to define the physical space of the analysis. At micro level, and at city level in particular, the qualification and definition of a control area are relevant for a correct computation of flows and their spatial comparability. This is a functional prerequisite in order not only to assure a common basis of interpreting the different phenomena to be considered, in terms of in/out flows and transformations within the territorial unit of the analysis, but also to allow a comparison between different fields: cities, metropolitan areas and regions etc. subject to urban metabolism analysis and comparisons.

The correct definition of the urban space enables to prevent any distortion due to the use of non-coherent denominators, spatial (measures per unit area) and per reference populations (measures per capita, per employees, per enterprises) to be adopted in the standardization of the metabolism indicators. This last aspect refers both to the case in which they are calculated from the different thematic fields referring to the same urban area, and to the case they refer to a single subject, which anyway has to be analyzed in a compared way for more urban areas. On this last point some challenges deserve to be highlighted:

a) Using administrative subdivisions in order to identify urban areas is a double-edged solution. In fact, if, on one hand, this method has the advantage to use areas for which a political level of governance exists, on the other hand it doesn't ensure that the spatial boundaries of the analyses correspond with those necessary for the measurement of the urban metabolism: the boundaries of the administrative city could present an extension larger than the real portion of "urban" territory or, vice versa, the urban area (functional and/or morphological one) could overpass the bounds of the administrative area, thus not enabling the application of a comprehensive analysis of the urban metabolism components;
b) Another factor to be considered, which comes directly from the first, is that for the subsequent application of sustainable government policies for urban metabolism, the political-administrative level of the territorial governance could not be in itself the optimal one compared to that of the authority of the functional area. This relates, for example, to those areas identified in order to optimize the provision of services, as far as distribution networks are concerned, from which it is possible to derive monitoring data on energy or water consumption, or those areas of government built up to manage outputs such as waste or the depuration of urban waste-water;
c) At last, the selection of areas which are exclusively administrative, because of their high level of heterogeneity as for surface, risks not to make applicable the comparison between the measures of urban metabolism applied at the same administrative level also within the same country, and, even more, among different EU countries.

Eurostat and OECD suggested a methodology (although not yet fully harmonized) for territorial classification and the definition of those with a high level of urbanization. At the moment, the methodology proposed by OECD[60] is the one that better combines the needs to objectively identify (by the application of metrics based on density per territorial unit of 1 km^2) those areas densely urbanized through the definition of control areas defined as high density clusters from which then it is possible to delimit an urban core and a commuting area. Even though the suggested steps to apply the methodology still demonstrate some critical points, it seems the best at this day in order to define the urban areas to which the measures of urban metabolism could be applied, however considering the above-mentioned challenges.

Implementation and outcomes of the UMAn model in UrbanWINS

The UMAn model was tested in UrbanWINS with the following results:
- Guidance and indications on data collection for implementing the model were provided for all 8 pilot cities;
- Urban metabolism accounts were provided for 7 cities: Leiria, Manresa, Sabadell, Torino, Cremona, Pomezia, Albano Laziale;
- Information and indicators provided for the 7 cities were used to develop the Roadmaps.

[60] http://www.oecd.org/cfe/regional-policy/Definition-of-Functional-Urban-Areas-for-the-OECD-metropolitan-database.pdf

POINTS OF ATTENTION

The model could not be run for the city of Bucharest due to the lack of necessary data.

The implementation of the model for Leiria was more straightforward and includes less uncertainty in the results than that for the Spanish and especially Italian cities due to completeness of datasets.

Full material flow model for Leiria (Portugal) is available for year 2013

Full material flow model for Manresa and Sabadell (Spain) is available for year 2008

For Cremona, Torino, Albano Laziale and Pomezia (Italy) is available for year 2013.

All results are collected in UrbanWINS Deliverable 2.3 to be consulted at: https://www.urbanwins.eu/deliverables/

The process that led to the implementation of the model was made of the following steps:
- elaboration of guidance for data collection by Chalmers University (developer and owner of the UMAn Model);
- data gathering by partners in each country, which included the compilation of multiple datasets gathered by different institutions and across multiple scales (country, region, city);
- additional data gathering, data processing and elaboration by Chalmers University, which included estimations for downscaling data to the urban level;
- model verification and fine-tuning by Chalmers University.
- model running and calculation of material balances and indicators by Chalmers University.

Basically, the information that the 7 UrbanWINS pilot cities have at disposal at the end of the process is the following:

- An overview of the patterns of consumption in the city, which enables to highlight the most important category of products consumed and to verify the correspondence of established political priorities and stakeholders' choices with the urgencies set by actual and foreseen material consumption patterns;

- A benchmark of different cities that can be used for discussions between the stakeholders in the 7 cities and others to understand their strengths and weaknesses;

- Accounting results by product groups, flows disaggregated by specific product/s and sub-products and economic activity/origin of the sector, which can be used to identify and support interventions to address resource use and management in specific sectors hence also to address circular economy opportunities;

ADDITIONAL TOOLS

The datasets built to run the UMAn model for the pilot cities have also been organized in an online database that allows exploring and visualizing the results of urban MFA accounts. The database is available at: https://www.urbanwins.eu/database/

As previously mentioned, the above information was used to develop a Roadmap for each city that analyses the main outcomes of the UMAn model, in terms of material flows occurring at urban level, with the aim to promote and support the administration in planning a sustainable long-term strategy that considers: the needs of the city, the expectations of the stakeholders, the potential effects on urban metabolism reshaping.

TO GO DEEPER

See UrbanWINS deliverable D2.2 Urban Metabolism guide at: https://www.urbanwins.eu/deliverables/

If the results of the model had been available earlier in the project, they could have been used also to inform the elaboration of the Strategic Frameworks.

TO GO DEEPER

See UrbanWINS deliverable D4.1 Methodological guidelines for the construction of Strategic Planning frameworks based on urban metabolism approach at: https://www.urbanwins.eu/wp-content/uploads/2018/06/Urban_Wins_D4.1-Methodological-guidelines-for-the-construction-of-Strategic-Planning-frameworks-v10.rev07.pdf

In fact, the Methodological guidelines for the construction of Strategic Planning frameworks based on urban metabolism approach do provide guidance to cities on how to include the results of an urban metabolism analysis in the planning process. This aspect shall be taken into account by cities that may decide to replicate some or all of the steps undertaken by UrbanWINS pilot cities.

TO SEE HOW THE UMAn MODEL RESULTS WERE USED FOR INFORMING WASTE PREVENTION AND MANAGEMENT POLICIES

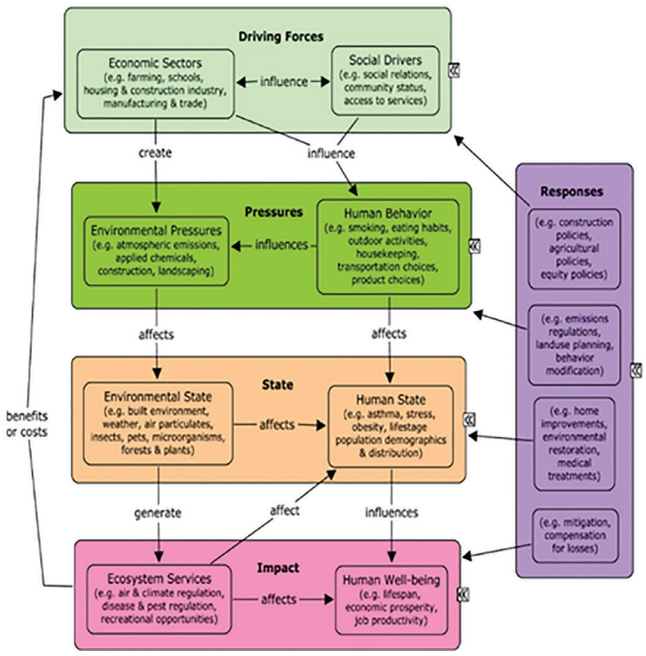
See UrbanWINS city ROADMAPS at https://www.urbanwins.eu/deliverables/

2.3 DPSIR, indicators set and LCA applications

In order to provide decision makers and other stakeholders with a complete set of information to orientate their policies, the construction of urban metabolism accounts was extended and completed with the adoption of other tools able to support the analysis of urban metabolism both from a conceptual and a quantitative point of view.

2.3.1 The DPSIR Model

The Driving Forces-Pressures-State-Impact-Response (DPSIR) model was used for a preliminary understanding and investigation of the causal relationships between different factors (economic, social and environmental ones) that shape the urban metabolism of a city and influence the design of waste prevention and management strategies. The model is widely used at global and European level to analyse the interactions between human activities and the surrounding environment and to develop and classify relevant socio-economic and environmental indicators.



The DPSIR Model

The Driving Forces enclose all those factors that motivate human activity and fulfil basic human needs i.e. create the necessary material and non-material conditions that enable a satisfactory life, accompanied by sound health, worthy social relations, security, and freedom.

Pressures come as a direct effect of production and consumption activities and choices, which induce changes in the State of the natural and built environment and affect also human state and health.

Changes in state generate an Impact on the quality and functioning of the ecosystems and on human well-being, meaning they can cause environmental and/or economic damages. Responses are the initiatives put in place to address specific factors along the causal chain.

The adoption of the model in UrbanWINS, specifically for the Waste Management case (DPSIR-W), was the result of a collaborative learning process, which aimed to:

1) help partners to better connect and shape the different components of UrbanWINS, i.e.
- urban metabolism
- strategic planning
- waste prevention and management

2)help end-users (i.e. urban policy makers, technicians, stakeholders) in placing their actions in a wider framework and in taking into account the different variables/factors that affect those actions and on which the latter can have an impact (causal relations).

3)guide the collection of additional information needed to analyse current waste prevention and management strategies

Project technical partners and representatives of the pilot cities identified the specific factors to be classified under the 5 categories of the model illustrated in the figure above. The information was then used to build interviews with relevant stakeholders involved in the design and implementation of waste management strategies with the scope to answer some guiding questions:
1. What variables/factors determine the current features of urban activities and the related production of waste?
2. On which factors can urban policies intervene?
3. Which factors must be taken into account when a strategy is designed for it to be effective?
4. How can the environmental, social and economic effects of different strategies be evaluated?
5. How do organizations measure the level of success of the strategies they have implemented?

The model was also used for supporting stakeholders in the definition of action proposals in the phase of strategic planning, as further described in the relevant sections of this toolkit.

TO GO DEEPER

Read BOX 3 for further details on the use of DPSIR-W

2.3.2 The indicators set

A set of indicators on waste prevention and management systems and strategies has been developed to strengthen the UrbanWINS approach, especially to ensure that the decision making process is supported by both qualitative and quantitative information. The selection and application of indicators is framed within a circular economy perspective, i.e., instead of focusing or being limited to the assessment of waste management, it considers a wider scope including sustainable consumption and production aspects (e.g., from material extraction to the environmental impacts associated with consumption). The wider scope provides insight on resource use and efficiency, contributing to a more comprehensive assessment of the potential impacts and benefits of strategies and policies for waste prevention and management.

The selection is focused on indicators that are suitable for urban areas (municipalities), which provide means to:
- assess performance and monitor progress over time;
- measure the effectiveness of strategic planning (e.g., providing insight on the efficiency of implemented strategies and policies);
- support decision-making (e.g., helping on the identification of priorities and targets for developing strategies and policies); and
- compare to other urban areas (e.g., benchmark).

The indicators are based on a wide number of sources, including literature on waste prevention and management, resource use, circular economy and urban metabolism. For example, the set includes indicators from the UMAn model and from the EU Resource Efficiency Scoreboard. All indicators are described in detail and guidance on their application is provided, including the classification according to the DPSIR framework previously described (they can be used to measure and assess aspects that can either represent a cause (positive or negative) or an effect (positive or negative) of a human interference with the environment).

A total of 60 indicators were selected and organized in two thematic groups: a more objective and narrow scope of waste indicators, and a group of more general indicators within a circular economy perspective (focused on resource use and environmental impacts). Within the set of indicators, presented below, 10 (highlighted in blue) are presented as dashboard indicators and 50 are complementary indicators. Dashboard indicators are a set of key indicators that should be calculated to have an overview/overall perspective of the urban area performance, to monitor progress over time and to compare with other urban

areas (benchmark). Complementary indicators should be selected according to the specific needs and purposes of decision-makers, in their analyses.

To ease the selection of indicators according to the specific scope and purposes of analysis and decision-making, an application matrix classifying/mapping indicators is also available, where the information is placed according to:
- the waste prevention and management phases they can be associated with;
- the possibility of subdividing into or looking at specific economic sectors; and
- the possibility of disaggregating into or looking at specific waste material categories or streams.

Lastly, to illustrate the application of this set, the 10 dashboard indicators were calculated for three pilot cities: Leiria, Sabadell and Manresa (Figure 5 below).

Waste indicators	Circular economy indicators
1. Available landfill lifespan (years) **2. Bring points coverage (no. bring points/100 000 p)** 3. Collected waste (t) **4. Composition of collected waste (%)** 5. Controlled treatment or disposal (%) 6. Cost of waste collection (EUR/t) 7. Cost of waste disposal (EUR/t) 8. Cost of waste treatment (EUR/t) **9. Food waste (kg/capita)** **10. Generation of waste (kg/capita)** 11. Generation of waste (t) 12. Hazardous substance presence (%) 13. Hazardous waste generation (t) 14. Landfill rate of waste (%) 15. Material capture rate (%) 16. Material collection (kg) 17. Material recovery (t) 18. Municipal solid waste generation (kg) 19. Residual waste share (%) 20. Social participation in waste separation (%) 21. Social perception on waste management (%) 22. Uncollected waste (t) 23. Value of waste recycled (EUR) 24. Waste collection coverage (%) 25. Waste collection efficiency (%) 26. Waste concentration (t/ha) 27. Waste disposal (t) 28. Waste intensive consumption (kg/EUR) **29. Waste intensive economy (kg/EUR)** **30. Waste management hierarchy (%)** 31. Waste management operations cost (EUR/t) 32. Waste minimization (%) 33. Waste recovery rate (%) 34. Waste recycling rate (%) 35. Wastewaters collection coverage (%)	36. Covered land area (km^2) 37. Crossing flows (t) 38. Dependency on other systems (%) 39. Depletion contribution (%) 40. Direct material input (t) 41. Domestic extraction (t) **42. Domestic material consumption (t)** 43. Domestic processed output (t) 44. Energy productivity (EUR/kgoe) 45. Expenditure on products repair (EUR/cap) 46. Exports (t) **47. Greenhouse gas emissions (kg CO_2 eq)** 48. Imports (t) 49. Index of common bird species (n/a) 50. Industrial production (t) 51. Material needs characteristics (%) **52. Material productivity (EUR/t)** 53. Net additions to stock (t) 54. Non-renewable energy in final energy consumption (%) 55. Physical trade balance (t) 56. Renewable energy in final energy consumption (%) 57. Self-sufficiency (t) **58. UM efficiency (%)** 59. Water exploitation index (%) 60. Water productivity (EUR/m^3)

TO GO DEEPER

The list of indicators together with the guidance for use can be downloaded from this link

2.3.3 Life Cycle Assessment (LCA)

As described in the relevant section, the UMAn model provides detailed product-level data on urban flows. Life-cycle assessment (LCA) was combined with the UMAn model outputs to estimate environmental impact associated with consumption and the approach was applied to Leiria. The approach consists of essentially three steps:
- analysis of the UMAn model results and selection of representative products for which LCA is performed;
- selection of relevant life-cycle inventories in databases and literature and identification of critical processes for which local or national context should be modelled (e.g., electricity mix, transportation requirements);
- quantification of potential environmental impacts associated with the inventories (life-cycle impact assessment) and of the overall urban consumption.

In addition, LCA was applied to assess the impacts of a selected set of pilot actions (see Box 6 bellow).

Life Cycle Assessment (LCA) is an internationally standardized methodology (ISO 14040[61] and 14044[62]), which quantifies the potential environmental impacts associated with products and services. LCA allows the identification of environmental benefits and impacts, the trade-offs and opportunities for improvement, taking into account the entire life-cycle of a product, process or service, from “cradle” to “grave” (or “cradle to cradle” in the case of circular systems). LCA considers the requirements and potential environmental impacts associated with all stages of a product’s life-cycle: from raw material acquisition, through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling.

According to the ISO 14040 and ISO 14044 standards, an LCA has to follow an LCA for a product typically consists of an LCA for a product typically consists of four iterative steps:
(1) definition of scope and goal,
(2) life cycle inventory (LCI),
(3) life cycle impact assessment (LCIA) and
(4) interpretation of results.

[61] ISO 14040:2006 - https://www.iso.org/standard/37456.html
[62] ISO 14044:2006 - https://www.iso.org/standard/38498.html

Important to note is that an LCA does not have "readily defined system boundaries" (Haberl, 2016). Instead, when defining the scope and goal of the analysis, the researcher decides what processes are to be included in or excluded from the assessment. The processes with a significant impact on the overall result need to be included, those with a marginal effect can be excluded. Commonly used impact categories in LCA include ((Haberl, 2016):

- Global Warming Potential (GWP)
- Acidification
- Eutrophication
- Photochemical Oxidant Formation
- Aquatic/Terrestrial Eco-toxicity
- Human Toxicity
- Energy Use
- Abiotic Resource Use
- Biotic Resource Use
- Ozone Depletion
- Land Use

Regarding urban metabolism, MFA-based approaches provide data on flows that go through defined boundaries of an urban area, which have resource requirements and environmental impacts that can occur inside or outside of the urban area (Pincetl et al., 2012). There is a need for methods and frameworks of urban metabolism to go beyond resource flows to the overall resource requirements and environmental impacts associated with urban metabolism, and several studies have recommended the application of LCA in this context, to account for direct and indirect impacts associated with urban consumption, from the local, to regional and global levels (Ramaswami et al., 2008; Minx et al., 2011; Chester et al., 2012; Pincetl et al., 2012; Goldstein et al., 2013; Beloin-Saint-Pierre et al., 2017). By combining MFA and LCA, urban metabolism studies can provide a better understanding of the physical flows and infrastructure that characterize urban systems, as well as their environmental and health impacts, which is crucial to support decision-making (Chester et al., 2012; Pincetl et al., 2012).

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TO GO DEEPER

Read BOX 4 for an overview of the LCA study conducted for LEIRIA. Read BOX 5 for an overview of the results of LCA applications to pilot actions

From the perspective of waste prevention and management strategies that aim at improving sustainability and circularity of urban systems, Municipal solid waste (MSW) should be seen as a resource for future products. However, oftentimes there is not one clear "best solution" for all stakeholders due to the multitude of their expectations, numerous technological alternatives for treatment processes and interactions between them. In a circular economy, interactions can even go beyond the waste treatment sector and incorporate areas such as agriculture, energy conversion and product manufacturing.

The complexity of all these considerations requires "a comprehensive, systemic, goal-oriented approach based on in-depth knowledge of the system behaviour and able to provide reliable information about how environmental hazards can be minimized and potential resources maximized" (Arena, 2014).

Some of the required in-depth knowledge can be gained from LCAs for different defined steps in the waste management system under consideration. LCAs provide an adequate instrument for environmental decision support helping to analyze and understand different options for the same steps. An LCA can be performed for waste management systems in two ways. There are either specific waste-LCA-tools or standard product-LCA-tools. However, virtually the same generic LCA-methodology can be used in either case.

The selected LCA-tool serves to model the environmental performance of a given waste management system, by providing detailed information on the following aspects:
- Emissions related to the elemental composition of the waste.
- Environmental performance for the management of a variable fractional waste composition.
- Emissions dependent on the operating performance of a waste treatment process.
- Emission offsets with other systems.
- Flexible system boundaries.
- Determination of life cycle inventory (LCI) of an integrated waste management system'. (partly modified according to Gentil, 2010).

When looking at different (technological) alternatives for a desired waste management system, LCA-models are frequently used for comparison. LCAs are typically designed and performed by experts, i.e. professionals or business organizations, researchers from universities or from R&D departments of companies.

WEB REFERENCES AND LITERATURE

European Platform on Life Cycle Assessment: http://ec.europa.eu/environment/ipp/lca.htm

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However, decision-makers and other stakeholders can make use of the results to make informed and science-based decisions.

BOX 3 The Driving Forces-Pressures-State-Impact-Response model for Waste Management (DPSIR-W)

TESTIMONIAL

José Jorge Espí Gallart, Project Manager at EURECAT's Sustainability Unit

"The DPSIR (Driving Forces, Pressures, State, Impact) methodology and the DPSIR-W tool specially developed in the framework of UWINS have allowed to introducing the social sphere into the definition, prioritization and implementation of the pilot actions held in the project. DPSIR-W is defined as a causal framework that describes the interactions between society and the environment related to waste management. This is an especially interesting approach, since it considers the interrelation between all these elements not only referred to ecosystems condition, but also about the well-being and people health.

Work developed has been focused on establishing a framework that translates the specific concerns related to waste management into the five components of the DPSIR model. By analysing these components during the on-site agora and based in the discussion held, this tool has allowed assistants themselves to define and precise the most prominent solutions to be part of the WMSP in each municipality".

Purpose of the tool

The Driving Forces-Pressures-State-Impact-Response for Waste Management (DPSIR-W) tool is a model, which describes the interactions between society and the environment concerning waste management and helps the selection and definition of the strategies to be implemented in the WMSP. The tool is based on a holistic perspective and allows local policymakers, technicians and social stakeholders to understand the challenges of waste management, including the social ones, and to introduce them in the general waste planning.

Through a collaborative learning process, links between the different perspectives of diverse professional and sectors can be detailed and reflected in the model.

Objectives

- To create a systemic and holistic model that enhances the goal and scope of each WMS;
- To empower citizens to participate in WMS processes through participatory approaches;
- To better address the effectiveness of the WMSP to be implemented as well as the opportunity to define solutions in a better manner.

Scope

The tool has 3 main stages:

1. Definition of the main priorities to be addressed in the WMSP. The DPSIR-W model allows the analysis and refining of the strategies; consequently, the main priorities must be known as a starting point. Coupled to that, the objectives to be fulfilled for each one of the priorities are at the same time stated.
2. Selection of the key factors and connections for the addressed priority or strategy. This process allows determining the effectiveness of possible measures; every aspect included along the model is analysed in terms of its relevance for the priority itself and for waste management as a whole. Hence, the analysis covers the five categories DPSIR:
3. Results evaluation and redefinition of responses. The final step is the integration of analysed aspects for the further development of the addressed strategy, mainly in the sense of creating/modifying/enhancing the details of the responses, which can be considered at this step as the actions to be implemented in the new WMSP.

Relation to urban metabolism

DPSIR-W complements the UM approach, adding the social component in the analysis. While UM describes the interactions of natural and human systems in specific regions, DPSIR-W describes the interactions between society and the environment.

Furthermore, valuable inputs from different stakeholders allow defining a set of responses (i.e. actions to be implemented in the WMSP) that can be integrated into a completely aligned approach.

Stakeholders involvement in the deployment of the tool

The tool is designed to be applied by municipal technician or consultants responsible for creating the WMSP, in conjunction with all key stakeholders involved: policy makers, technicians and social interested parties like NGOs, neighbourhood associations, social pressure groups, etc.

To facilitate the replication of the tool, details of the application of DPSIR-W tool in Manresa, Spain, are explained below.

Stage 1: WMSP priorities. As a result of the previous agoras, the identified priorities included:
1: The improvement of urban facilities for the collection of waste;
2: The enhancement of sorted waste collection, especially with regards to the organic waste fraction;
3: The increasing of environmental awareness in order to change citizens' habits;
4: Prevention and circular economy;
5: The improvement of waste collection from substantial producers of waste.

The analysis of the 5 priorities was performed in two meetings with the participation of 8 and 5 people respectively.

For each priority, the whole process proposed by DPSIR-W model was followed point by point. Indicatively, the results regarding Priority 1 are described below. Within this priority, six objectives were defined: a) Grouping containers in single units and adequate spaces; b) Improving access to dumpsters and collection areas; c) Reducing the number of containers throughout the city; d) Developing a door to door pilot test and a benefits' system linked to the implementation of recycling e) Improving the general perception of infrastructure based on aesthetic values and f) Upgrading the technological capabilities of the facilities.

Stage 2 and 3. Key factors and responses. Connections as well as the interrelationships for the addressed priority and objectives aligned were defined. At the same time, responses

were also evaluated and redefined. For completing these two stages, three additional meetings were necessary.

The main driving forces in Manresa were the transportation and storage sectors (they possess waste management facilities) together with the professional, scientific and technical activities, which take place in the city. On the other hand, social drivers acting as a catalyst for a change in WPMS and the creation of improved infrastructures included local interest groups, non-governmental organizations and neighbourhood communities whose influence on the local government was observed to be notable. Just as important is the city's orography, which, together with the fact that many districts of Manresa present complications due to their age, constitutes an important conditioning factor, which could not be ignored.

The analysis enabled the selection of a series of preliminary driving-forces based responses. The development and reinforcement of the existing waste management policies, legislation, restrictions, and guidelines aimed at minimizing waste generation were deemed the most promising. These would include:

- Environmental education including training, demonstrations and brochures such as infrastructure user guidelines;
- Policies that seek to improve equal access to waste services among the population through the elimination of barriers to waste-facility access;

In order to ensure the effective implementation of the proposed responses, three decision-making support tools were identified as being necessary:

- The improvement of the visualization and geospatial analysis of waste generation points, and treatment infrastructures in Manresa;
- A Cost-benefit Analysis for any defined waste management action;
- A proactive scheme named 'RECYCLE AND WIN' which would constitute a key element of the programme and respond to the determining factor of human behaviour.

Concerning pressures, the human activity and behaviour that demands changes in the WPMS in Manresa were identified as a key effect. The main one was the noise generated by transport and the collection of waste. Climate change was also linked to this factor, which at first sight may appear slightly bewildering until one realizes that in poorer districts, residents often do not have air-conditioning or do not have the financial ability to pay high electricity bills and are therefore forced to maintain their windows open at night. Regarding human behaviour, the influence of factors such as the status of the neighbourhood, housekeeping practices, recycling habits, the use of personal resources as well as the level of personal concern, were selected as main determining factors. As a consequence, a key response was identified in the improvement of the perception of social and civic duties for increasing responsibility and awareness. It was decided to plan a campaign addressed to reinforce positive behaviour in order to decrease uncontrolled waste generation and inadequate waste disposal.

From an environmental perspective, the agreed pressures-based responses involved improved land-use and infrastructure development coupled with technological innovation (the circular economy approach would be reinforced as new uses for waste were developed). This would entail land-use zoning, the construction of specific facilities and the designation of certain restricted areas.

In the case of Manresa, no direct effect of the physical environment on the human state could be detected. Neither the surroundings nor the size of the population could be described as affecting one's economic or social status or the relationships established between distinct stakeholders. Attention was therefore shifted towards the built environment as an object of change. In this aspect, urban planning came to the fore, considering factors such as waste management infrastructures, possible green areas, local orography and architecture.

Finally, Impact would be defined by those opportunities that result from the releasing of space for new uses (e.g. the elimination of container zones facilitating more parking space). A coherent educational programme designed to increase environmental awareness and the public visualization of an improved waste infrastructure should support this opportunity. Further recreational opportunities were also deemed as being part of the expected impact, which would include a positive effect on human welfare due to increased economic activity, improved cultural and social well-being and a reinforced behavioural pattern as the result of the proper use of the proposed infrastructures. Improved physical and social conditions enhance a sense of belonging, a pride in one´s community, which supports the continuity of improved social behaviour. Impact-based responses identified by the team in Manresa consisted of on-site observation which would allow one to further understand the problems caused by waste infrastructures and the development of a scheme whereby financial compensation would be offered in return for the proper use of waste facilities, together with a pay-by-generation plan. In order to fully analyse the results of this priority in Manresa, the success of the implemented decisions would be monitored employing both environmental and human well-being indicators supported by surveys, opinion polls, market evaluation and the aforementioned field observations.

Conclusions

Application of DPSIR within UrbanWINS project and through all pilot cities involved has demonstrated the power of the tool for the development of WMS. The tool has proved extremely helpful for municipality technicians that are involved in the waste management planning who sometimes deal with social aspects in an undifferentiated way despite the fact that they are complex and different in every suburb.

According to UrbanWINS pilot cities technicians, the holistic perspective of DPSIR, which brings a collaboration with different departments and stakeholders, the inclusion of the social perspective which allows to emerge new solutions and topics not covered until

that moment as well as the highly accurate process which makes easier the development of the waste management plan are the main advantages that DPSIR-W brings.

Resources

For more information, please consult the following document: "UrbanWINS D1.2: Assessment of Determinants and Effects of Waste Prevention and Management Strategies Policies and Strategies" available here: https://www.urbanwins.eu/wp-content/uploads/2018/02/UrbanWins_D1-2_Assessment-of-determinants-and-effects-of-waste-prevention-and-policies.pdf

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BOX 4 Estimating life-cycle impacts of consumption in Leiria

Motivation and scope

Building on the product-level data on urban flows provided by the UMAn model, LCA is applied to estimate life-cycle environmental impacts associated with consumption in Leiria, Portugal.

Essentially, impacts are estimated for a selection of products, representative of urban consumption. Since a consumption perspective is considered, impacts are estimated for products consumed by the inhabitants of Leiria, while impacts associated with extraction, production or manufacturing of exported goods are excluded.

Objectives

- To estimate environmental impacts associated with consumption in Leiria;
- To develop a model integrating LCA and the UMAn model to provide further insight into the environmental impacts associated with urban metabolism;
- To support decision-making by helping to identify hotspots, improvement opportunities

and potential trade-offs in strategies for reducing environmental impacts associated with urban flows.

Methods

The approach consists of essentially three steps:
1. Analysis of the UMAn model results for consumption and selection of representative products for which LCA is performed;
2. Selection of relevant life-cycle inventories for each representative product in databases and literature, and identification of critical processes for which local or national specific data is modelled (e.g., electricity supply mix, transportation requirements);
3. Quantification of potential environmental impacts associated with each product (life-cycle impact assessment) and extrapolation to the overall urban consumption.

The overall impacts of urban consumption along one year (2013) are estimated for the following midpoint impact categories: primary non-renewable energy (NRE) based on the Cumulative Energy Demand (CED) method (Hischier et al., 2010); greenhouse gas (GHG) intensity using the IPCC method for a 100-year time horizon (IPCC 2014); marine eutrophication (ME) and freshwater eutrophication (FE), calculated using the EUTREND model, in ReCiPe (Goedkoop et al., 2009); and acidification (AC) and terrestrial eutrophication (TE) using the Accumulated Exceedance model (Seppälä et al., 2006).

Relation to urban metabolism

LCA complements the UM approach, going beyond material flows and estimating their potential environmental impacts. This insight is particularly relevant to better inform decision-making, as larger material flows might not be the most relevant in terms of environmental impacts.

Conclusions

Combining LCA and the UMAn model to estimate environmental impacts of urban consumption, within the UrbanWINS project and through the application to Leiria, demonstrated the relevance of estimating material flows but also their potential environmental impacts to inform decision-making. The model can help to identify improvement opportunities for reducing environmental impacts associated with urban flows, as well as potential problem shifting and trade-offs in mitigation strategies.

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BOX 5 Life Cycle Assessment (LCA) applied to assess the impacts of a selected set of pilot actions

Purpose of the LCA

The holistic approach offered by LCA is adequate to determine the environmental feasibility of a product, process or service throughout its life cycle, from the natural resource extraction, through processing, use, maintenance and management to the end of its useful life. The LCA are prepared on the basis of ISO standards on LCA 14040:2006 & 14044:2006 and the recommendations set in the ILCD Handbook published by the European Commission [1][2].

The general scope of the LCA studies on the pilot actions, additionally to the environmental benefits and drawbacks of the specific actions is to demonstrate the potential of the LCA studies as supporting tool during the design, implementation and execution of the WMSP.

Based on the priorities and pilot actions implemented in the UrbansWINS project, LCA

had been applied to the following actions:

- Bucharest: Developing an integrated "zero waste" separate collection system in Bucharest restaurants.
- Torino: H2O zero waste in order to increase potable water consumption and reduce plastic packaging.
- Sabadell: Public Service for the cession of tableware in order to reduce single-use products.

Detailed information of these actions can be found in deliverable 5.2 about pilot cities evaluation plans.

Objectives

- To assess the environmental benefits and drawbacks of the selected pilot actions.
- To set the environmental hot spots, i.e. define key factors influencing the environmental performance of pilot actions in order to provide recommendations for its improvement.
- To compare the implemented pilot actions in terms of environmental impacts against current or alternative actions developed in cities.
- To provide quantitative data to support citizen engagement to the new actions.
- To demonstrate the benefits for the use of LCA methodology at the city level.

Scope

The LCA will be performed using a cradle to grave approach in order to provide a global picture of pilot actions. LCA is focusing on three aspects of the life cycle: manufacturing (extraction, production and transport of all raw materials), the use phase where the pilot actions will be carried out as well as the End-of-life stage, considering the treatment of wastes associated to the capital goods accounted.

The LCA studies will focus on the environmental benefits derived from the applications of pilot actions such as the valorisation of different fractions of waste, the reduction of plastic packaging and single-use products or fewer transports due to the number of non-used plastic bottles.

This approach can be applied to evaluate the environmental performance, focusing on greenhouse gas (GHG) emissions, of a WMSP and to compare it with alternative systems to assess the potential effectiveness of different waste policy measures. Previous LCA studies concluded that LCA methodology is a powerful decision-making tool when it is applied to the waste management sector, because it is able to consider both site-specific conditions and improvement opportunities [3]. A sustainable waste management system requires a multidisciplinary approach and consequently, it is necessary to adopt a holistic view of the system [4].

The development of LCA methodology at the city level can be summarized in the following contributions:

- Application of LCA approach to evaluating a complex waste stream at the city level.
- Novel use of publically available waste data to comprehensively model waste flows through the system.
- Provision of information to policymakers regarding the potential effectiveness of waste policy measures.
- Assistance to local authorities in identifying optimal WMSP.

Relation to urban metabolism

The LCA complements the UM approach, focusing on the urban flows that enter and leave the city (from a qualitative point of view) and the impacts of a selected set of pilot actions, which indirectly provide information about its urban metabolism. While the UM describes the interactions of natural and human systems in specific regions, LCA quantifies the environmental benefits and pressures related to goods and services for achieving improvements taking into account the entire life-cycle of a product, process or service. In the planned actions, LCA will provide a quantitative score from the environmental impact derived from reducing the inputs for packaging and tableware, flow streams in UM.

Stakeholders involvement in the LCA of the pilot actions

Stakeholders involved in these implementations depend on each pilot action (described in deliverable 5.2). However, key stakeholders involved are policy makers, technicians and social interested parties like citizens, associations, social pressure groups, etc.

The interpretation of the results obtained from the LCA studies could be replicated by UrbanWINS pilot cities and by other cities interested in developing and implementing innovative and sustainable strategic plans for waste prevention and management.

Conclusions

The LCA support the technician from municipalities to set, implement and assess the selected local strategic action plans, with a special focus on the citizen engagement to each action. In general terms, LCA will help to enhance the long-term sustainability of innovative and sustainable strategic plans for waste prevention and management. Application of LCA methodology will guarantee progress towards more sustainable production and consumption patterns together with improvements in the recovery and recycling of wastes.

Resources

For more information, please consult the following documents:
- UrbanWINS D2.2: Urban Metabolism Guide.
- UrbanWINS D5.2: Pilot Cities Evaluation Plans.

External references:

[1] E.N. „ISO 14040" Environmental Management - Life Cycle assessment - Principles and Framework. International Organisation for Standardization, Brussels, 2006.
[2] E.N. „ISO 14044" Environmental Management - Life Cycle assessment - Principles and Framework and guidelines. International Organisation for Standardization, Brussels, 2006.
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BOX 6 Life Cycle Assessment (LCA) for pilot actions in the cities of Sabadell, Bucharest and Torino

The common objective of the overall LCA studies was to calculate the main environmental impacts provided by the new actions in front of the reference situations. Results have demonstrated the environmental benefits of all actions in almost all environmental vectors. Thanks to that, results have been used for the different municipalities to support the improvement, implementation and replication of these actions. LCA assessments on three pilot actions have been the following:

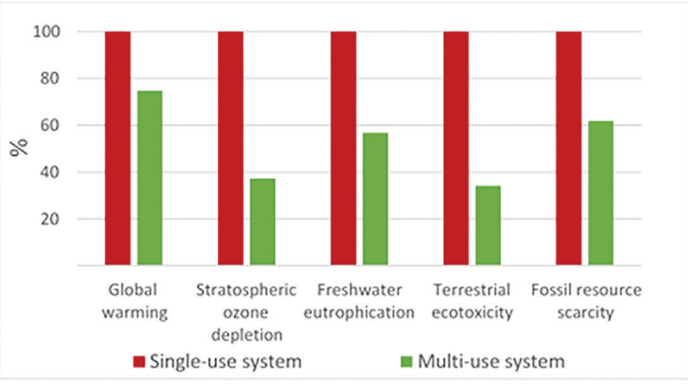


Figure 1: Relative comparison between the environmental impact of the pilot action implemented in Sabadell (use of multi-use tableware) with the reference situation (use of single-use tableware).

- Sabadell: municipal service of cession for durable tableware (up to 250 persons per event) in order to reduce single use products at city events.
- Bucharest: implement separate collection points in main events (concerts, Christmas market).
- Torino: installation of chilled water tap fountain in a municipal office. The environmental profile of the action had been compared versus the current source of water, a vending machine of plastic bottled up water.

As indicative, main results from Sabadell calculated with European ReCiPe midpoint method as implemented in Simapro are summarized in Figure bellow. Full studies are described can be found in Deliverable 2.3.

The results of Sabadell show a reduction for the use of multi-use tableware in almost all of the environmental impact categories assessed. Specifically, in global warming potential, reductions of 25% were accounted. Study states that for supplying 10000 meals (around 50 events) within reusable tableware, the emission of 350 Kg CO2 eq. is avoided.

It is worth to mention that the contributions from the production of each single-use item exceed the contributions from the energy consumption due to dishwashing process of the reusable system, leading to general benefits of the reusable system compared to the disposable one.

Results of Bucharest show that an effective strategy of solid waste management plan (SWMP) reduces most of the environmental impacts analyzed in comparison to the reference situation, where no infrastructure and no dedicated strategy for the separate collection have been implemented. The LCA results demonstrate that thanks to the new strategy, the total amount of waste generated is reduced thanks to prevention measures compared with previous years (circa 3 Tn), and overall, around 10 Tn were separately collected during the pilot, which means and overall reduction of around 12 tons CO2 eq. (minimization up to 155%).

Finally, results from Torino shows a clear advantage of the installation of a chilled water tap fountain for supplying drinking water in the registry office. For global warming category, reductions of 76% were accounted, which means a total avoided impact of around 61 Kg CO2 eq per week. In that case, results highlight the importance of reducing disposable plastic bottles and increasing the use of more sustainable systems.

Overall, LCA results show that an effective strategy of SWMP reduce most of the environmental impacts analyzed. Therefore, by implementing the LCA methodology would help to demonstrate and promote waste prevention and management strategies that aim at improving sustainability of urban systems. Following the principles of circular economy, MSW can be seen as a resource instead a problem.

2.4 Strategic planning frameworks

2.4.1 Nature and objectives

The information provided in this sub-section is directly derived from the policy framework development experiences realized within UrbanWINS. Pilot cities have been guided and supported throughout a planning process that led them to adopt a Strategic Planning Framework for waste prevention and management based on urban metabolism principles.

The Strategic Planning Framework (SPF) is an exhaustive description of the city's strategy for the setting of specific priorities and objectives to be achieved through appropriate measures/actions in order to make the resource/waste sector more sustainable. It is a flexible instrument for a long-term orientation that enables to bring additional information to the technical planning and to support an efficient allocation of the resources within the planning phases and among different tools.

Specific objectives of the SPF are:

- To promote circular economy and to reduce the production of waste within the city through the definition of appropriate policies;
- To guide policy makers in the definition of strategic goals and related measures/actions for their achievement in relation to the resource consumption and waste production;
- To provide the municipality with a planning instrument that can be used not only during the UrbanWINS project, but also for further reasoning and projects related to the urban metabolism, circular economy and waste management and prevention processes;
- To establish and test methods for stakeholders' engagement that result in the share of responsibilities and commitment for the planning of urban policies on the resource/waste sector.

The next paragraph describes the methods and steps adopted for developing the SPF with the aim to provide inspiration and guidance for other EU cities interested in addressing waste prevention and management issues from a non-conventional point of view, that is to transform them in an opportunity for managing urban resources to improve circularity and reduce the material flows (both in input and output) needed to sustain the city's activities.

POINT OF ATTENTION

The Strategic Planning Framework is built on the basis of the principles and approaches described in Chapter 2.1 of this toolkit

TESTIMONIAL URBANWINS PROJECT TECHNICAL COMMITEE

Livia Mazzà, Fondazione Ecosistemi, UrbanWINS Project Technical Committee coordinator

After three years of intense work, continuous dialogue, great expectations, challenges, online and physical meetings, smiles, big and small talks, we are proud and happy to see that UrbanWINS partners and the individuals representing them have built something really new: a common language and understanding between organizations, experts, decision-makers, researchers and public officials on a complex theme such as that of urban metabolism. Each of us had to make an effort and a step forward to be able to contribute to the project with her/his own competences in an innovative and fruitful manner. The synergies and the dialogue we established at the partnership level were reflected in the strategies adopted by cities and their stakeholders. It surely took some time to give the right shape to our activities, to see the results and to become really aware of them, but we believe that this is the time that a real transition takes. Changing our mindsets, changing the way we look at things, being able to transfer knowledge and to use new knowledge requires a big effort, but it is all paid back when you see that it is worth it because it serves the needs of society. UrbanWINS had an impact on decision making processes at local level, it brought actions and innovations in pilot cities that represent seeds for the future, yet it also stimulated debate and openness between the research world and the decision makers and across disciplines.

Providing decision-makers with useful indicators for resource management and circular economy at local level, empowering urban stakeholders for changing their consumption modes, enhancing the circularity of materials and energy at the urban level, sharing knowledge and practices in the fields of urban metabolism and circular economy, promoting new ways of stakeholders engagement in decisions about urban resources management: we took the path and we have to continue.

2.4.2 Methods and steps

The SPF includes and resumes the elements emerged from the participatory process that a city puts in place and from the relevant internal processes undergoing in it. The process for the engagement of stakeholders in the definition of the SPF contents is described in Part three of the Toolkit, while this section focuses on what are the contents of the SPF and the steps followed to build it.

The SPF has the following structure:

1. City's profile and overview. This first part is aimed at giving a general overview on the city's profile and on the state-of-the-art concerning natural resources, land uses (built environment, infrastructures, etc.), social and economic relevant data.

2. Plans, policies and programmes analysis. This step of the planning process should help to avoid overlapping strategies (with current ones ongoing within the municipality and already embedded in a policy framework) and to better focus the efforts.

3. Priorities. A priority is the medium/long term strategic vision that the municipality is determined to reach in order to base its own urban policies on the urban metabolism concept.

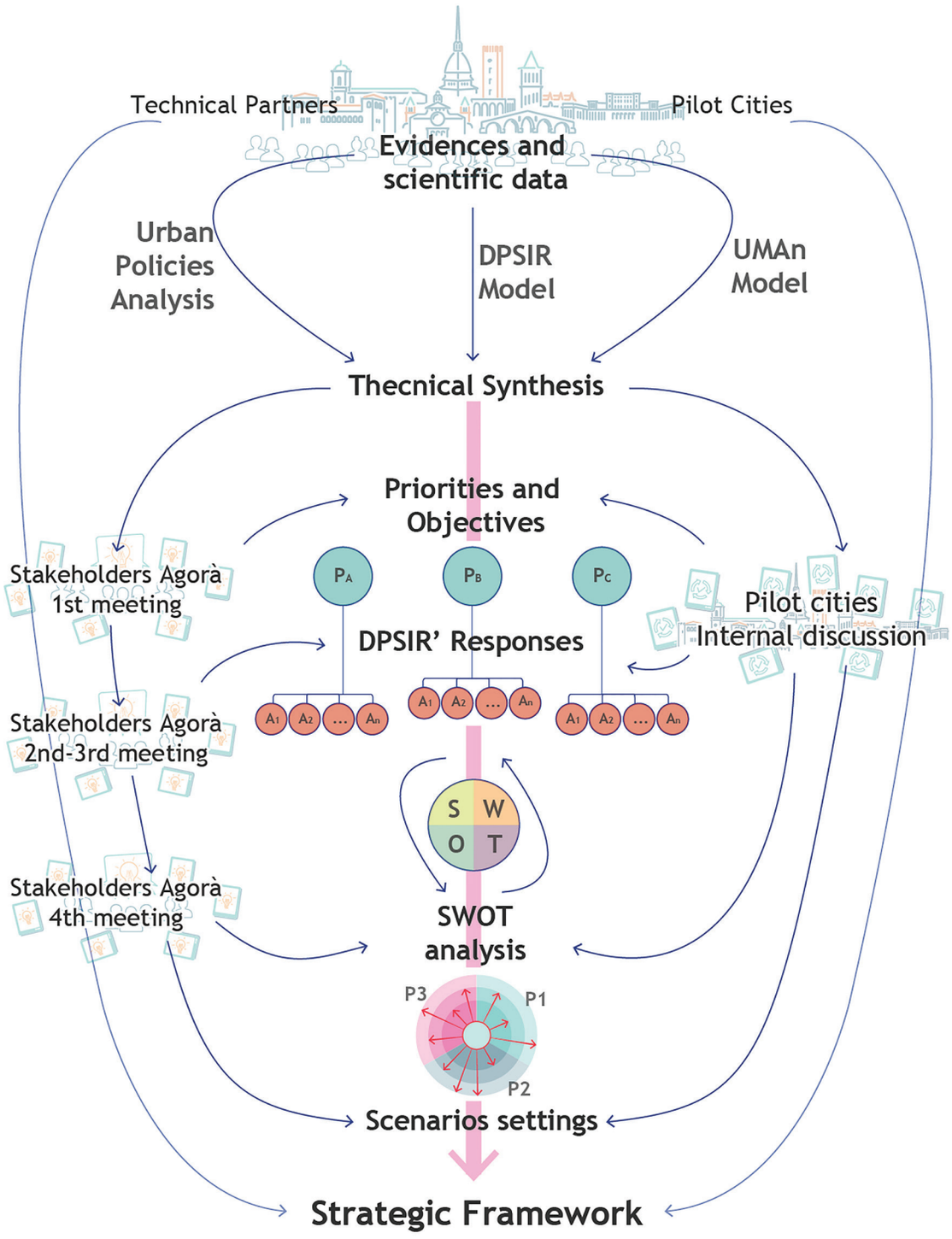
4. Objectives. An objective is the operational context of the activities to be implemented to reach the priority identified: i.e. objectives relate to those "subsequent steps" that a municipality needs to undertake in order to achieve the strategy.

5. DPSIR and SWOT analysis, coming from the information collected within municipality's internal meetings and urban face-to-face agoras (depending on the planning process followed by each city, these analyses are carried out in relation to priorities, objectives or actions).

6. Scenarios for objectives, which are aimed at identifying (for each objective) the most influent variable factors/elements, the so called "drivers", the timeframe, the expected outputs and the indicators aimed at measuring the achievement of the expected outputs.

7. Actions. An action is the operational context aimed at achieving a related priority/ objective, and can be of three types: regulatory, voluntary or awareness rising.

The first two points of the list above were elaborated by pilot cities on the basis of their own knowledge. IUAV, that coordinated the definition of the methodology to be applied for the construction of the SPF, supported the elaboration by guiding cities through the collection of relevant information, plans and policies already adopted by each city.



UrbanWINS Strategic Framework (Source: Deliverable 4.1)

USEFUL TOOLS FOR REPLICATION

ANNEX 1 of this section of the toolkit contains the sample questionnaire that pilot cities used to collect information on their current plans and policies. To consult the full Methodological Guidelines that were used by UrbanWINS pilot cities: https://www.urbanwins.eu/wp-content/uploads/2018/06/Urban_Wins_D4.1-Methodological-guidelines-for-the-construction-of-Strategic-Planning-frameworks-v10.rev07.pdf

Before starting the process of engagement of external stakeholders, internal meetings were organized within the municipal administrations to share UrbanWINS objectives across various departments and to identify some priorities on the basis of the political and strategic vision of the city. The priorities were then analysed and further shaped and defined with the stakeholders that also participated in the design of objectives and actions to be included in the SPF. The construction of scenarios was conducted internally on the basis of all the information collected.

Within the eight Pilot Cities, a total of 31 priorities, 91 objectives and 104 actions have been defined. Major topics emerged in the SPFs are:

- Circular economy (3 priorities and 7 objectives);
- Waste management (1 priority and 9 objectives);
- Waste prevention (5 priorities and 9 objectives);
- Reuse of resources/materials - (3 priorities and 6 objectives);
- Recycle (3 priorities and 2 objectives);
- Collection of waste (3 priorities and 4 objectives);
- Food waste (1 priority and 5 objectives);
- Reduction of packaging (5 objectives).

EXAMPLES AND CASE STUDIES

To read the contents of the SPF of the cities of Albano Laziale, Bucharest, Cremona, Leiria, Manresa, Pomezia, Sabadell, Torino see deliverable D4.2 Strategic Planning Frameworks for the 8 pilot cities at: https://www.urbanwins.eu/wp-content/uploads/2018/06/UrbanWINS_D4.2_Strategic-Planning-Frameworks-for-the-8-Pilot-Cities.pdf

2.5 Action plans and pilot actions

The Local Strategic Action Plan - is the practical operationalisation of the city's strategy, which results from the SPF process, through the planning of strategic actions to be implemented in order to achieve the related priorities and objectives. First, it details Pilot Actions identified by the city that will be implemented in the short term, by providing additional information for their implementation and monitoring. Within UrbanWINS, Pilot Actions are the actions that have been selected during the participatory process – i.e. the meetings organized within the urban agoras - in order to be implemented during the lifespan of the project. Second, LSAP considers all the other measures/actions identified within the SPF, specifying their potential role in the urban metabolism, circular economy and waste management and prevention processes. Within UrbanWINS, these actions refer to actions that will not be implemented during the UrbanWINS project but are included within this plan for their potential further implementation on the medium/long term.

The LSAP is designed to be used by local administrations and by all actors that will be involved in the implementation and monitoring of the actions.

The LSAP has the following structure:

1. First section – Pilot Actions

a. General information coming from the SPF.

b. Additional specific information for the implementation and monitoring of the action. This step includes the information supporting the implementation of the action (timeframe, budget, contact person, critical factors) and the monitoring of the action (expected outputs, indicators).

c. Economic sectors related to the action. In this step, guidance on the economic sectors (among which transport, waste and emissions, wood and food, minerals, energy, industrial

production, import-export, population) on which the action is foreseen to have an impact/a consequence are reported.

2. Second section – Other Strategic Actions

a. General information coming from the SPF.

b. Analysis of the action's contribution to the urban metabolism, circular economy and capacity of integration in the WP&M system processes. In this step, the other strategic actions are analysed (in a theoretical way) in relation to the processes of i) urban metabolism (materials and resources flow analysis), ii) circular economy (contribution to the urban circular economy processes) and iii) capacity of integration in the WP&M (waste prevention and management) system, in order to have an overview about their role towards these topics, with a view to their (potential) further implementation.

c. Economic sectors related to the action. In this step, guidance on the economic sectors (among transport, waste and emissions, wood and food, minerals, energy, industrial production, import-export, population) on which the action is foreseen to have an impact/a consequence are reported.

Within UrbanWINS, the actions to be included in the LSAP are the results of the process of stakeholder engagement. In fact, stakeholders co-designed the actions that were included in the LSAP, also prioritising them by going through a voting process, as described in Part III of the toolkit. The participatory process must be considered as "a must" in the definition of both the SPF and the LSAP.

TO GO DEEPER

Read Deliverable 5.1 Collaborative Methodology to personalize the Urban Strategic Plan for each city at: https://www.urbanwins.eu/wp-content/uploads/2019/01/D5.1.-Collaborative-Methodology-to-personalise-the-Urban-Strategic-Plan-for-each-city.pdf

The eight LSAPs include a large array of waste intervention actions (management and demand-side voluntary tools, educational/awareness raising initiatives and regulations) organized according to the involved stakeholders, by various areas of action (e.g. prevention, reuse, recycling) and by sectors (e.g. buildings, industrial, households, business). They follow the path "from the city's strategy to the action planning", in which, after setting the city's priorities and objectives, a set of strategic actions needed to reach each specific goal is specified for further implementation.

Regarding the implementation of Pilot Actions within the eight Pilot Cities, as defined in the LSAPs, a total of 26 Pilot Actions have been selected to be implemented, for a total budget of 207.000 €. The implementation of the actions was mainly sustained by the budget foreseen by UrbanWINS. However, there were also cases in which pilot cities identified zero-cost actions or actions to be realized with the integration of the internal budget. Regarding their type, the 26 Pilot Actions are subdivided as follows: 6 each for regulatory actions, voluntary actions and awareness raising actions; 5 regulatory/awareness raising actions; 1 each for regulatory/voluntary action; voluntary/awareness raising actions and regulatory/voluntary/awareness raising actions (see table 6 below).

Table 6 List of pilot actions implemented by each city

CITY		ACTIONS	TYPE OF TOOL		
			VOL	REG	AWA
Rome	Albano Laziale	Communication campaign			X
		Reuse Area Barter		X	
		Sustainable tourism	X		
	Pomezia	Creation of a port equipped with small catering and fish market		X	
		Awareness raising activities and involvement of citizens in waste reduction			X
		Repair and Reuse Center	X		
Bucharest		Integrated „zero waste" (pilot) separate collection system (recyclable and food waste) in food industry units		X	
		Implementing pilot projects for separate collection for waste generated in public events organized by Bucharest City Hall	X		
		Development and implementation of an awareness campaign and prevention of waste generation in educational establishments			X
Cremona		Punctual Tariff		X	
		Improvement of citizens' lifestyles	X		
		Last minute market: Enhance recovery and donation of food surpluses and expiring products			X
		Development of materials resulting from the processing of fruit, vegetables and other vegetative waste for food purposes	X		
		Managing production outputs and reconsidering waste materials produced on farming sites		X	

Cremona	Guidebook to the reduction of food waste	X		
	Training project for catering establishments			X
	Regulation for the promotion of sustainable events		X	
Manresa	Creation of a local plan for waste prevention and management		X	
	Environmental information and training for singular producers			X
	Disseminate and analyse resource, waste and sub products flows in order to explore new business models	X		
Sabadell	Space for eco-awareness related to waste and its reuse			X
	Reducing single use products		X	
	Awareness raising and prevention of food waste			X
Torino	Hub of circular economy			X
	Guide for municipality events		X	
	H20 Waste	X		

EXAMPLES AND CASE STUDIES

UrbanWINS Deliverable D5.3. Eight Urban Strategic Plans at ground level collects the LSAPs of the 8 pilot cities in their own languages: https://www.urbanwins.eu/wp-content/uploads/2019/01/D.5.3-Eight-Urban-Strategic-Plans-at-"ground-level".pdf

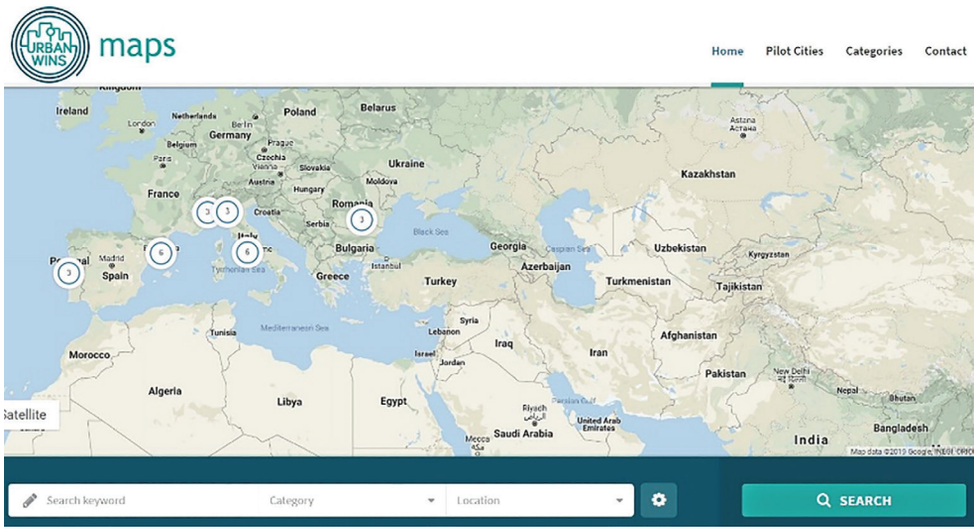
After defining the LSAPs and before starting the implementation of the pilot actions, each pilot city also elaborated an evaluation plan to analyse the effectiveness of the implementation and the impact of the pilot actions within the framework of the project. The contents of the evaluation plan result partly from the internal work of the public officials in charge of UrbanWINS activities and partly from consultation with the stakeholders, that gave inputs on specific elements to be evaluated.

EXAMPLES AND CASE STUDIES

The Evaluation Plan of each pilot city (in English and in the city's own language) can be found at this link: https://www.urbanwins.eu/deliverables/

UrbanWINS maps

UrbanWINS maps is a platform that aims to connect different stakeholders, collect reports of virtuous examples and good practices and identify and localize circular economy initiatives. The actions and practices related to the circular economy and waste prevention and management are collected and classified by geographic location, type, and sector. A special focus of the platform is related to the pilot actions implemented by the 8 pilot cities of the UrbanWINS Project.



Users have the opportunity to suggest new best practices in the platform using a user-friendly contact form. When the homepage is open, the user can start browsing the general map using a few intuitive commands. The initial markers immediately make an overview of the areas in which there are visible items. By zooming in on the map - which responds to both mobile touch and desktop mouse clicks – the user can identify individual items in cities, neighbourhoods and streets.

There are also filters, which select the items according to a specific category / sub-category, or the geographical location (e.g. by choosing the name of one of the pilot cities), or by setting the research within the search field, or by choosing the radius (max 100 km from your device) within which to extend the search. By clicking on the single marker, the user can open a pop-up window that provides a preview with some information and will have the possibility to access the extended item with a further click. By clicking on the single location or on the single category it will appear a brief description and the list of the items connected to it. By accessing the „Contact" page users can request to insert a new item. The request will be verified and validated by a team member and, if considered relevant, it will subsequently be added to the map. Users can save the web app on the homepage of their device, tablet or smartphone.

The web-app UrbanWINS Maps is online here: https://www.urbanwins.eu/maps/

The dedicated page on the UW website is here: https://www.urbanwins.eu/maps-info/

2.6 Mapping tools and actions

Various practices concerning urban waste prevention and management in relation to urban metabolism and circular economy principles have been deployed over the last decades by various private and public actors in European cities. The first part of the present Toolkit showcases a part of these practices that emerged as “best practices” according to the criteria established within the project. This section is instead focusing on the process of identification and classification of urban waste prevention and management practices and tools from the perspective of the various issues that they can address.

In parallel with the development of the strategic planning process of the pilot cities, tools and practices identified as a result of the research conducted within the project (in particular within WP1), of partners exchange of experience and of proposals emerged in the cities’ agoras were collected and mapped with the double objective of:
- offering pilot cities an overview of tools available to address their priorities and objectives and of potential common experiences;
- highlighting the needs of involving different departments in their strategies for waste prevention and management by associating tools to be implemented to the areas of urban activities affected that fall under different responsibilities.

The entry point in the identification of waste tools has been represented by urban flows. The main urban flows for which tools/initiatives have been mapped are the ones related to priorities and objectives emerged from pilot cities urban agoras: accommodation, food service and tourism; air pollution; bulky waste; construction and demolition waste - CDW (or inert residues); food and organic waste; industrial waste; land uses; manufacturing; municipal waste; packaging waste; paper; textiles; water; WEEE – Waste electrical and electronic equipment; wholesale and retail trade.

In order to facilitate their analysis and use, the tools have been divided into various typologies: “voluntary”, “regulatory”, “awareness raising”, “innovative technologies and businesses”. In the project, a total of 166 tools have been identified, out of which 75 voluntary tools, 48 regulatory tools, 30 awareness-raising tools and 13 innovative technologies and businesses tools. The urban flows for which more proposals have been developed are related to food and organic waste, and to municipal waste.

Each identified tool has been connected not only to the related urban flow and to the tool typology, but also to other important data:

- the "Potential promoter of the tool" that can support and foster the development of the initiative, because it has either: the necessary administrative competences, the governance of the processes related to the tool, or the capacity to involve the other relevant stakeholder. The potential promoter of the tool had also the purpose of supporting cities in the identification of the main stakeholders to be engaged;
- the "Areas of urban activities affected by the tool" (mobility, energy, buildings, food consumption, food distribution, provision of environmental services, management of green areas, private consumption, public consumption, tourism, trade, industry);
- the "Municipal department in charge" for the identified areas of urban activities affected by the tool.

The following image presents a general overview of the tools collected within UrbanWINS, divided per urban flows, main potential promoter and typology:

		URBAN FLOWS														
POTENTIAL PROMOTER OF THE TOOLS	TYPOLOGY OF TOOLS	Accommodation, food service and tourism	Air pollution	Bulky waste	Construction and demolition waste (or inert residues)	Food and organic waste	Industrial waste	Land uses	Manufacturing	Municipal waste	Packaging waste	Paper	Textiles	Water	Waste electrical and electronic equipment	Wholesale and retail trade
MUNICIPALITY	Voluntary tools	X			X	X	X		X	X	X	X	X	X	X	
	Regulations		X		X	X	X	X	X	X	X	X				X
	Awareness raising				X	X	X		X	X			X		X	
	Innovative technolog		X							X				X		
METROPOLITAN/ REGIONAL INSTITUTIONS	Voluntary tools				X	X		X		X	X					
	Regulations					X					X				X	
	Awareness raising					X				X						
	Innovative technolog					X								X		
HOSPITALS, HEALT BODIES	Voluntary tools					X										
	Regulations					X										
	Awareness raising															
	Innovative technolog															
ASSOCIATION OF ENTERPRISES, PROFESSIONAL ORDERS	Voluntary tools				X	X	X		X	X						
	Regulations															
	Awareness raising									X						
	Innovative technolog															
ENTERPRISES	Voluntary tools					X									X	
	Regulations					X										
	Awareness raising					X				X						
	Innovative technolog															
NGOs	Voluntary tools				X	X							X		X	
	Regulations			X	X											
	Awareness raising					X			X	X						
	Innovative technolog															
CITIZENS	Voluntary tools					X			X							
	Regulations															
	Awareness raising															
	Innovative technolog															
RESEARCH SUPPORTING BODIES	Voluntary tools								X	X	X					
	Regulations															
	Awareness raising															
	Innovative technolog					X										
SCHOOLS	Voluntary tools					X					X					
	Regulations															
	Awareness raising					X				X	X				X	
	Innovative technolog															

The image below is a snapshot from the Map file that organizes and presents all the tools identified in UrbanWINS, whose structured can be followed and adapted by other cities:

N.	Urban flow	Tool typology				Description of the tool	Potential promoter of the tool	Areas of urban activities affected by the tool/initiative											Municipal department in charge	Source of information	
		Voluntary	Regulatory	Awareness raising	Innovative technolog			Mobility	Energy	Buildings	Food consumption	Food distribution	Provision of	Management of green	Private consumption	Public consumption o	Tourism	Trade	Industry			
1	Air Pollution		X			Development of new road infrastructures and improvement of the existing ones (including cycle and pedestrian paths) in order to avoid long-lasting traffic congestion	Municipality	X													Agorà	Pomezia
2	Air Pollution				X	Electrification of road public trasportation in the city centre	Municipality	X													Agorà	Leiria
3	Construction and	X				Voluntary agreements with private sector aimed at reducing, reusing and recycling materials used in building sites	Municipality			X											Agorà	Bucharest
4	Construction and	X				Inspections on construction and demolition sites	Municipality			X											Agorà	Leiria
5	Construction and	X				Reuse and recycling center for construction & demolition waste	Municipality						X								Agorà	Cremona; Leiria
6	Construction and	X				Green Homes - Certification for green residential projects	NGOs			X											Experiences	RoGBC
7	Construction and		X			Implementation of GPP criteria for construction and demolition (public buildings)	Municipality			X											Agorà	Torino; Pomezia

TOOLS OVERVIEW AND FOCUSED DESCRIPTIONS

The full Map of tools and the guidance for use can be downloaded from this link. The focused descriptions below can help in better understanding the use of specific types of tools and cross-cutting approaches: FOCUSED DESCRIPTION 1-Regulatory tools; FOCUSED DESCRIPTION 2- Educational tools; FOCUSED DESCRIPTION 3- Voluntary tools: GREEN PUBLIC PROCUREMENT; FOCUSED DESCRIPTION 4 - EEE SECTOR; FOCUSED DESCRIPTION 5 - WASTE MANAGEMENT INDICATORS

FOCUSED DESCRIPTION 1

Regulatory tools in waste prevention and management - Country focus: Italy

Context

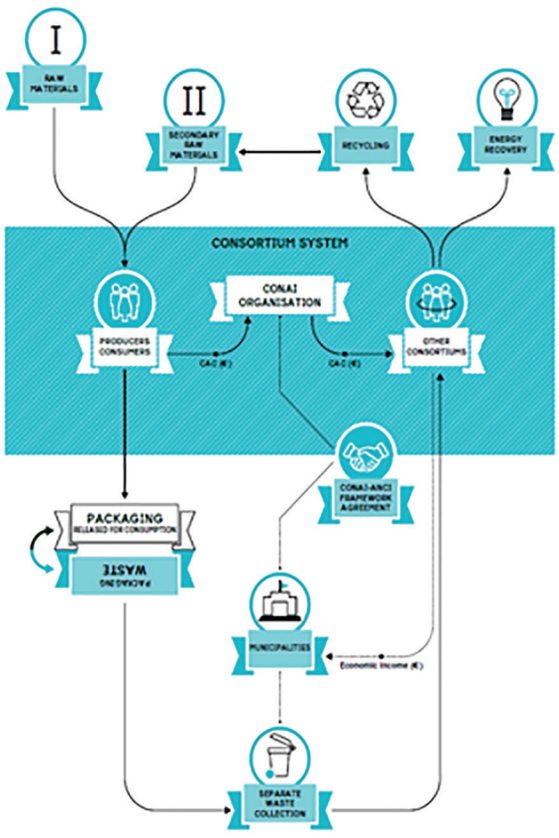
Regulatory tools find their roots in current legislation, both at national or international (i.e. European Union) level. EU Directives, transposed at national level by means of laws approved by the national parliament, might contain several tools that shall be applied by companies and organizations, as well as citizens, in the whole market. Regulatory tools are designed to effectively engage all the relevant stakeholders in specific behaviours aimed at contributing to meet the policy goals intended by the policymaker. These tools might assume

the form of requirements, prohibitions, taxations, incentives, etc.

The next paragraphs focus on the Italian waste regulatory system managed by CONAI, which represents a successful normative framework whose approach, experiences and lessons could be followed by various national, regional and even local decision-makers with waste responsibilities.

A closer look to CONAI system

The CONAI System is the Italian Consortium for collection and management of packaging material waste, instituted by the national legislation. CONAI is a private body and it is the main way private companies comply with national legislation on packaging waste management. CONAI encompasses more than 850.000 Italian companies both producing and using packaging materials, being, in fact, a model based on the principle of „shared responsibility" which assumes the cooperation of all main actors involved in waste management: companies, public administration, citizens who play an active daily role of separating their waste. The CONAI System includes six specific consortia belonging to the packaging material sector, such as: steel, aluminium, paper, wood, plastics and glass. Within a circular economy framework, each consortium has the goal to coordinate, organize and increase the take back of packaging waste (mainly from the separated waste collection), the recycling as well as the recovery processes.



Objectives of CONAI system

CONAI system aims to:

- create a model based on the principle of „shared responsibility", involving all key actors in the waste management chain
- enhance the circularity of packaging materials by means of increasing reuse, recycling and energy recovery
- fostering the growth and reinforcement of environmental awareness in all of the players in the packaging chain, from the producer to the final consumer, promoting the adoption of a „top to bottom" approach, attentive to all the stages of the packaging life cycle.

CONAI system has 3 main stages:

1. Engagement of private companies operating in the packaging sector. Companies finance the CONAI System by mean of a mandatory association fee, which allows CONAI to operate at a national level.
2. Specialisation in single packaging material sectors. By means of the creation of sector-specific consortia, CONAI is able to focus on single materials and to design the most effective strategies for collecting and managing waste streams, which have different features and market dynamics.
3. Waste Prevention Policy. CONAI, in accordance with National legislation, plays a vital role in supporting companies, promoting actions capable of reducing the environmental impact of packaging and called upon to draft the annual edition of the General Prevention Programme. The initiatives promoted by CONAI towards prevention include, for instance, the assignment of the Environmental contribution and award formulas for application of the Contribution for transferred packaging (reuse) and initiatives for raising awareness among companies and to support them in their improvement efforts on their packaging materials along the entire life cycle of the packaging, starting from the design stage.

The Consortium system diagram is reported in the next scheme: when producers and consumers of packaging join CONAI and, for producers, one of the six Consortiums, they are obliged to pay the CONAI Environmental fee (CAC), which is determined by the Board of Directors on a yearly basis and differentiated according to the type of packaging. CAC is the main source of funds that are distributed between producers and consumers according to the costs of separate waste collection, as well as the costs of recovering and recycling packaging. The Environmental Contribution takes place on the national territory or packaging material created by a “producer of raw material or semi-finished products” for a “self-producer” and is managed by CONAI that represents the other Consortiums and their interests.

CONAI withholds a quota for the completion of institutional activities, and distributes the remaining part to the six Consortiums that are tasked with organizing the collection of paper, glass, plastic, wood and metal (steel and aluminium) packaging waste separately collected within municipalities, as well as the processing and delivery to the final recycler, that could be a single facility or a certified intermediary. The Consortiums must then proceed to pay Municipalities according to the quantity and quality of collected packaging (source: CONAI sustainability report, 2018).

Relation to urban metabolism

CONAI uses the urban metabolism approach as it measures the relevant packaging waste flows in a specific area as well as the reuse and recycling rates. CONAI withholds a huge database including the relevant flows of each type of packaging waste managed in specific geographic areas. These data are a valuable input for the urban metabolism framework.

Stakeholders involvement CONAI system

CONAI system is designed to be applied to all the companies producing or operating with

packaging materials as it is prescribed by the Italian national legislation.

Citizens are also actively involved since they are the key stakeholder in the separate collection of the waste types. Local authorities, such as municipalities, are engaged by means of a Framework Agreement, a tool designed in the national legislation, through which the Consortium system guarantees the coverage of increased expenses for separate collection of packaging waste for Italian municipalities.

CONAI is applied throughout Italy, involving the above-mentioned stakeholders. Thanks to its application, significant figures have been achieved, such as an overall recycling of packaging materials of 67.1% (year 2016) of the total consumption, with a total of 8.448 million tonnes (+ 2.7% over 2015). This is already largely above the European targets for 2020.

Resources

For more information, please consult the following link: www.conai.org, including CONAI sustainability report, 2018.

FOCUSED DESCRIPTION 2

Educational tools in waste prevention and management – Focus on the educational campaigns in Cremona, Italy

Environmental education is a „process through which individuals acquire awareness and attention towards their environment; acquire and exchange knowledge, values, attitudes and experiences, as well as the determination that will enable them to act, individually or collectively, to solve current and future problems of the environment". According to the International Union for Conservation of Nature, Commission on education and communication (IUCN), environmental education is a fundamental tool for changing behaviours and models through conscious choices oriented towards sustainable development. In the European Union, environmental education has become an integral part of the curricular activities of primary and secondary schools: many Member States have introduced environmental education in their schools as an educational offer.

In 2012, UNECE developed the document „Learning for the future: Competencies for Education for Sustainable Development", which recognizes in continuous learning the basis for the development of a sustainable society. In the documents produced by UNESCO and UNECE during the "Decade education for sustainable development" 2005 - 2014, education is not intended as an information tool but as a process of reforming the way of life and conceiving the environment.

In line with the international and EU commitments for environmental education, Linea Gestioni (LG) - a company specialized in the management of waste collection, transportation

and disposal service that operates in the provinces of Cremona, Lodi, Pavia and Brescia and one of the 27 partners of UrbanWINS – is strongly committed to building environmental sustainability through education and through building active roles in the society for the younger generation. LG supports students, teachers and public administrations in their work with the program „The Adventures of Professor LandLand", an educational program that provides educational support for classroom lessons and guided visits to waste treatment plants, waste recovery plants and energy production plants from waste.

The program is designed for five different age groups (3-5 years, 6-7 years, 8-10 years, 11-13 and 14-18 years) to better prepare tomorrow's global citizens. It is distributed to about 478 classes, with an average of 11,000 students per year. For over 20 years the LGH Group companies have been promoting educational projects to raise awareness among young generations about the waste, water and energy cycle. Over the years, the various educational projects have been harmonized in a single educational project since 2012, becoming „The adventures of Professor LandLand".

The present section is based on LG experiences with this program, and aims at sharing the deployment of the programme and its main learnt lessons that might be useful for urban waste companies, waste policymakers and other urban waste stakeholders interested in implementing similar educational campaigns.

Objectives of the programme

The program "The Adventures of Professor LandLand" aims at various complementary objectives to build complex, environmental competences – knowledge, skills and attitudes:

- promote environmental education and sustainable development in schools through a method of learning that goes beyond watching and listening to the teacher but involving students and teachers, in re-elaborating and deepening the contents;
- provide knowledge tools related to energy, waste, food, water cycle, agriculture, lifestyles, and energy supply that allow students to think critically, to reflect, to imagine new solutions, new approaches and new ideas;
- prepare students for "how to be ecologically aware" as a part of the living Earth system.

The programme kicked off with the involvement of the highest number of first and second level primary and secondary schools in the territories where LG is present. The project takes into account the ages of the pupils involved modulating the proposed activities accordingly. The interventions consist of lessons in the classroom in the form of games, lessons with experts, guided tours of the facilities. As far as the integrated waste cycle is concerned, guided visits are foreseen to: ecological platforms, waste treatment and transformation plants: waste recycling, compost production, waste-to-energy plants, woody biomasses facilities and landfills.

The educational project has a holistic approach which is able to involve pupils in a personal and responsible way. Faced with a topic shared with the teachers, or even proposed by the

students, the experts interact with the class facing the „problem" or „the topic", involving the students in a personal and responsible way, taking into account the knowledge and skills that students show. The lessons and the visits are interactive and based on the continuous dialogue / comparison with the experts, using various tools: thematic publications, technical sheets of the plants, concrete activities such as producing objects from waste such as paper or other recovery materials, shooting videos, doing research on internet or in the field, promoting specific activities for waste reduction within the school, participating in calls for tenders or projects or even organizing events that involve the territory.

Links of the programme with urban metabolism approaches

The study of urban metabolism allows quantifying inputs, outputs and the accumulation of energy, water, nutrients, materials and waste in a city. The holistic nature of urban metabolism allows comparing different stages of development and alternative urban assets to support the achievement of objectives compatible with sustainable development. In assessing sustainability, attention must be paid not only to the processes of consumption of matter and energy, but also to that extraordinary resource, renewable, which is knowledge. Educating tomorrow's global citizens through information and training programs focused on the environment to increase awareness and knowledge of environmental issues requires a holistic, systemic approach. The education for sustainable development is a fundamental tool to sensitize citizens for greater responsibility and conscious attention to environmental issues and to good governance of the territory.

The program provides didactic support for environmental sustainability, a theme that requires a multidisciplinary approach, as it combines knowledge of biology, earth sciences, chemistry, geography, history and more, various practical and social skills, such as cooperation, teamwork, empathy and solidarity.

At a more general level, the promotion of environmental sustainability based on urban metabolism approaches requires holistic and systemic competences in order to understand and act in a complex way on a city, as mentioned above. These types of key competencies – considered central by UNECE and UNESCO in order to develop the education for sustainable development – should be acquired by people since early stages of their life, starting with the school. In this sense, the program developed by LG prepares the pupils to act in a complex future society, in which environmental aspects such as waste are organically linked to other environmental issues, such as biodiversity, energy, water, but also with social and economic ones, complexity which is at the core of urban metabolism approaches.

Stakeholders involvement in the deployment of the program

The tool is designed to be used by any primary and secondary school. It involves not only schools, students and teachers, but also citizens, municipal administrations, waste collection service operators, consortia of waste packaging materials, local and non-local economic associations, NGOs. Obviously students and teachers are a central part of the program, as

they are also those who determine the development of the activities according to their interests and needs. Families, citizens, the community are an integral part of the program because it is to them that the students bring their knowledge of problems and solutions related to the environment. The public administrations are equally important because they share the events proposed by the students on the territory and / or prepare calls or selections in the environmental field.

Conclusions

Sustainability in general, and waste prevention and sound management in particular, needs young people, with their energy and creativity, to find solutions for the transformation towards a better future for mankind and the environment. In 2015, the representatives of 193 countries adopted what is in all respects the most important and pressing agenda of the century: the 17 sustainable development goals promoted by the United Nations. No Poverty, Zero Hunger, Quality Education or Climate Action, Sustainable Cities and Community, Sustainable consumption and production that addresses also waste issues - all the 17 global goals are important if we are to achieve the final milestone of a truly sustainable world. Young people are the real solution to these challenges, and they are perfectly placed to set in motion a revolutionary change. Young people are positive about the future, they are idealistic and their creativity enables them to think outside the box and find new solutions to problems that seem impossible to solve, including waste-related ones. Through their creativity and openness, they are one of the best actors capable of addressing sustainability issues by using complexity approaches, as it is the case of the urban metabolism ones, and participatory, democratic processes, two values added of UrbanWINS project. And last but not least, we must remember that there are a lot of young people in the world today, there are 3.5 billion young people aged below 30, an army that can make a huge contribution to the cause of sustainability.

FOCUSED DESCRIPTION 3

Voluntary tools in waste prevention and management – Tool focus: Green Public Procurement

Green Public Procurement (GPP) represents a strategic tool that public authorities can easily use in reaching various environmental targets, including in the waste sector. This section provides an insight into GPP definition, its relation to urban metabolism/circular economy and provides basic guidelines on GPP use for urban waste optimization objectives.

What is GPP and how can it be applied?

GPP is defined by the European Union as „a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured.” [63]

[63] Communication (COM (2008) 400), “Public procurement for a better environment”

GPP is a voluntary instrument, i.e., public authorities can define the extent to which they implement it, and can be applied by including clear and verifiable ecological criteria for products and services into the public purchasing procedures. The only exception to the voluntary nature of GPP is represented by Italy, which on December 2015 adopted a law that made it mandatory for all Italian public authorities to include minimum environmental criteria (CAM) in their public procurement actions. The CAM are provided as part of the Italian GPP National Action Plan and, at the end of 2018, covered 17 categories of products and services. Introducing GPP into the procurement practices requires some planning: defining the scope of the purchasing activities covered; setting clear targets, priorities and timeframes; organizing appropriate training for staff and monitoring performance. This initial planning allows municipalities to connect their procurement strategy with the city's own development goals, policies and challenges, and, in particular, to make use of GPP to support the achievement of the specific environmental goals already laid down in the sectoral policies (e.g. energy, mobility, waste and construction).

GPP role in reaching various environmental urban targets

Although GPP is a voluntary instrument, it has a crucial role to play in the EU strategy to make Europe a more resource-efficient economy. Through their procurement policies, public authorities can leverage their purchasing power to stimulate a critical mass of demand for more sustainable goods and services, while achieving relevant environmental protection targets. In particular, at a city level, GPP can play an essential role in reaching EU-related environmental policy goals established both by the Covenant of Mayors on energy efficiency and by the Circular Economy Package on waste prevention and management. As for the Covenant of Mayors, GPP can provide significant support for the implementation of the Sustainable Energy (and Climate) Action Plans, which each local authority is committed to adopting in order to achieve the EU 40% greenhouse gas reduction target by 2030. As specified by the documents attached to the agreement, measures on energy efficiency, projects on renewable energy and other energy-related actions can be introduced in many varied areas of regional and local government activity, by taking into greater consideration the relevant role played by public authorities as consumers, producers, and suppliers of goods and services. In several public sectors (e.g. construction and maintenance of buildings, buildings' lighting and heating, public transport, road lighting) many actions for energy efficiency and CO2 emission reduction could be put in place by merely including environmental and minimum energy performance criteria into the procurement processes of the relevant goods and services to be supplied.

GPP also has a key role to play in the achievement of the ambitious legally binding EU targets for waste recycling and reduction of landfilling established in the new Circular Economy Package adopted by the European Council on May 2018. The updated municipal waste recycling target is set to 55% by 2025, 60% by 2030, and 65% by 2035, while the landfill reduction target is set so as to ensure that no more than 10% of municipal waste is landfilled by 2035. Through their procurement policies, municipalities can drive a significant change for the durability, reparability, reuse and recyclability of many products, thus making it

easier for them to reach the above-mentioned EU policy targets on waste prevention and management. In fact, environmental criteria can be inserted on one side in public tenders for the assignment of urban waste management services so as to ensure that the service aims at high environmental performances, on the other side waste reduction objectives can be achieved by including relevant environmental criteria transversally in the acquisition of most goods and services. Some examples are: reduction of packaging in the delivery of goods; elimination of single-use cutlery in catering services for public canteens; requirements for separate waste collection in the execution of cleaning services; acquisition of recycled materials for buildings.

From the research work carried on within UrbanWINS, one of the conclusions is that the relevant stakeholders of the waste management chain see GPP as a critical element for innovative Waste Management Strategic Plans (WMSP) as it helps to overcome the technical, economic and bureaucratic issues which usually limit the efficient implementation of innovative practices.

The interdisciplinary approaches behind GPP and its links to urban metabolism and circular economy

Another important role played by green purchasing is its potential contribution in accelerating the delivery of the circular economy[64] and in optimizing urban metabolism. Circular public procurement is defined by the European Commission as "the process by which public authorities purchase works, goods or services that seek to contribute to closed energy and materials loops within supply chains, whilst minimizing, and in the best case avoiding, negative environmental impacts and waste creation across their whole life-cycle."[65]

Table 7 - Circular Procurement Models

System Level	Supplier Level	Product
Product service system	Supplier take-back system	Materials in the product can be identified
Public-Private Partnership	Design to disassembly	Products can be disassembled after use
Cooperation with other organizations on sharing and reuse	Reparability of standard products	Recyclable materials
Rent/Lease	External reuse/ sale of products	Resource efficiency and Total Cost of Ownership

[64] The European Commission defines the circular economy as an economic model where "the value of products and materials is maintained for as long possible. Waste and resource use are minimized, and when a product reaches the end of its life it is used again to create further value. This can bring major economic benefits, contributing to innovate, growth and job creation."

[65] European Commission, "Public Procurement for a Circular Economy" (2017)

Supplier take-back systems including reuse, refurbishment and remanufacturing	Internal reuse of products	Recycled materials

Many of the circular economy principles established within the EU Action Plan for the Circular Economy[66] are already reflected in the existing sets of EU GPP criteria[67] and will be increasingly integrated as new or updated sets of criteria are developed. Circular economy actions currently supported by GPP criteria sets include promoting product eco-design and design for recyclability, extended producer responsibility, waste prevention, collaborative economy, reuse and refurbishment (see table 4 above).

Overall, EU GPP criteria include requirements that increase the demand for products made with materials resulting from the treatment of waste, either by setting a minimum threshold for recycled content (e.g., in casings and components of computers and monitors), or by requiring the use of compost from separately collected waste for the provision of specific services (e.g., compost to be used as a soil improver and fertilizer for the gardening service). Other requirements stimulate the market uptake for products designed to be dissembled and recycled, as for the specifications requiring furniture items/parts to be easy-to-disassemble into different material streams, as minimum plastics, metals, textiles and wood.

Bringing circular concepts into school catering in Turin, Italy

In 2013, the City of Turin introduced a number of measures in their school catering contract to enhance its sustainability, which included requiring the use of energy efficient appliances and low environmental impact transport, as well as significantly reducing packaging and waste, for example by using tap water instead of bottled water, and favoring reusable and refillable products where packaging is unavoidable. In addition, contractors were required to shift from using plastic to reusable dishes. This one requirement alone resulted in a reduction of 157 tones/year of plastic waste.

Note: Box taken from "Public Procurement for a circular Economy", EC (2017)

By encouraging high-value recycling and functional use and reuse, all these requirements contribute to keep products and materials in the value chain for a more extended period and to transform waste in new inputs for urban metabolism, thus reducing the dependence of the cities on external resources.

[66] Communication (COM (2015) 614), "Closing the loop - An EU action plan for the Circular Economy"
[67] Full sets of EU GPP criteria are available at: http://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm

FOCUSED DESCRIPTION 4

Waste type focus: EEE (Electric and electronic equipment)

This waste stream type focus should help local decision makers and stakeholders to acknowledge and address the Waste of Electrical and Electronic Equipment (WEEE) problems as a part of urban metabolism and circular economy approaches, in line with various environmental requirements.

Challenges related to WEEE and its role in urban metabolism

All EEE purchased in one year will become WEEE over the years. Most probably, in 10 years, more than 60% will reach the waste flows. A study1 in this scope was made by the United Nation University and was included in the European regulation2 2017/699 for the calculation of the WEEE Generated at the State level.

WEEE is the waste with the fastest growing rate as technologies are changing rapidly and new types of products appear on the market, generating at the same time large quantities of discarded products.

WEEE contains hazardous substances that are harmful to the environment and human health, such as: freons, PCB oil, mercury, heavy metals, brominated flame retardants etc. These substances should be extracted and treated properly.

WEEE also contains materials with economic value that become secondary raw materials after the recycling processes: Fe, Al, Cu, Au, Ag, Pb etc. Multiple substances that are classified as “critical raw materials” by the European Commission are found in WEEE and therefore the concept of “Urban Mining” is close to this domain.

Besides the environmental and economic impacts, WEEE management presents some important social challenges, mostly related to the labour conditions from the developing countries where WEEE is processed for the recuperation of various materials. However, in various urban areas, WEEE management can generate contexts to recreate social links within community self-organized structures for WEEE repairing or recycling, such as the fab labs or repair cafés.

WEEE Responsibilities

WEEE is subject to extended producer responsibility criteria that are implemented in the EU by the Waste Directive3 2008/98/CE and WEEE Directive4 2012/19/EU. The last one lays down collection targets for the Member States of 65% from the average quantity put on the market in last three years (starting 2019 and 2021 in Eastern Europe) or 85% from generated WEEE.

Producers are responsible for the EEE put on the market starting with the eco-design and finishing with organizing and paying the costs of collection, recycling and sound environmental disposal. In most EU countries, producers established PROs – Producers Responsible Organizations – to fulfil their mandatory requirements of collection and recycling. There are cases where PROs have other types of private ownership. In some EU countries, there are Clearing Houses established to make sure that all producers are involved.

Municipalities have the responsibility to provide availability and accessibility for the necessary collection facilities to their citizens.

Retailers and distributors are obliged to take-back, free of charge, the WEEE handed-over on purchasing new products. For very small WEEE - external dimension should not exceed 25 cm - they should provide recipients for WEEE collection if the facility has more than 400m2 of EEE sales area.

All WEEE should arrive at authorized treatment operators' yards in order to extract pollutants and meet the recycling targets. Being certified in CENELEC standards EN 50625 or WEEELABEX standards means that a treatment operator is doing a proper job in protecting the environment and human health.

The objectives of urban decision-makers in WEEE area should include at least the four complementary ones listed and explained below:

1. Provide solutions for discarded WEEE available to all citizens and business sector
2. Education and information and awareness campaigns
3. Encourage reuse and preparing for reuse/repair
4. Protect human health and the environment by limiting the dispersion of hazardous substances caused by improper WEEE treatment in the informal sector.

1. Solutions to collect discarded WEEE

A municipality should be considered performing in this field if it can account for WEEE collected quantities in one year close to 65% of the average purchased by the citizens and the business sector in the last 3 years or 85% of WEEE generated in that year (it is difficult to calculate but includes the principle that all EEE become WEEE after a specific period), as per country target mentioned in WEEE Directive 2012/19/EU2. In this case, all quantities should be considered: those collected by the municipal collection points or from the mobile collection, collected by authorized WEEE collectors from business-to-business (b2b) and by retailers.

As a principle, every citizen should have access to municipal services for WEEE collection and he/she should know about it.

These services should include:

• Municipal collection points – they can combine WEEE with other recyclable and reusable

waste, and other hazardous waste from households (that should not be sent to landfill): package waste, batteries, paper, plastic, iron scrap, oil, furniture, books etc.
- These collection points should be established in peripheral areas but with easy access for the citizens.
- The mobile collection should be made by the municipality, with the message to place WEEE outside the house on one specific day to be collected, at least one time per quarter. The day should be widely promoted in the local media.
- WEEE collection bins for small WEEE should be present in all institutions depending on the municipality. This requirement should also apply for companies with more than 20 employees. Boxes for toner and lamps, also considered as WEEE, should be present in all businesses and in the public sectors.

The cost of WEEE collection should be covered by PROs (Producer Responsibility Organizations) in a transparent way or with their involvement in the previously mentioned operations. WEEE collected should be handed over to the PROs in order to ensure proper recycling with authorized treatment operators, preferably EN 50625 certified.

2. Education and information

Education is a very important pillar in the WEEE field. People should know that WEEE must be collected separately in order to protect the environment and human health from hazardous substances and also to gain secondary raw materials.

People should also be aware of WEEE collection facilities provided by municipalities and retailers.

Education should start in kindergartens and schools with dedicated sessions for recycling and collection contests.

Local media (TV, newspapers, online media) play also an important role in explaining to people why WEEE and other waste should be recycled and discarded in a proper manner.

Good examples should be promoted as good practices while the bad examples should also be highlighted.

Collection and awareness campaigns, organized together with PROs, are highly appreciated by the public. Involvement of local officials and other local personalities is necessary.

A citizens' guide should be edited by the municipality every year and should include all obligations of the members of the community, including the separate collection of WEEE and places to properly discard them. This guide should be printed and sent by post to every household.

The municipality website should include a section for waste, including WEEE – why to collect and where they can be discarded. The municipality should promote the proper behaviour on social media.

Combating the bad behaviour should be also organized – fines should be given to those who discard WEEE improperly and the business sector must prove where their WEEE are discarded.

3. Encourage reuse and preparing for reuse

This objective has multiple benefits:
- It is part of the circular economy and there are multiple models that could be implemented,
- It reduces social discrepancies making products available for people with low income,
- It creates jobs in repairing shops,
- WEEE prepared for reuse is accounted for recycling target for municipal waste.

When we talk about proper WEEE prevention, reduction and reuse, we need to consider some mandatory measures, which should be met by the actors involved in managing these types of waste. Pressure should be put on EEE producers to eliminate the planned obsolescence, to increase the use period by at least 10 years (as there was 30 years ago for example for large appliances such as refrigerators, washing machines), to consider the eco-design that uses recycled raw materials, materials from sustainable sources and materials that have a longer lifetime, imposing the obligation to make reusable, easily repairable and sustainable products and providing the necessary information for repair centres to stimulate such „business".

Of course, imposing these obligations on manufacturers can only be done through regulatory norms, fortunately the European directives are easily moving towards these resolutions. Until such measures are adopted at the central level, municipalities have the possibility of adopting local measures to support these solutions.

What a municipality should do (adopting some measures that have proved effective in many European countries):
- improving the monitoring system, traceability and supervision of waste management activities
- the development of separate collection, transport and storage conditions to allow adequate preparation for re-use and to prevent the destruction and loss of materials; for example, collection points must have a space dedicated to reusable goods;
- recognition of the role of social economy actors in waste collection and treatment as well as the possibility of donating WEEE to these entities –so that they can carry out the verification, separation, repair, post-donation (etc.)
- the possibility of including social clauses in public procurement and partnerships to give priority to social economy actors in waste management activities
- encouraging set up of reuse hubs – places where people could bring stuff they don't need

and other people can take it for free or after working there for a couple of hours (example in Romania: www.samusocial.ro)
- encouraging second-hand markets (as was done, for example, in Sweden: https://www.retuna.se/sidor/om-retuna/)
- encourage the opening Repair Café for WEEE (a public meeting place in order to fix together objects that have been broken). There are already over 1.500 Repair Cafés worldwide (https://repaircafe.org/en/)

4. Combating the informal sector

In some EU countries, such as Romania, the informal sector is strongly present in WEEE field. Abandoned WEEE is picked up or purchased from citizens against a small payment, materials with value are removed, all pollutants are released and unwanted materials are left randomly. Important quantities of WEEE like washing machines, fridges and cooking devices are lost in iron scrap flows with no depollution and no evidence.

In Western Europe, important quantities are shipped illegally to African countries, where some products are refurbished and the rest are improperly treated, generating huge pollution problems.

An important project6 CWIT – Countering WEEE illegal trade – was conducted by a consortium that included Interpol, determined that 70% of WEEE is not properly managed.

The municipality should combat this phenomenon by:
- Involving local police to stop the informal street collection
- Control the iron scrap yards and give fines if there are WEEE mixed in iron scrap
- Cooperating with national environmental guard and police to combat the illegal waste shipments

Sources:

1. https://unu.edu/projects/e-waste-quantification.html#outputs
2. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017R0699
3. https://eur-lex.europa.eu/legal-content/RO/TXT/?uri=CELEX%3A32008L0098
4. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32012L0019
5. http://ec.europa.eu/environment/waste/weee/standards_en.htm
6. https://www.cwitproject.eu/

FOCUSED DESCRIPTION 5

Waste indicators focus: Informative framework for waste collection - indicators for planning and monitoring, ISTAT, Italy

The present is an info tool suggested as a possible way for the local administrators and other stakeholders to follow in order to delineate the basic informative framework for waste collection. The info tool has been developed by the Italian Institute of Statistics, ISTAT, one of UrbanWINS partners and can support the implementation or improvement of the urban waste management cycle, in particular in the collection phase. It is particularly useful for national/regional institutions in charge of statistics, as well as for urban decision-makers in their work of collecting waste qualitative and quantitative data.

The waste informative framework developed by ISTAT is composed of two parts:

1)An inventory of statistical sources for Italian municipalities, which make available information on

i. production and management of urban waste by Italian local authorities
ii. citizen behaviour with respect to separate waste delivery
iii. citizen opinions on waste collection services
iv. policies adopted by authorities on a random sample of Italian municipalities in order to prevent and reduce waste production and facilitate recycling (also on those actions which local authorities could apply to their own structures and offices).

2)A descriptive report on the main evidence-based information deriving from surveys on the above-mentioned issues, built thanks to the most recent results available. The description of the present informative framework tool also encompasses some recent Italian evidence-based data in order to provide some waste qualitative and quantitative highlights that could be representative for other EU countries too and it can be consulted in Annex 2 of the Toolkit.

Objectives of the informative framework

The inventory and the descriptive analyses are made available on an annual basis to local authorities and stakeholders required to develop proper management processes of the waste cycle, calling users to share and participate in it. The objectives of this info tool are:

- Have a general framework to use as info base on the issue of waste management,
- Have an inventory of sources of easy access to use in order to update and replay analyses with respect to regional context and years of interest,
- Have an inventory of relevant indicators (and relative metadata) which to foresee computation of
    - ex-ante during planning/re-engineering phases of the collection management process and
    - ex-post while monitoring the results: measures of effectiveness and efficiency of the processes and user satisfaction.

Description

The inventory of statistical sources for Italian municipalities is based on data collection from official statistics or from local surveys:

i. Separate production and collection of urban waste: general overview (Italy - NUTS1, NUTS2) and Cities (Italy - LAU2: metropolitan core units and provincial capitals)

Description: The amount of urban waste produced and the impact of the collected amount through separate mood represent a strategic indicator for the planning/re-engineering of the waste collection system and for the planning of management ways of it.

Source for Italy
For the computation of both the indicators the source to refer to for Italy is the database on urban waste (RU), which can be accessed to via the National land register managed by "Istituto Superiore per la Protezione e la Ricerca Ambientale – Ispra (The National System for the Environmental Protection – SNPA). It contains information on the separate production and collection (including details at the municipal level), on the management (including each single plant) and on the cost of the service of urban cleaning (including details at the municipal level).

ii. Behaviour and perceptions of Italian households with respect to the conduction of separate collection: general overview (Italy – NUTS1, NUTS2 and LAU2 Class)

Description: Citizen assessments which describe delivery behaviour, causes which may affect the proper separation of waste, the overall perception of the quality and satisfaction of the effective and efficient collection service adopted are all elements to take into account for the implementation of an effective and efficient collection service that could count on the active collaboration of the users.

Source for Italy
The Italian municipalities could consult data resulting from the survey made by Istat: "Aspetti della vita quotidiana/Aspects of Daily Life". This is a survey carried out according to the sample type on annual basis (in the first quarter of the year on a sample of about 28 thousand households (information is directly given by all individuals aged 14 and over which are members of). The data collected from the survey can be matched up with four macro thematic groups: 1. household, housing and area where it is settled down; 2. health conditions and way of living; 3. culture, social life and activities in the spare time; 4. services. In detail, the survey gathers data on: carrying out of home composting; access to services for waste delivery: availability of garbage cans; availability of an opinion on door-to-door services; opinion on the cost of the service of waste collection; carrying out of separate waste delivery by households in cans located in the streets, through door-to-door collection, in waste separation areas (according to product groups of waste that can be delivered); reasons of non-carrying out and opinions on policy and incentives to carrying out separate delivery.

iii. Policies adopted by metropolitan core units and provincial capitals (Italy - LAU2) for prevention/reduction of waste production and facilitate its recycling

Description: The inventory of best practices activated by local authorities for the prevention and reduction of waste production, paving the way also to the effective circular reboot, enables local authorities to know and make a comparison with the actions adopted in other contexts and repeat them, eventually reshaping them in the more suitable ways for their its own territorial area.

Source for Italy
The data resulting from the survey by Istat "Dati ambientali nelle città / Urban Environmental Data": the territorial universe which the survey refers to is represented by capital provinces or the centre of a metropolitan city (116 cities: more than 18,2 million inhabitants, 30% of the Italian population) among which 14 LAU2 city core of metropolitan area (Turin, Genoa, Milan, Venice, Bologna, Florence, Rome, Naples, Bari, Reggio di Calabria, Palermo, Messina, Catania e Cagliari) and 4 LAU2 Provincial Capitals with a population of more than 200.000 inhabitants including LAU2 i.e. Verona, Padova, Trieste e Taranto. The survey is made up of 8 questionnaires which gather data on the following thematic dimensions: air and noise pollution, urban green areas, eco-management policies; environment utilities: water, energy, local means of transport and urban waste. For the 8 environment issues, a set of indicators is spread about not only pressures, state-of-the-art and impact for the main thematic dimensions which qualify the urban environment but also about the relative action in reply activated by the administrations in order to grant the quality of the urban environment and of the main environmental services.

iv. Sustainable management of the structures of the local Public Administration (metropolitan core units and provincial capitals. Italy - LAU2) on the issue about produced waste sorting

Description: Among the policies applied by local authorities on the proper waste delivery those addressed to an eco-friendly management of the offices or within the administrative processes are most relevant. The latter can be described in accountability reports in order to make administrative action transparent and shared with citizens.

Source for Italy
Istat survey which users can refer to in order to define the information statistical framework is "Censimento continuo delle istituzioni pubbliche / Permanent Census Of Public Institutions". Nowadays this survey is conducted every two years to collect data not only about the structure of the institutions within Public Administration but also about the carrying out of separate collection within each single local unit.

Relation to urban metabolism

The present info tool is focused on the way to manage urban waste and particularly in its collection phase. An efficient collection, starting from waste delivery in separate parts, is a

strategic factor for the metabolism outputs' measurement as well as for the planning of re-use and recycling ways necessary to minimize pressures produced by the cities on resources and environment.

Stakeholders involvement in the deployment of the tool

The various stakeholders can use the tool according to different perspectives:
- the national institutes of statistics, regional and local authorities to define a basic informative framework to support the implementations and improvement of the cycle of urban waste management, particularly in its collection phase and, through the monitoring of the indicators, to verify the effectiveness of the applied policies;
- citizens and other users in order to have a transparent framework on the efficiency of the local administrative action.

The use of the tool within the UrbanWINS project

Some information and indicators proposed in the present info tool have been used to define the initial framework about the issue of production and collection of urban waste by the Italian pilot cities (Deliverable 1.1. State of the Art for Waste Prevention and Management Strategies in UrbanWINS countries and municipalities).

Conclusions

Applying the tool as a definition of the informative framework is fundamental for all those administrations oriented to planning or reshaping the waste management cycle and, in particular, the collection phases of urban waste (state-of-the-art and indicators for the monitoring). In order to have a successful policy also the part of the tool which describes the framework of citizens' behaviour on waste delivery, level of satisfaction of the service and the initiatives that in users' opinion would facilitate the best practices of delivery and collection (including the activities to support prevention of production and reduction of the delivered share) is to be considered relevant. This is a strategic component: the proposed indicators are in fact intended for the assessment of the positive involvement of users, an indispensable factor without which the outcome of policies, even the theoretically better ones, risks turning into a failure. An important, potentially critical factor to be taken into account for this component is the „granularity" of the information data available. The best option for the acquisition of data on behaviour and user satisfaction is to foresee both targeted information campaigns and survey on local samples to investigate the many different social and economic realities that characterize urban contexts and which are translated into much differentiated answers by the users, in order to provide policies „cut" on specific local realities.

Resources

For more information, please consult the following document: "UrbanWINS D1.2: Assessment

of Determinants and Effects of Waste Prevention and Management Strategies Policies and Strategies" available here: https://www.urbanwins.eu/wp-content/uploads/2018/02/UrbanWins_D1-2_Assessment-of-determinants-and-effects-of-waste-prevention-and-policies.pdf

External references:

- ISPRA - Istituto Superiore per la Protezione e la Ricerca Ambientale – National Waste Cadastre: http://www.catasto-rifiuti.isprambiente.it/

National programme for waste prevention: http://www.minambiente.it/sites/default/files/archivio/normativa/dm_07_10_2013_programma.pdf

- Directive 2008/98/CE Targets for the reuse and recycling of specific waste flows: https://eur-lex.europa.eu/legal-content/IT/TXT/PDF/?uri=CELEX:32008L0098&from=IT
- Legal decree no. 152 from 3 April 2006 for the unique environmental test, art. 205 "Measures to increase separated waste collection" http://www.gazzettaufficiale.it/atto/serie_generale/caricaDettaglioAtto/originario?atto.dataPubblicazioneGazzetta=2006-04-14&atto.codiceRedazionale=006G0171
- Istat survey "Aspects of daily life": http://siqual.istat.it/SIQual/files/AVQ2017%20-%20ISTAT_IMF-7_A.17.pdf?ind=0058000&cod=5094&progr=1&tipo=4
- Istat survey "Dati ambientali nelle città"/"Urban environmental data": https://www.istat.it/it/archivio/55771 and http://www.istat.it/it/archivio/207482
- Complete framework of the collected information from Istat survey "Censimento continuo delle Istituzioni Pubbliche"/"Permanent Census Of Public Institutions": https://www.istat.it/ws/fascicoloSidi/431/CensIP_Modello%20unit%C3%A0%20locale.pdf
- DPSIR model, European Environmental Agency (EEA 1995): https://www.eea.europa.eu/publications/92-9167-059-6-sum/page002.html
- National annual report 2017 from the Coordination centre Batteries and Accumulators: http://www.cdcnpa.it/wp-content/uploads/Rapporto_Annuale_2017_CDCNPA.pdf
- Definition of LAU2 Hinterland of metropolitan areas of Istat survey "Aspetti della vita quotidiana"/"Aspects Of Daily Life": https://www.istat.it/it/informazioni-territoriali-e-cartografiche/sistemi-locali-del-lavoro

Part 3 - Guidelines for stakeholders' engagement in urban waste policies

3.1 General considerations on stakeholders' engagement

In an ever-increasing complex world, as the one we are living in today, stakeholder engagement processes have evolved from a "should" to a "must" for almost all institutions and companies. Taking into account the interactions between the social, economic, environmental, cultural and political spheres in our societies, stakeholder engagement becomes more and more necessary in the life cycle management of public policies. Nowadays, public policies need to overcome the reductionist paradigm that characterised the previous industrial era, accordingly to which each domain and sector should develop and be dealt with autonomously (e.g., public policies aiming at social objectives, others at economic ones etc.).

Decision makers and other organizations involved in public policy design and implementation need to challenge themselves to open the decision-making process to as many actors as possible in order to feed public policies with heterogeneous perspectives, thus building the basis for public accountability and ensuring an interdisciplinary dialogue between disciplines and sectors. The need to engage stakeholders is even more necessary in the processes and policies dealing with sustainability, an area that is by definition complex, interdisciplinary and that will be confronted with ever-increasing challenges such as climate change, biodiversity, resource scarcity, equity etc. Stakeholders engagement is a two-way process, aimed at bringing additional experiences and perspectives in the decision-making process, and a way for the local actors to be more accountable and take responsibility for actions that influence long term policies, otherwise known as social responsibility.

PILOT CITY TESTIMONIAL

Ana Esperança, Councilwoman for health and Environment at Leiria Municipality

„We consider that the crucial aspect of UrbanWINS was the innovation provided by the participatory process itself. During and at the end of the process, people felt proud to have been involved effectively and to have contributed to the definition of local politics. It is expected that the implementation of the actions will have adequate financial and institutional support. Participatory processes and methodologies used in the project (SWOT, reports, Agoras, etc.) have contributed to policymakers' awareness of difficulties, proposals and even expectations of

stakeholders, including citizens, associations, traders, industry and services. Based on this knowledge, decision-makers will be able to plan strategy and management options more in line with the key issues identified by stakeholders."

According to the international standard ISO 26000 "Guidance on social responsibility"[68], a stakeholder (or interested party) represents an individual or organization that is affected, positively or negatively, by the decision and activities (such as projects, public policies, campaigns etc.) of another organization. According to the same standard, stakeholder engagement represents an "activity undertaken to create opportunities for dialogue between an organization and one or more of its stakeholders, with the aim of providing an informed basis for the organization's decisions". The engagement of stakeholders is considered by the same standard as one core principle of the social responsibility policy of an organization (company, public authority, NGO etc.).

In the case of urban waste prevention and management policies, stakeholders refer to people and organizations having a direct or indirect interest in waste prevention and good management, and participating in activities that make this possible. Stakeholders may generate waste, function as service providers, participate as state or local government departments (with decision makers and technicians), academia or other relevant research institutes, NGOs and other organizations concerned with certain aspects of waste prevention and management.

When placing waste policies in the broader context of urban metabolism, the analysis of stakeholders is enlarged with actors

- from urban areas having positive or negative impacts on waste (such as construction, agri-food, transport),
- having an interest on urban policies affected by waste such as climate change, air pollution, health, environmental justice, and
- from professional areas that were not traditionally involved in waste processes (such as research, business incubators, different professional associations outside the waste sector).

An extensive list of categories of waste stakeholders from the urban metabolism perspective is provided in the next sub-chapters.

To resume, identifying and engaging stakeholders represents a way of opening the decision-making processes towards those who are positively or negatively affected by it, thus contributing to the design and implementation of participatory public policies. Stakeholder engagement activities bring a large palette of positive effects, as we will see in the next sub-chapter.

[68] www.iso.org/iso-26000-social-responsibility.html

3.2 Role of stakeholder engagement in urban waste prevention and management policies

3.2.1 Benefits and opportunities of stakeholder engagement in urban sustainability policies

Waste sector is very sensitive and dependent on public and stakeholders' cooperation to prevent, reduce and recycle and their understanding and acceptance of innovative waste management practices. If in the past the communication efforts of the waste sector focused on the traditional approaches of advertising, PR and marketing, more recently it opened to new approaches, stakeholder and community engagement being the most important ones, thanks to the benefits and opportunities they trigger. These include:

- broader base in the society where to solicit ideas, test visions, discuss alternatives for waste prevention and management;
- higher likelihood of long-lasting support of decisions and actions in society, the wider and more diverse involved stakeholder groups are;
- promotion of leadership and assuming the responsibility of decisions;
- enhancement of the pool of creativity and unexpected solutions or ways on how to get there;
- funding and sponsoring by third parties, taking over work using a different/additional budget, including public-private partnerships;
- the inclusion of influential third parties with significant history/standing in the region;
- different ways of thinking, different perspectives based on different expertise and knowledge of each group;
- anchoring in the young generation approaches if young people are involved;
- involvement of dominant players to change their conventional mentalities on "traditional" procedures (e.g., conventional construction vs. green construction) leading to long-lasting positive effects;
- collaboration for synergistic effects (e.g. to minimise waste early on instead of handling waste as intelligently as possible afterwards);
- stakeholders representing different regional scales (from city districts to regions, national or international level) that provide other perspectives to the process, at micro and macro scales;
- involvement of stakeholders that do not feel the same type of „pressure" when having to give comments and make decisions;
- on mid / long term, acquire and maintain a wider legitimacy and maintenance of the social license to operate for waste management companies.

3.2.2 Methods for the identification and selection of relevant stakeholders for urban sustainability policies

Organizations/authorities and their activities (such as public policies) may have many stakeholders. Moreover, different stakeholders have various and sometimes competing interests. For example, community residents' interests could include the positive impacts of an authority or policy, such as employment, safety or focus on clean neighbourhood, as well as the negative impacts of the same policy, such as pollution. In order to put an initial "order" in this palette of actors, organizations can use a first set of criteria for the identification of stakeholders depending on how they are positioning themselves compared to the organization or activity: internal vs. external; primary vs. secondary; actual vs. potential; strategic vs. moral; voluntary vs. involuntary etc.

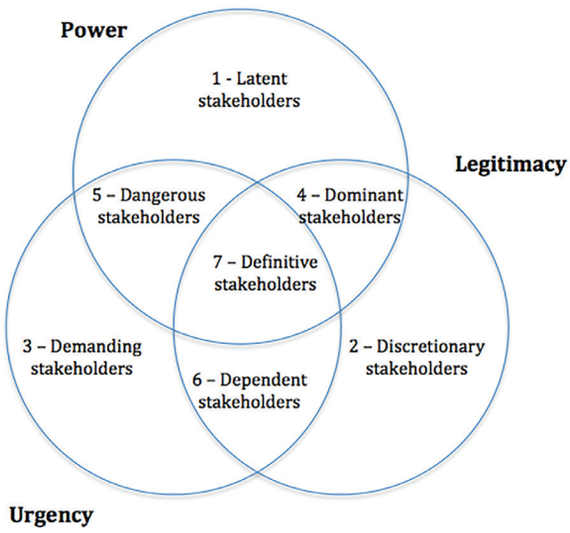
It is important to underline that not all stakeholders of an organization belong to organized groups that have the purpose of representing their interests; it can be the case of vulnerable groups, of citizens that have difficulties in getting auto-organized. Such categories of stakeholders' risk to be overlooked or ignored in the decision-making process. Moreover, an authority should examine whether groups claiming to speak on behalf of specific stakeholders or advocating specific causes are representative and credible; in the case of waste management, a particular attention should be paid to professional associations who rarely represent all the interests of the industry and to the consumers/citizens associations who have challenges in gathering representative voices. In order to overcome such challenges and make sure that the process of stakeholder identification and engagement starts on sound premises, the social responsibility standard ISO 26000[69] recommends that the organizations start by answering the following questions:

- To whom does the organization have legal obligations?
- Who might be positively or negatively affected by the organization's decisions or activities (such as a public policy)?
- Who is likely to express concerns about the decisions and activities of the organization?
- Who has been involved in the past when similar concerns needed to be addressed?
- Who can help the organization address specific impacts?
- Who can affect the organization's ability to meet its responsibilities?

Answering these preliminary questions will help to make a first, informal step of identification of relevant actors to be engaged. A second, more formal step consists in the classification of stakeholders in order to prioritize the actors that will afterwards be involved in the respective activity or policy. The literature and practice of stakeholder engagement from the last three decades proposed several criteria for the classification of the stakeholders in order to enable organizations to prioritize the engagement only of those having a direct impact on an activity or process. We will briefly present two of the most common and user-friendly ones.

[69] Info available at https://www.iso.org/iso-26000-social-responsibility.html (accessed in January 2019)

One is the model of Gardener et al. (1986). It proposes to classify stakeholders according to two criteria: power and dynamism. By combining them, we obtain four types of stakeholders. For example, we can have weak but dynamic stakeholders, such as some environmental associations. They are often unpredictable, and it is difficult to assess a priori what their support / impact on a project might be. Another type of stakeholder, accordingly to this classification, is the powerful and dynamic one, which should be taken into account in the decision-making process. This is, for example, the case of waste professional associations. If your project/policy meets their needs and expectations, they can be an important support for it; if it is poorly engaged, this type of stakeholder could endanger it.



Stakeholder typology adapted according to Mitchell R., Agle B., and D. Wood (1997)

A second model has been proposed by Mitchell R., Agle B., and D. Wood (1997). It ranks and prioritises stakeholders according to three attributes and seven possible combinations. Stakeholders with all three attributes are referred to as „definitive" because they are unavoidable and must be included in the engagement and consultation process. The importance of stakeholders decreases when they have only two attributes („dependent", „dangerous" and „dominant"). So, they are called „pending". Stakeholders with only one attribute are considered „latent" („dormant", „requesting" and „discretionary"). Actors who have none of these three characteristics are not considered stakeholders and are excluded from the engagement processes.

We can use the above classification systems not only for the analysis of stakeholders of waste policies in general, but also of the stakeholders interfering when placing these policies in the context of urban metabolism. Thanks to their extensive use in the literature and practices dedicated to stakeholder engagement and to their user-friendliness, these stakeholders' classification systems have been selected and used within UrbanWINS in the first steps of stakeholder involvement processes.

The first step has been to decompose urban metabolism process in various components – material inputs in a city, physical outputs as well as symbolic, non-material inputs and outputs - identify relevant stakeholders for each of them.

The analysed components are summarised in the table below.

Table 8. Relevant urban metabolism components for the waste stakeholder identification process

MATERIAL INPUT	• Raw Materials • Products • Energy
PHYSICAL OUTPUT	• Waste from households • Waste from construction sector • Waste from trade and industry • Waste from waste treatment • Emissions of CO2 and other greenhouse gas emissions • Particulate matter
SYMBOLIC INPUT and OUTPUT	• Socio-political factors • Architecture • Knowledge • Information • Technologies • Values (culture) • Gender dimension

The identification and classification of stakeholders starts with their positioning within the urban metabolism framework. For each of the input and output components of the urban metabolism selected as relevant (see table 1 above), likely stakeholders are identified, on the basis of their role in relation to that specific component, i.e. if they can be potentially affected by a change in the input/output or if they can potentially affect that change with their actions and choices. This leads to the identification of the general groups of stakeholders that represent the basket of stakeholders to be addressed by the organization / decision-maker / public policy as a whole. Those groups are reported in Table 2 and 3 below. In practice, Table 2 and 3 are built by answering the following questions:

1) who is most affected by a change in the present urban metabolism in respect to every single input and output?
2) who can influence most the present urban metabolism in respect to every single input and output?

Table 9: Likely stakeholders for selected material and physical components of the urban metabolism

MATERIAL INPUT		
	STAKEHOLDER GROUPS POTENTIALLY AFFECTED	STAKEHOLDER GROUPS POTENTIALLY AFFECTING
Raw materials	• Producers/ importers of raw materials • Producers/ importers of secondary raw materials • Farmers • Mining companies • Forestry companies	• Universities and research institutes • National, regional and local policy makers • Advocating NGOs • Firms operating in the green economy • State owned companies
Products	• Building companies • Producers of semi-finished goods for the building sector • Private operators/consortia operating in the collection and treatment of waste • Trading companies (includes big and small retailers-hypermarkets, supermarkets, grocery shops- and commercial activities- restaurants, cafes, clothing shops, etc.) • Companies of industrial sectors other than building and waste • Companies from the agri-food sector • Providers of public services	• Policy makers at national and EU level • Universities and research institutes • Advocating NGOs • Public authorities implementing GPP • Critical consumers
Energy	• Producers/ importers of energy (including producers from biomass at municipal level) • Energy distributors/grids • Independent energy producers	• National, regional and local policy makers • Local administrations • Firms operating in the sector of renewable energies • Local action groups • Universities and research institutes • Citizens

PHYSICAL OUTPUT		
	STAKEHOLDER GROUPS POTENTIALLY AFFECTED	**STAKEHOLDER GROUPS POTENTIALLY AFFECTING**
Waste from construction sector	• Private operators /consortia working in the collection and treatment of waste from the building sector • Companies and operators of the restoring sector	• Policy makers • Local public administration • Green young innovators/ incubators • Universities and research institutes • Advocating NGOs
Waste from trade and industry	• Private operators /consortia working in the collection and treatment of waste from industries • Trading companies (includes big and small retailers-hypermarkets, supermarkets, grocery shops- and commercial activities -restaurants, cafes, clothing shops, etc.) • Providers of public services • Companies from all production sectors	• Policy makers • Local public administration • Universities and research institutes • Advocating NGOs
Waste from waste treatment	• Private operators /consortia working in the collection and treatment of waste	• Policy makers • Local public administrations • Universities and research institutes • Advocating NGOs

Emissions of CO_2 and other greenhouse gas emissions	• Producers/ importers of raw materials • Producers/ importers of secondary raw materials • Farmers • Mining companies • Forestry companies • Building companies • Producers of semi-finished goods for the building sector • Private operators/consortia operating in the collection and treatment of waste • Trading companies (includes big and small retailers-hypermarkets, supermarkets, grocery shops- and commercial activities -restaurants, cafes, clothing shops, etc.) • Companies of industrial sectors other than building and waste • Companies from the agri-food sector • Providers of public services • Producers/ importers of energy – (including producers from biomass at municipal level) • Energy distributors/grids • Independent energy producers	• Cooperatives for the consumption of renewable energy • Business and professional associations • Farmer associations • Breeder associations • Organic producers/ associations of producers • Citizens • Green young innovators/ incubators • Local action groups • Universities and research institutes • Advocating NGOs • PAs implementing GPP • Firms operating in the green economy
Particulate matter	• Companies of the automotive and mobility sector • Companies operating in the cement sector • Producers of heating systems • Managers/owners of incineration plants • Owners of wood fuelled plants (e.g. households, industries, restaurants) • Operators of the agricultural and forestry sectors • Wood treatment industry	• Policy makers • Local public administrations • Citizens • Research institutes • Technology poles • Advocating NGOs

Table 10: Stakeholders for the symbolic components of the urban metabolism

SYMBOLIC INPUT/OUTPUT		
	STAKEHOLDER GROUPS POTENTIALLY AFFECTED	STAKEHOLDER GROUPS POTENTIALLY AFFECTING
Socio-political factors	• Citizens • Companies	• Universities and research institutes • Policy makers • Advocating NGOs
Architecture	• Building companies • Citizens	• Architects/ engineers • Policy makers • Urban planners • Critical consumers • PAs implementing GPP • Universities and research institutes
Knowledge	• Companies • Policy makers • Citizens • Public administration • Advocating NGOs • Green innovators	• Research institutes • Schools • Environmental education centres • Experts on waste management • Experts on eco-design
Information	• Companies • Policy makers • Citizens • Public administrations	• Universities and research institutes • Media • Advocating NGOs • Environmental education centres • Schools
Technology	• Companies • Policy makers • Citizens • Public administrations	• Universities and research institutes • Technology poles • Green young innovators/ incubators
Values (culture)	• Companies • Policy makers • Citizens • Public administrations	• Schools • Advocacy NGOs • Environmental education centres • Media

Gender dimension	• Families • Male citizens • Female citizens	• Policy makers • Media • Schools

3.2.3 Stakeholder engagement process – steps and participatory techniques

The engagement of stakeholders represents a complex but yet full of rewards process that should consistently engage at least one staff member of the organization in charge of coordinating the process (in the case of UrbanWINS, a municipality or any other stakeholder having an interest on waste and/or urban metabolism in connection to waste). In other cases, the stakeholder engagement processes are led by the PR/communication/external relations departments, in close cooperation with the technical departments in charge of the activity for which the engagement of stakeholders is sought. In the case of a waste policy, the process can be pursued by the communication department of the decision maker body in partnership with the waste /public utilities/ environmental / sustainable development departments.

Before starting this process, it is important for an organization to be aware of the steps and tools that are recommended to be engaged in order to obtain optimal results, and to properly plan the objectives, timing and resources of the stakeholder engagement process. The lines below summarise this process in 5 steps, derived from the "Stakeholder Engagement Manual – The practitioner's handbook on stakeholder engagement"[70] elaborated by AccountAbility, the United Nations Environment Programme (UNEP), and Stakeholder Research Associates. The Manual offers detailed information on each of the five steps, and it represents a useful lecture for the readers that would like to set up a consistent process of stakeholder engagement.

5 steps for getting stakeholders engaged

The steps proposed by UNEP have been followed and adapted for the process of stakeholder engagement of UrbanWINS.

1) Strategic thinking

In the first step, the organization is trying to answer strategic, political questions related to the stakeholder engagement process such as „who", „what", „why"

[70] http://www.unep.fr/shared/publications/pdf/webx0115xpa-sehandbooken.pdf

and "who" will be involved in this process? What common vision can we build with the interested parties? What do we want to accomplish with the stakeholders? What are the reasons for proposing such a project/public policy?

It is recommended that this step be realised with the involvement of various internal departments of the respective organization, in order to gain their support in the process.

2) Analysis and planning

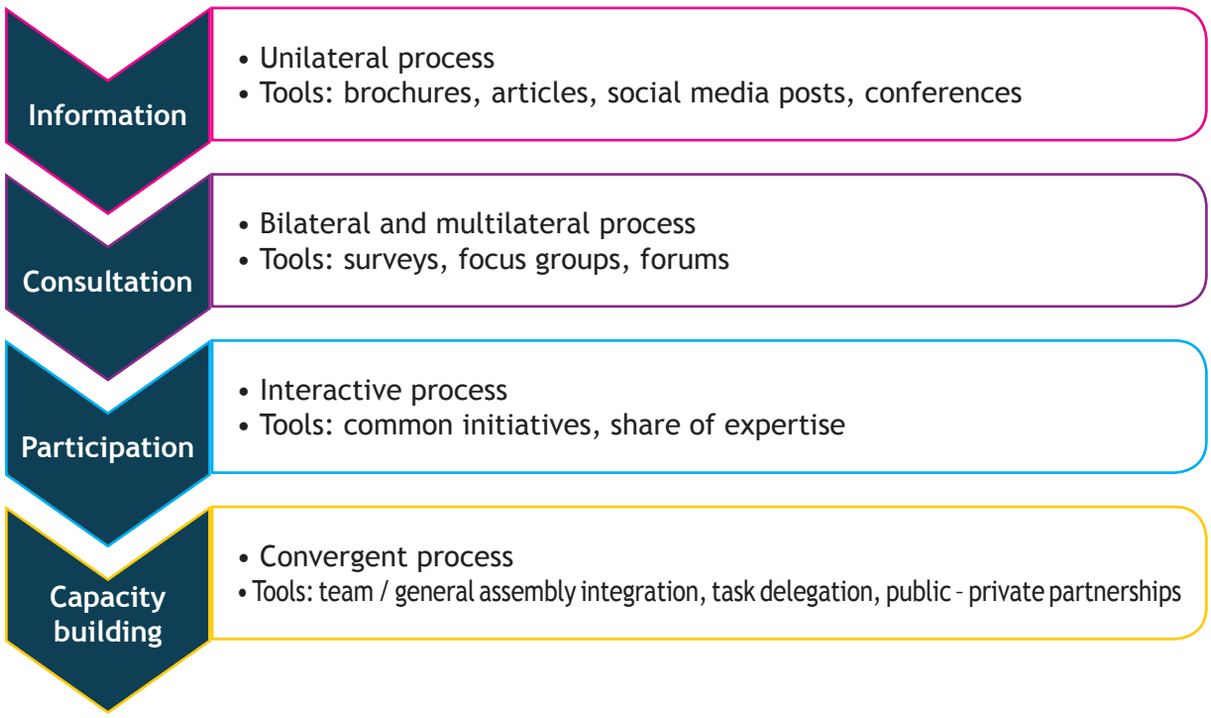
The second step involves a systematic identification and characterisation of the various stakeholders that will be involved in the process, accordingly to the previous sub-chapter. This step also involves the analysis of the needs, expectations, fears and individual hopes concerning the project, as well as the capacities (knowledge, skills, attitudes) of each actor involved.

3) Capacity building

In the third step, efforts are being deployed to build the capacities of dialogue and engagement both of stakeholders and of the organization itself. For an urban waste prevention and management policy, this step can include training on the construction of a common vision between the actors, on the links between waste and urban metabolism, on objectives and joint actions that can be deployed by the stakeholders.

4) Involvement

In the fourth step, the organization identifies the best methods for engagement of each stakeholder and implements them. The range of engagement will vary from simple information to capacity building and empowerment, which will allow a real co-construction with stakeholders:



In order to create shared and authentic spaces for dialogue and decision-making, for the activities taking place face-to-face, it is highly recommended to use non-formal, active and participatory methods. They are often called "maieutic" methods and are characterised by the fact that are placing at the centre the relation between the participants and the reality, instead of starting with predefined notions, presented as absolute and unchangeable truths. One first value of the maieutic approach is that it allows building on the knowledge and experience accumulated over the years by the stakeholders and uses them for collective reasoning. Moreover, learning through dialogue and reasoning allows the support of people with different backgrounds, making it possible to actually interact in contexts where experts meet non-experts, as it is the case of stakeholders' meetings. Moreover, maieutic models facilitate an interdisciplinary approach and deepening of a theme, by reuniting various perspectives of stakeholders, thus enabling the appropriation of technical topics (as it is the case of waste and urban metabolism) by people who do not necessarily have a scientific background. To exploit all these opportunities, the vast family of facilitation tools comes to our rescue: these are the methods and techniques used to make the groups work better, exploiting the possible synergies between the different people and leveraging the energies that people generate through interaction. We briefly describe in the lines below some facilitation tools that are very popular and easy to use by urban waste decision-makers and their stakeholders. In UrbanWINS not all this tools were used, but some of the methodologies applied were very similar sharing the same rationale approaches.

1) WORLD CAFE'

In brief: a methodology used to allow all participants to express themselves informally, circulating ideas as much as possible and giving more importance to the concepts expressed than to those who express them. Participants are divided into tables (minimum 3, maximum 7 people per table) as heterogeneous as possible. At each table, there is a facilitator who has the task of asking the question that is addressed at the respective table and keeping track of the answers. At certain intervals, the participants change the tables, mingling, except for the facilitators who remain at the same table.

In training: it is useful to bring out the information and knowledge already existing in the group before an explanation of a thematic and to focus the learners on the topic

Numerical limits: minimum 15 people, the maximum number depends on the available space (all tables must be in the same room and there must be enough space to move)

Spaces and materials: tables, chairs, paper and post-its, felt pens, adhesive tape.

Further information:
http://www.theworldcafe.com/key-concepts-resources/world-cafe-method/

2) BRAINSTORMING

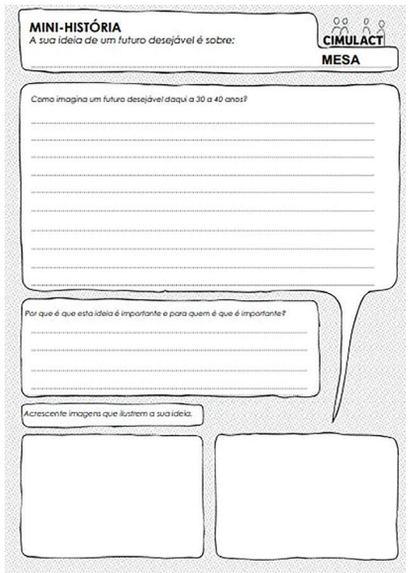
In brief: the participants, guided by the facilitator, are invited to express their thoughts in the absence of judgment from the other participants. All the ideas emerged are collected and systematised by the facilitator, who can use them to build a cognitive map or cluster. To speed up the operation and to make sure everyone is able to express himself or herself, the participants can write their own proposals on coloured cards or adhesive sheets, which are then collected and organized by the facilitator so that all the participants can see them.

In training: it is useful to bring out basic expectations and knowledge, but it can also be used to summarise what has been tackled together at the end of the meeting

Numerical limits: between 5 and 15 people

Spaces and materials: the participants should sit in a circle, or around a table. A surface is necessary to illustrate the results (wall, blackboard, etc.)

3) IDEA RATING SHEETS



In brief: using the leverage of non-judgmental competition, this method favours collaboration within the groups. The participants gather in tables where they elaborate proposals that are reported on the appropriate cards (idea rating sheets). The cards are then displayed and everyone can vote the others' proposals, anonymously, and add comments.

In training: it is useful for stimulating the collaboration between participants to put into practice what has been learned through a design exercise. The component of non-judgmental voting adds a bit more fun, which is useful to promote the cohesion of the group, necessary for the construction of a climate of cooperative learning.

Numerical limits: minimum 6 people

Spaces and materials: card printing, felt-tip pens, adhesive tape, a surface on which the completed forms can be made visible and accessible

Further information: http://www.idearatingsheets.org

4) GRAPHIC FACILITATION

In brief: while the participants expose their ideas, the facilitator summarises the speech with a cognitive map organized in words, signs and drawings.

In training: it is useful for sharing in an effective and clear way what is being said, fixing the key concepts

Numerical limits: not applicable

Spaces and materials: a surface visible to all, billboards or a writable surface, felt-tip pens or / equivalent

Further information: www.youtube.com/watch?v=S5DJC6LaOCI

5) Evaluation and reporting

Based on the feedback received from stakeholders, the engagement process is analysed and adjusted to improve it for future activities/policies. It is advised that the key stakeholders, together with the staff of the organization involved in the first step – strategic planning -participate in this evaluation process. The evaluation report is then circulated among participants for information and feedback is again welcomed.

TESTIMONIAL ON URBANWINS PARTICIPATORY PROCESS

Lia Vasconcelos, professor at FCT NOVA and researcher of MARE, focus her research in innovative decision making and new forms of collaborative governance in public policy.

„Being brought up in a multicultural environment, dialogue soon called my attention as a key component for mutual understanding and collaboration. Genuine dialogue proves to have a main role in overcoming misunderstandings and contribute for a more cohesive society. The use of genuine, sound and professional collaborative processes has proved to empower participants and open the processes.

Recurring to these processes to address complex problems bring added value by guaranteeing that the social, intellectual and political capital is collectively built, creating joint learning experience to all involved and reducing the level of conflict that might exist, assuring a more constructive environment able to motivate, involve and mobilize the ones that participated.

Politicians/technicians working with the stakeholders in a transparent and effective process have greater potential to integrate in a timely manner the concerns and interests of the ones that will be affected by the decisions, bringing them into the process. In a time of short resources, any municipality gains in having its constituents involved directly into the local strategies, since besides a wider support this also represents a move to success.

Physical Agoras played a key role in the UrbanWINS project since it created spaces for dialogue bringing together the stakeholders and the politicians/technicians triggering a joint work towards the same aim. During the process everybody gained, all learned with each other and contributed to the development of the actions. While doing so, the ones involved got appropriated of the project, become co-responsible and committed to the implementation phase. This guarantees the success of the project since it gets wider local society support. Simultaneously, more interventive and responsible citizens contribute to more sustainable communities."

3.2.4 Challenges in stakeholder involvement

Obtaining the engagement of stakeholders for a certain activity or project, including a public policy, may encounter a series of challenges that we briefly describe below.

- Constraints in terms of time. The engagement process is generally a medium/long term one (from several weeks to several months), and in order to be successful it needs time availability from the various physical and sometimes online meetings, provide feedback etc. Moreover, certain types of stakeholders such as SMEs have a very prioritized / limited agenda, while other stakeholders such as public authorities have multiple priorities, which triggers important time constraints. In order to overcome this challenge, it is important to identify from the very beginning the actors who are really relevant for the process, meaning that they have a clear interest for it and they see a clear purpose to the engagement. For this last aspect, tailor-made communication towards each stakeholder to explain the objectives and opportunities of engagement – especially if it is a long-term process – is essential; general communication in terms of awareness and support are not very likely to make the engagement a priority on a stakeholder agenda. Also, the engagement on a certain project or policy may be linked with other programmes or initiatives, in order to make the most out of the time of participants. Moreover, for specific activities that need involvement from a large number of stakeholders, a local authority may analyse

the opportunity to use online tools and social media. You can get some inspiration from UrbanWINS online experiences of stakeholder engagement.

- Constraints in terms of skills and culture. The process of stakeholder engagement needs various types of capacities from the various actors: facilitation and leadership ones, from the organization leading the process, dialogue, open mind, critical thinking, creativity, cooperation from the stakeholders participating in the process. These skills are particularly sensitive for sectors that were not traditionally open to co-construction, such as the public policies ones, within which the stakeholder engagement process was limited to general consultations with the public. When placing urban policies, including waste ones, in complex systems, such as urban metabolism ones, stakeholders need to be moreover endowed with skills such as systemic and prospective thinking. These skills enable them to understand and create links between various components of a system (system thinking) and to vision, in a realistic way, positive, alternative futures. In order to overcome this barrier, Capacity building (step 3 from the previous sub-chapter) deserves a particular importance and dedicated resources. The organization leading the process should pay particular attention to the staff that will be involved in the stakeholder engagement activities in order to be endowed with facilitation and leadership skills; if such skills are not available internally, an organization may look for an external facilitator, as it has been the case with the community activators from UrbanWINS pilot cities. Moreover, an organization may encounter resistance from its technicians who see this interference – public participation – as a challenge to their technical expertise.

- Shifts in staff involved in the process. Nowadays the professional world is characterised by rapid changes of the personnel, both of stakeholders and project team members. In order to overcome this challenge, an organization should periodically revisit the stakeholder lists and make sure it is up to date. Moreover, it should see the new persons involved in the process as opportunities to engage and invest time and efforts in developing these engagement capabilities and motivation.

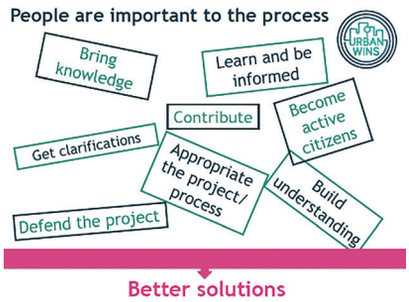
At a more general level, the social responsibility standard ISO 26000 highlights some key issues, on which to focus when engaging stakeholders, that help in overcoming the above challenges: a clear purpose for the engagement is understood; the stakeholder's interests have been identified; the relationship that these interests establish between the organization and the stakeholder is direct or important; the interests of stakeholders are relevant and significant to sustainable development; and the stakeholders have the necessary information and understanding to make their decisions.

3.3 Stakeholder engagement process in UrbanWINS

3.3.1 Description of the general framework of UrbanWINS stakeholder involvement

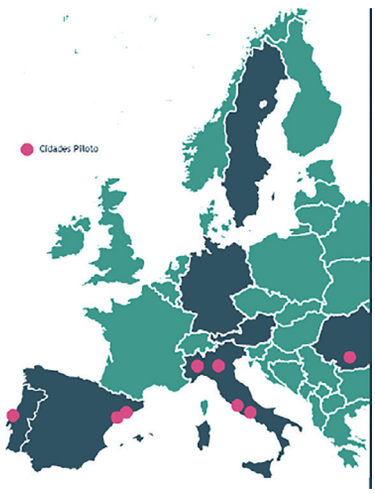
UrbanWINS deployed a complex stakeholder engagement process for the design and implementation of urban waste prevention and management policies.

The stakeholder engagement process of UrbanWINS has been designed around the concept of "agoras", term chosen as it is easily understandable in various languages. Historically, it represented a place of meeting, democratic debate and co-construction among the citizens of a territory, functionalities with which the UrbanWINS agoras have been also invested.



UrbanWINS agoras consisted in two complementary components:

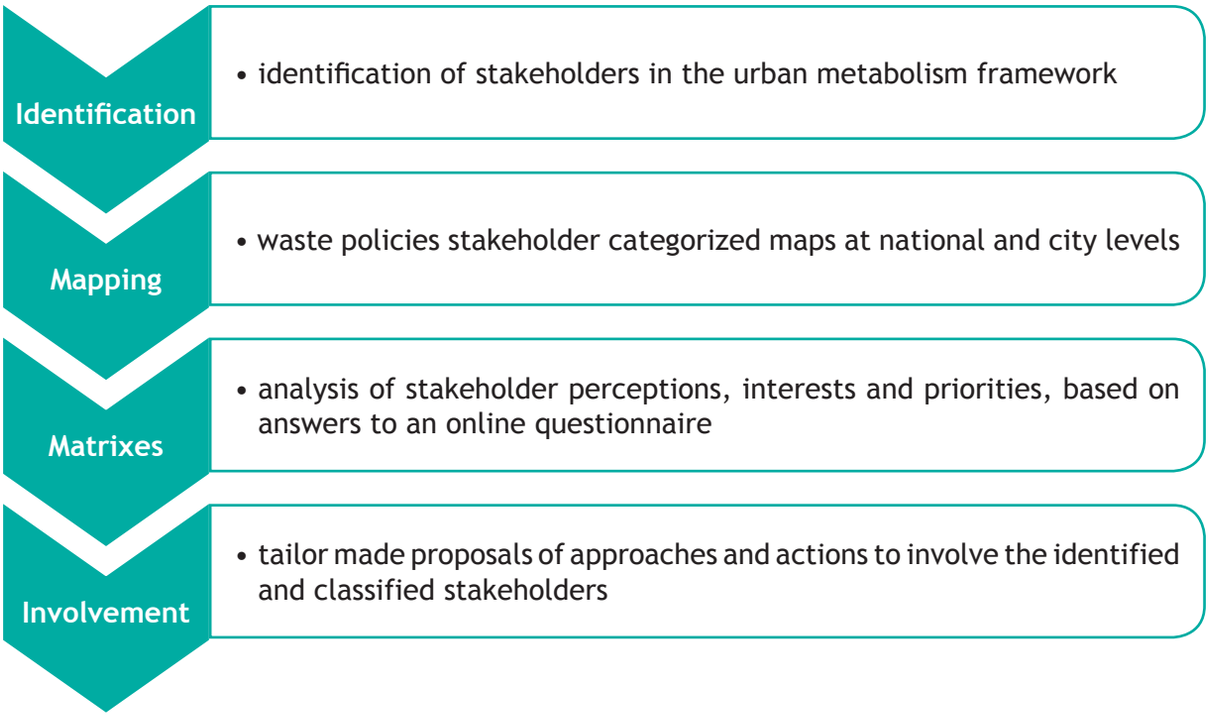
1) eight physical/face-to-face agoras that have been constituted in each of the eight pilot cities from UrbanWINS: Cremona, Torino, Pomezia and Albano Laziale (Italy); Bucharest(Romania); Leiria (Portugal); Manresa and Sabadell (Spain). These cities have elaborated and implemented urban waste prevention and management strategic approaches designed in a participatory way with the stakeholders reunited in the agoras;



2) an online agora that reunites all the stakeholders from the physical agoras and other EU interested parties. The online agora hosts relevant information related to the physical agoras for each city, including the reports after each event.

The objectives of the stakeholder engagement process deployed in UrbanWINS have been both strategic and operational. At strategic level, stakeholders have been invited to co-create with the decision makers' strategic frameworks and action plans to test innovative urban waste prevention and management solutions. At operational level, the engagement of stakeholders has been an important approach to facilitate the generation of innovative ideas and feedback for better implementation, share knowledge and experience, create networks between users.

The stakeholder identification process of UrbanWINS has been based on a series of tools and steps. A Stakeholder Categorized Map (SCM) has been initially used to identify the stakeholder groups that are relevant to the different components of the urban metabolism and that will need to be involved in the different project tasks. It followed the approach presented in section 2 from the current chapter. On the basis of this list, an initial group of country and city specific stakeholders has been identified (around 150 stakeholders per city / country) that has been constantly updated throughout the process.



In order to better understand what role the stakeholders could have in the shape of the current urban metabolism and in the designing, implementing and monitoring of the strategies for waste prevention and management, the partners profiled the stakeholder selected in the SCMs on the basis of the results of the questionnaire for stakeholders of waste prevention and management strategies. The questionnaire explored three main dimensions of stakeholders' approach to waste management: their capability (power) to affect the design, implementation and monitoring of strategies for waste prevention and management; their dynamism to their stance in relation to waste prevention and management; the stake (interest) in relation to the strategy for waste prevention and management.

Based on the answers to the questionnaires, stakeholders were organized in two separate but consequential types of matrix:

1) Power/Dynamism Matrix: it provides the lenses to see how cooperative stakeholders can be, and to understand where greater opportunities of successful cooperation in bettering

waste management lay. It provides information on how deeply each stakeholder's stances should be analysed;

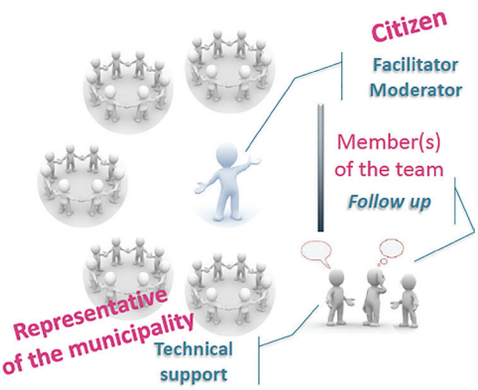
2) Power/Interest Matrix: it provides information on how to handle each stakeholder and which groups had to become included in the making decision process.

The stakeholder identification process from UrbanWINS, including the used tools, is largely described in one deliverable of the project, "Thematic, actor and country-oriented waste stakeholder matrixes"[71].

UrbanWINS agoras include citizens, local authorities, research bodies & universities, companies, NGOs and more that have been considered relevant / important accordingly to the matrix analysis. They have been engaged through tailor-made actions in the urban waste policies process, following the process described in the next sub-chapters.

3.3.2 UrbanWINS physical agoras – design and actions

As stated in the previous sub-chapter, UrbanWINS face-to-face represented a physical meeting space for the stakeholders of the 8 pilot cities where the participants periodically exchanged and co-built urban policies that make use of the urban metabolism concept.



The physical agoras involved directly several types of actors:

- Cities' stakeholders (between 15 and 65 participants to each agora organized by the pilot cities) selected following the approach described in the previous sub-chapter;

- Representatives of the municipality that hosted the agora (communication experts, technicians from the waste/environmental /sustainable development departments) who gave credibility to the process, explained various urban waste policies issues, and enabled the adjustment of the solutions proposed;

[71] https://www.urbanwins.eu/wp-content/uploads/2017/06/UrbanWINS-D3.1.-Stakeholder-matrixes.pdf

PILOT CITY TESTIMONIAL: SABADELL

Raquel Iglesias Pareja, Innovació I Coneixement Sabadell Municipality

"The Urban Wins agoras methodology has been highly assessed by municipal officers in the field of waste collection and urban sustainability. They will be applied to other fields of the municipal management, beyond waste prevention and management.

The agoras are indeed a powerful tool. Face-to-face agoras have shown us an interesting way to decision-making, not only regarding waste also to other city issues. Urban waste policies involve technical opinions, not only organisational ones, also economic or political, aspects that are needed to be taken into account when we invite stakeholders at the discussions for urban waste policies. So the agoras are a methodology useful in key moments of decision-making like at the beginning of the process of brainstorming or for searching the best way to implement a concrete system."

➢ Members of UrbanWINS team (partners):

- Technical partners - considered all the project partners who have supported and collaborated with the pilot cities in the participatory sessions, both in logistical issues and providing technical support during the agoras and facilitated the follow ups, accordingly to the fixed objectives and outcomes of each agora;

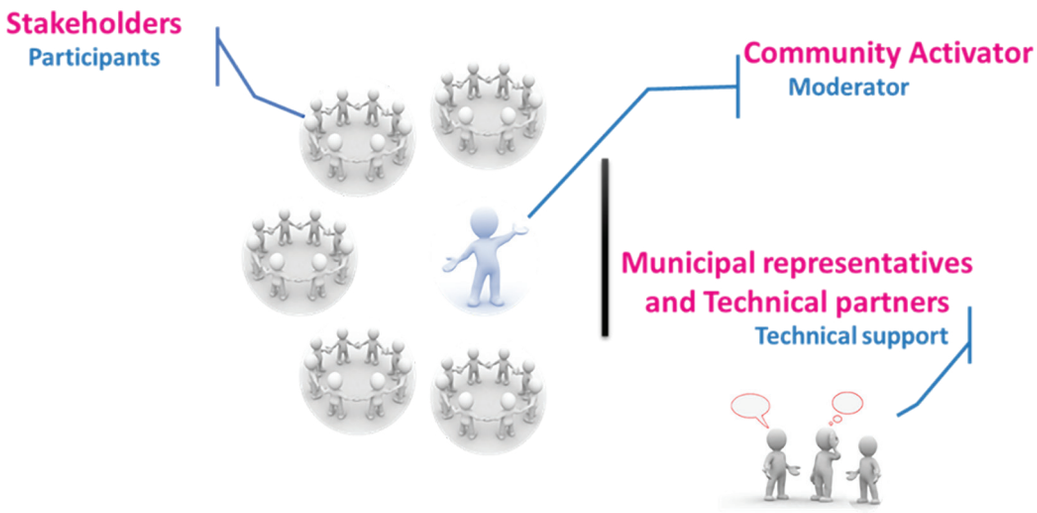
- Pilot Cities - Municipality official representatives, technicians and collaborators that were the main conductors of the participatory sessions in their cities and that had a prominent role in the identification and involvement of stakeholders in the project and throughout the process, as in the organisation and in conducting each session.

Among all municipality representatives each city selected one person to be the "face" of the project. This individual, who had technical capacity, had the responsibility to follow up the process, to answer to issues related to the project content, operating as intermediary between the process and the project, and supporting the moderator. He/she was also responsible to promote the articulation between Physical and Online Agoras. It was suggested that the person selected had good empathy characteristics, was able to explain either technical details of issues related to waste management, legislation or was able to get information and/or experts to be in the sessions and clarify the participants.

- Community activators who moderated, on a voluntary basis, each physical agora. The community activator was a citizen, member of the community, responsible to follow up the whole process of the participatory sessions in a role of moderator. He/she was also responsible for conducting the sessions, assuring the timings and promoting the debates. More than a Moderator, the community activator was someone who:

    - assure the inclusiveness and equity of the process;
    - was trusted and respected by everybody, with good interpersonal qualities and able to mobilize and motivate people;
    - independent and able to make the shy ones to speak out and the most talkative to restrain, assuring a chance to be heard to everybody.

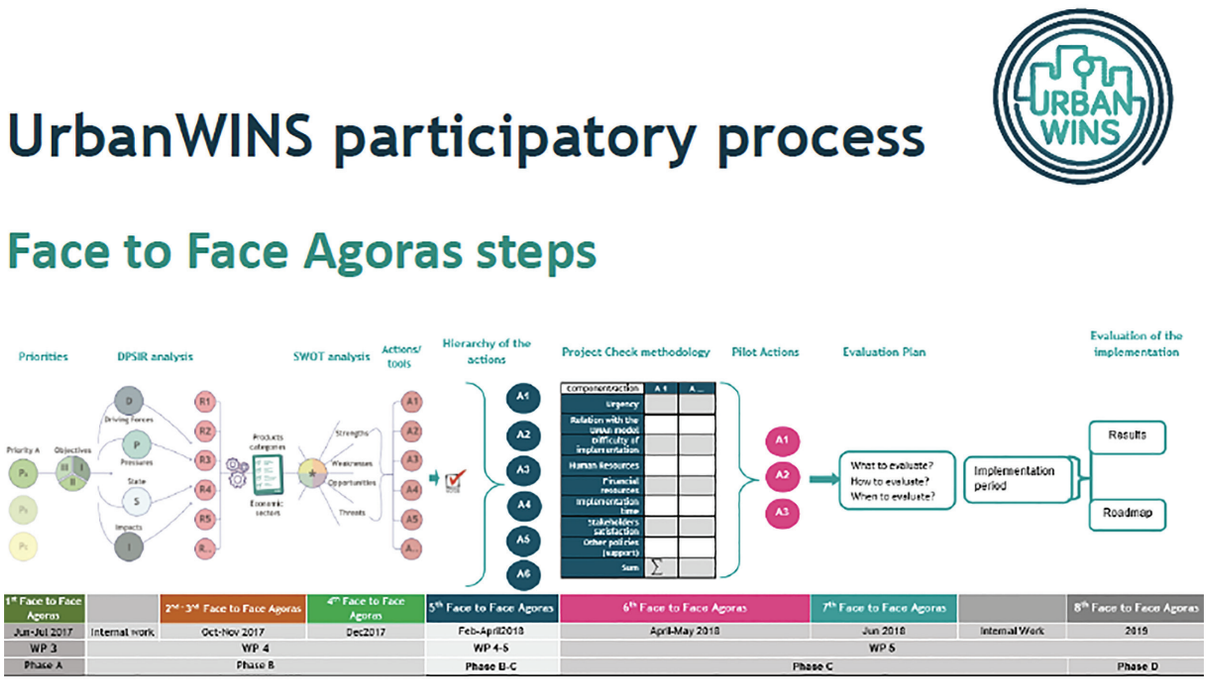
In opposition of to the Municipality representative, the community activator should try to keep away from the content of the project, to be seen as someone with no stakes in the process/project.



Scheme representing the type of actors involved in FF Agoras sessions

Before the kick off of the physical agoras, the community activators from all the 8 pilot cities have attended a capacity building training in collaborative methodologies and inclusive participation processes held between 8 – 10 May 2017 in Portugal (FCT NOVA).

Between June 2017 and April 2019, each pilot city involved in UrbanWINS organized 8 physical agoras. The municipalities together with their stakeholders are working together throughout the life cycle of a strategic framework and plan for waste prevention and management, from its design, to its elaboration, implementation, monitoring, evaluation and follow up. The participatory process of the physical agoras is synthesised below.



The pilot cities have organized within UrbanWINS 8 face-to-face agoras each, with over 1200 citizens and various stakeholders. It was expected to have in each of the 8 Pilot Cities for each Face to Face Agora between 30 to 40 participants, also it was considered very important to have in the room, as participants, 1-2 members of the municipality in order to express the vision of the municipality about the issues on debate, like any other stakeholder.

In order to ensure a homogenous approach among the pilot cities, the Faculty of Sciences and Technology (FCT NOVA)[72] in charge of the participatory process of UrbanWINS, designed before the organization of each physical agora a Toolkit for municipalities and partners encompassing various organizational issues, methodological recommendations, including objectives and expected outputs, and follow up actions.

The Pilot Cities were also instructed on key aspects related to the organization and the layout of the room. For example, for catering services we aimed for zero waste events based on local goods, avoiding meat and disposable cutlery, all meetings and events organized had a reduced environmental and social impact. A focus was on the use of organic and bulk catering solutions. The selected catering services supplied seasonal fruit and vegetables, and fair trade products for certain categories (coffee, chocolate, sugar, tea, etc.), tap or glass bottled water, with equilibrated menus and minimal quantities of meat while avoiding the beef in the menu. Regarding the venues, they were chosen to facilitate low energy consumption with natural light, with a proper waste management in place and an easy access by public transport. The same sustainable aspects were taken into account for the communication materials to increase the awareness level on waste prevention using the power of example and to offer participants the necessary information upon request.

For each agora the participants were seated at round tables, with mixed backgrounds so that the dynamic of the group to be used as much possible. For each agora a check list with the necessary materials and equipment was provided to support the 3 to 4 hour sessions; specific invitations and posters were designed and adapted for each city, together with a detailed script for the organizers. All agoras started with the registration of participants and a welcome coffee, followed by a buffer activity and specific topics, and ended with a session of questions and answers, closing remarks and written feedback sessions (what did you like most and less and suggestions for the future event). After the agoras reports were prepared in both English and local language, published on the online agoras and sent via e-mail to the participants who had the opportunity to provide extra feedback or to comment on specific issues.

The intermediary phase of the participatory process that occurred from the first session until mid-January 2018 (3 or 4 physical agoras in each city) aimed to identify and analyze the actions to be included in the Strategic Planning Frameworks that each pilot city developed with its stakeholders.

Face to Face Agoras

Meetings	Date	Focus	Expected results
1st meeting	June-July 2017	Setting the priorities and objectives	At least 3 priorities and related objectives
2nd meeting	Oct 2017	1) Validation of DPSIR analysis	A set of tools, activities and tasks which could support the achievement of the established priorities. (Primary list of actions)
3rd meeting	Nov 2017	2) Responses-voluntary tools, Regulatory tools and measures	
4th meeting	Dec 2017 (8th)	SWOT analysis on priorities	List of actions in order of their feasibility.

Strategic Planning Framework (SPF)

The 1st agora aimed at the identification of at least 3 city priorities on environmental issues related with resource consumption and waste

[72] https://www.fct.unl.pt/

prevention. The buffer activity had 2 questions: what is the most problematic waste in your city/municipality; the second was optional and open to each pilot city (if they wanted to collect some info from participants). In the group work, the participants debated about the City Priorities in Resource Consumption and Waste Prevention and the result was a simplified SWOT with the results voted and proposals for each identified priority.

In the 2nd and 3rd agoras, each pilot city generated a preliminary list of actions that responded to city priorities on environmental issues related with resource consumption and waste prevention identified in the first face to face agora; for this purpose, a DPSIR[73] analysis has been used for each priority prior to the event. During the agora, the participants were asked to contribute to the DPSIR tables and to validate in the end the information after a world café session.

During the 4th agora, stakeholders realized a SWOT and TOWS analysis of all actions that emerged out of each priority in the previous agoras. All these actions have been described in the SPFs of each city, action coordinated by one partner from UrbanWINS, Iuav University[74]. The Strategic Planning Frameworks (SPFs)[75] represent an exhaustive description of the city's strategy and measures for a sustainable management of the resource/waste sector.

Face to Face Agoras

Meetings	Date	Focus	Expected results
5th meeting	Feb 2018	Hierarchy of the actions from SPF and selection of at least 6 actions.	SPF to LSAP
6th meeting	Mar 2018	Compare the different actions based on a semi-qualitative technique of points attribution given to each component.	Pilot Actions
7th meeting	Apr-Jun 2018	Identify and select positive & negative impact indicators to monitor and evaluate the implementation of the pilot actions.	Evaluation Plan
8th meeting	Apr-May 2019	Evaluation of pilot actions' implementation.	Implementation results/ evaluation

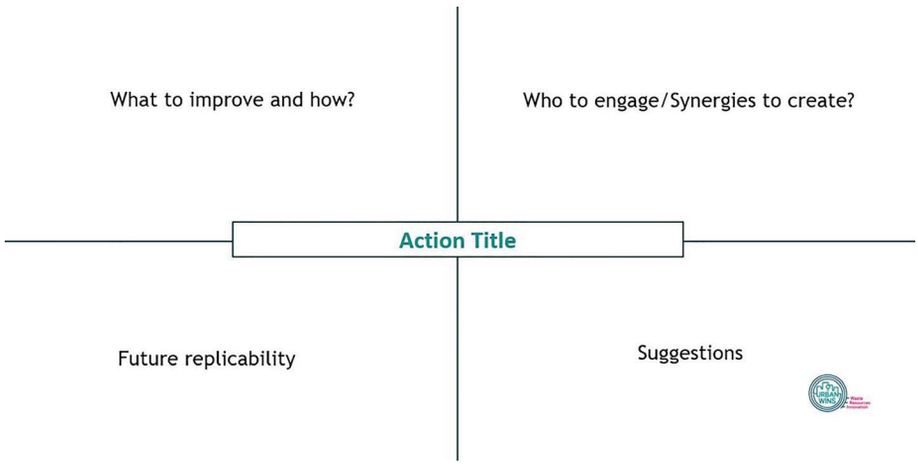
Starting from the SPF, pilot cities were able to pass to the phase of the participatory process after a careful and in-depth analysis, the top 6 actions for urban waste prevention and management placed in a context of urban metabolism were selected. After this step, the participants evaluated the 6 actions using a comparative methodology and the top 3 actions were defined. The comparative methodology supported the participants in the evaluation of the different actions allowing the comparison among different actions based on a semi-qualitative technique of attribution of points given to each component by the group members. The components included: 1) urgency of implementing the action; 2) importance of the action; 3) more or less difficulty of implementing the action (e.g., human or financial resources). Moreover, each city tried to find a balance between the types of tools proposed - voluntary, awareness raising and regulatory – in order to enable a complex intervention. This phase, which comprises two physical agoras (5th and 6th agoras), took place between the end of February and the beginning of May 2018. All the relevant actions coming from the SPF were included in a complementary strategic tool, LSAP – Local Strategic Action Plan.

[73] More about DPSIR in the second part of the Toolkit
[74] http://www.iuav.it/ENGLISH/ABOUT-IUAV/IUAV-PROFI/
[75] The Deliverable can be found at https://www.urbanwins.eu/wp-content/uploads/2018/06/UrbanWINS_D4.2_Strategic-Planning-Frameworks-for-the-8-Pilot-Cities.pdf

For more information on SPFs and LSAPs, consult section 2.2.1 Waste strategic planning frameworks and action plans of the present Toolkit.

The 7th agora aimed at defining the framework for the evaluation plan of the actions to be implemented by the municipalities in partnership with the local stakeholders, answering questions such as what / when/ how should be evaluated and a monitoring set of activities to be implemented. Each pilot action had one poster with the general information regarding action implementation to which all participants have contributed raising questions while the municipalities gave answers regarding the implementation while actively inviting stakeholders to join the implementation. Starting summer 2018, each pilot city began the implementation of the 3 top actions, as described in the LSAPs, in partnership with the urban stakeholders that contributed to the respective action and/or showed interest for it.

The final (8th) agora was set at the end of the piloting process (March 2019) by each municipality to present the outputs of the actions implemented in partnership and evaluate them with the involved stakeholders. Another objective of the last agora was to improve the implementation of the future actions and to ensure continuity.



UrbanWINS online agoras

The UrbanWINS Online Agoras[76] represent a virtual community and knowledge-sharing platform created and maintained to support the objectives of the UrbanWINS project and to facilitate the engagement of the wide variety of stakeholders at the level of EU and the eight pilot cities. The platform has been developed based on the previous experience of online engagement of stakeholders of the UrbanWINS partners.

[76] https://www.urbanwins.eu/online-agora/

The Online Agoras represent an experiment at EU level to engage online urban stakeholders in the definition and implementation of urban policies – more specifically, waste policies. The platform takes into consideration the need to engage a large breadth of stakeholders (citizens and other actors relevant to the implementation of these policies) and the difficulty to get this engagement online.

In addition to citizens' involvement, participants in the Online UrbanWINS Agoras include organizations, waste management solution providers, research institutes and educational centers. The hosts of the online platform post content related to waste policies or technologies, together with ideas and suggestions for the Face-to-Face Agoras (workshops) and local actions organized in UrbanWINS eight pilot cities across Europe. During workshops, participants were encouraged to share opinions, discuss ideas and collectively plan solutions.

Consequently, from a strategic viewpoint, the online agoras was developed to provide a framework to ensure the transparency of the participatory process once all the dissemination, information and results of the physical agoras were hosted by each pilot city in the platform. The users of the online agoras, although not numerous, had the opportunity to engage online in some live discussions and to get informed about physical agoras conclusions. to share opinions and stay informed contributed to the process openness.

➢ **Structure & functionalities**

The UrbanWINS Agoras virtual community includes activities that are part of a very dynamic and expert group of partners dedicated to improving the design and implementation of Strategic Approaches for innovative waste prevention and management within UrbanWINS project. Here is a brief breakdown of the platform posting possibilities:

Personal Posts. One can add content regarding a point of view, an interesting occurrence related to the UrbanWINS project, a useful article, etc. It can be left as a Personal Post (associated with the user profile) or can choose to share it with one or more "Groups".

The information on the platform is "cross pollinated", to encourage collaboration of ideas and experiences from around Europe - the Groups section aims to bring together persons interested about a particular topic - either thematic or geographic (or both) discussions. Participants can add a group but are encouraged to first check the existing Groups to see if a relevant one already exists. This will help keep the conversation together.

The "Pilot Cities Agoras" section is where the activities around the Face-to-Face Agoras events planned for each Pilot City occurred. The platform curators were in continuous contact with the responsible person(s) in each Pilot City to confirm their understanding of how they post content in the platform.

➢ **Results, challenges and next steps**

The UrbanWINS Online Agoras present both significant opportunities and challenges. In terms

of strengths, they are free and easy to use, and they assure the mutual sharing of knowledge between the pilot cities. Also, the platform includes cross sectional studies that serve as a solid base of debate and interaction between stakeholders from all participating countries.

As opportunities, the platform encourages knowledge sharing and healthy competitiveness between the pilot cities and ensures the extension of the purposes of the project beyond its finalization; this may prove to be a huge asset in the future, especially taking into account the EU dynamics and the participatory nature of governance and urban policies. Also, as an online tool, it has the capacity of continuously improving and growing based on user feedback.

On the other hand, the ease of connectivity for users from all the participating countries may be a challenge for some people, as there is no clear separation between the languages used on the platform. Also, cultural and behavioural differences have sometimes proved to be a challenge for urban policies stakeholders, not familiarized with engagement processes, especially in an online format. Some stakeholders have a certain reluctance to sign up, given the current digital flood of social networks. The functional similarity with other social media platforms is an advantage in terms of ease of use, but it may also translate in the possible redundancy of having a dedicated platform. Also, the Online Agoras do not support link sharing outside the platform without signing up, which might be a reason for the somewhat limited involvement from some users. The platform has not yet reached the tipping point – it still needs continuous human and time efforts from the project partners to animate the network and keep the content flow constant.

The Pilot Cities, with support of the national partners involved in the UrbanWINS project use the online agora as a process journal to promote waste prevention and management strategies, linked to the physical agoras, publishing activity reports and local decisions. After each of the eight physical agoras, the eight Pilot Cities published comprehensive reports in both English and native language, in order to encourage debate on the platform. All the reports followed the same structure, analysing all the tools used and promoting the results of the respective meetings, including feedback forms filled in by the participants – over 600.

Actor focus: Urban bloggers, an important actor to innovatively story tell engagement processes

Citizen engagement was a big part of the story in the UrbanWINS project, therefore the aim was for everyone living in the UrbanWINS cities to be able to discover how eco-innovation happens locally, through attractive and accessible stories told in the local language. This is why a call was published to look for local bloggers who could report on the activities in their cities, by interviewing local stakeholders, reporting from local meetings or contributing to the project's online platform. Applications were received and each of the cities assessed them to choose, together with ICLEI – the project partner in charge of this activity - the final candidates to do the blogging activity.

The bloggers have published content on UrbanWINS activities in various formats and different

platforms, some have their own blogs, others have published in online magazines, and others have created videos. Since the bloggers are very well connected with the local sustainability scene, they can disseminate relevant content and have access to other activities that happen in this area.

The urban bloggers in some cities have also been active in the online agoras and contributed to the dissemination of public events organized by the cities within UrbanWINS, such as the face-to-face agoras and project conferences.

3.3.3 Role of peer-to-peer exchanges among cities

Throughout the project, besides the online agoras presented in the previous section, the UrbanWINS team has developed different channels and activities for exchanges among pilot cities and their stakeholders. These tools proved to be very useful in ensuring the share of knowledge, peer-to-peer learning and continuous motivation of the actors involved, which are key ingredients when working with cities on complex and innovatory issues, such as the definition and implementation of urban policies with an urban metabolism approach and with the systematic engagement of stakeholders. This section briefly presents the engagement tools deployed in UrbanWINS with the purpose to inspire their replication in other similar contexts.

- Webinars: A set of webinars has been organised to discuss specific topics connected with the different aspects covered by UrbanWINS. Webinars allow a group of participants sitting in any location to take part in an online event via Internet. This format allows different levels of participation: from receiving information by watching and listening to the presentation, to actively participating by asking questions, adding extra information or sharing experiences and ideas.

The UrbanWINS team planned webinars open both to participants in the project and to external actors. The same logic has been applied when choosing speakers for the webinars: some of them belonged to project partners, whereas others were external speakers invited to enrich the discussion and to offer information from different perspectives.

In first place, these webinars have been used to present the project and communicate what its objectives and activities are, as well as the progress made at the moment of the presentation. In second place, these webinars have served to present a topic in-depth, in order to gain a better knowledge on it.

Webinars were set up to host between 35 to 50 people, a number of participants that would allow them to feel comfortable to ask questions and discuss ideas.

Webinar 1: How can urban metabolism lead to a circular economy and a more sustainable

future for cities? – Focus on the concepts of urban metabolism and circular economy

Webinar 2: More sustainable and circular urban metabolisms with participatory mechanisms – Focus on participatory mechanisms

Webinar 3: How cities pilot circular economy actions to fight urban waste – Focus on circular economy

All webinars were recorded and uploaded to YouTube, so that people interested in the topic could watch them afterwards.

- City Match: The aim of the City Match Exchange Programme was to help bring people together to develop competences, and share knowledge, ideas and working methods on sustainable and innovation procurement in the waste and resources sector. The idea was that collaborators interested in the waste and resource sector could visit another organisation working on this topic, to provide new experiences and ideas. The exchange would last between 1 to 4 days.

Cities and organisations could apply to host a City Match activity, and once the activity was agreed, other cities and organisations could apply to participate in it.

Amongst the benefits for the host, one can mention the wider dissemination of the work done on waste management, innovation and circular economy, growing the network of peers and experts, an insight into how replicable the applied methods are, and sharing problems, solutions and good practices with highly motivated individuals. On the other side, the benefits for the participant are to acquire a broader understanding and develop skills on smart, strategic, green and innovative public procurement, receiving direct assistance and support on day-to-day tasks related to public procurement on waste management solutions, and being informed about the latest technologies, products and services in the resource sector.

1st UrbanWINS CityMatch: Hosted by the Metropolitan City of Capital Rome, participants had the opportunity to discover how furniture circular procurement and Green Public Procurement monitoring work in practice.

2nd UrbanWINS CityMatch: Hosted by the City of Zurich on recycled concrete and circular economy. It provided a forum for exchange for public authorities from across Europe.

- Sector Watch: The Sector watch is a highly targeted source of information for public procurers on the waste sector, where the sector is monitored and developments are shared. It collects best practices, criteria sources, labels, innovative solutions, guidance and news. The publications follow different developments in the sector over a period of time e.g. a procurement process and its results. It is a one-way communication channel.

TESTIMONIAL REGARDING THE ROLE OF PEER-TO-PEER EXCHANGES AMONG CITIES

Photo Credits (c) ICLEI

Mr. Philipp Tepper, Coordinator, Sustainable Economy and Procurement, Procura + Network Manager - ICLEI - Local Governments for Sustainability (European Secretariat)

„A key aspect of UrbanWINS is the involvement of diverse stakeholders. Our goal at ICLEI was to spread the UrbanWINS message far and beyond the project in a tangible and easily accessible way. To do so, we have worked with a variety of engaging formats, covering different aspects of the project.

Our highly targeted source of information – Sector Watch – helped to inform stakeholders in the waste management sector and related organisations about innovations and new policies. We focussed on bringing forward inspiring and thought provoking stories from within and outside the UrbanWINS project.

Elevator Pitches, a format that conveys a key message in 2 minutes or less, were developed to present some aspects of Sector Watch articles in a fun and engaging way. Some of the UrbanWINS cities also produced elevator pitches introducing the key goals and benefits of UrbanWINS in their city. The pitches helped to get people curious about the project and engage in more depth with the outcomes both on a city level and EU wide.

Finally, the CityMatch programme, the exchanges between European public authorities were a successful way to connect practitioners across Europe and inspire them with cutting edge innovations that their peer are implementing – sometimes all it takes is seeing that a solution actually works."

3.3.4 Lessons learned and recommendations for stakeholder engagement

The participatory process, namely co-working, proved to be key for the success of the project in several of the municipalities involved in the UrbanWINS project (UW).

The participatory process set up for UW defended as key the co-working of stakeholders with a set of other relevant elements – community activators, cities representatives and technicians – opening the setting for expanded decision-making processes at the local level.

Besides being innovative the potential for finding better solutions in complex and uncertain contexts, such as waste management, proved to be useful, as reported by the ones where

these participatory processes were successful. As any other scientific field, participatory settings have a whole conceptual support and can be conducted with more and/or less success depending on following specific requirements that constitute the guidelines issued by the FCT NOVA team responsible for this component.

Methodology for the evaluation

The participatory process was conducted through sequential phases, each one of them with a specific objective involving several stakeholders.

Stakeholders were actively involved in the participatory process by a continuous and close contact conducted by Pilot cities and technical partners where results and products of the process were disseminated, and invitations were made and challenges were launched. This approach and the type/format of the events lead to an effective engagement of the involved stakeholders, what is confirmed by the attendance level of more than half of the stakeholders that participated in more than one session.

In order to assess the general opinion of all actors concerning the stakeholder's engagement, this evaluation was carried out encompassing two components:

1) Analysis of the evaluations filled in by the stakeholders at the end of each session;
2) SWOT analyses (strengths, weaknesses, opportunities and threats analysis) accomplished by the partners and project collaborators that were directly involved in the participatory process: technical partners, pilot cities and community activators.

The first component encompasses the analysis of the individual evaluations carried out by the stakeholders, during the seven sessions that took place in their Pilot Cities, with the objective to identify the main positives and negatives points and to collect suggestions for improvement. These evaluations contributed for the continuous improvement of the process during its development.

To achieve a complete evaluation of the process, it was essential to take into account the opinion of all the actors involved in the process. Therefore, a SWOT analysis by all partners and project collaborators was carried out.

This second component - the SWOT analysis - is a framework for identifying and analysing the internal (strengths and weaknesses) and external (opportunities and threats) factors that can have an impact on the process. The framework is considered a powerful support tool for decision-making because it enables to uncover opportunities for success that were previously unarticulated or to highlight threats before they become overly burdensome.

It was also requested to all involved parts to suggest some strategies that allow the use of the identified points to optimize and potentiate the replication of the UrbanWINS participatory process and the stakeholder's engagement elsewhere. The types of strategies used in the

evaluation are identified below:

- SO - "Maxi-Maxi" Strategies that use strength to maximize opportunities;
- WO - "Mini-Maxi" Strategies that minimize weaknesses by taking advantage of opportunities;
- ST - "Maxi-Mini" Strategies that use strengths to minimize threats;
- WT - "Mini-Mini" Strategies that minimize weaknesses and avoid threats.

To optimize this analysis a set of topics were established depending on the role of each actor (technical partners, pilot cities, community activators) (see table 11 below).

Table 11 – Topic for analysis by actor

Question/Topic	Pilot cities	Technical partner	Community activator
Analyse your role in the participatory process (Face to Face Agoras)	NA	NA	X
Involvement / engagement of stakeholders	X	X	NA
Agoras general appreciation	X	X	X
Online Agoras	X	X	X

Each partner (pilot cities and technical partners) organized an internal meeting where the analysis was jointly developed by all collaborators involved in the organisation and/or conducting the session.

Lessons learned and recommendations

Several points in the evaluation fit simultaneously positive and negative aspects, this has to do with the fact that what went well in some of the cities, went no so well in others. This allows us to extract a set of lessons that must be seriously accounted for if we want a participatory component of success.

A set of factors to be carefully planned:

- Community activator (CA): the role of the CA is central for the whole process. Cities with an adequate CA are reported by the participants, the technicians and the cities representatives to have a participatory process more successful.

Recommendation: More than a Moderator, the community activator should be someone with the characteristics reported above. It is key to put a special emphasis in selecting the person with the required characteristics, and to be defined among the different actors in the FF Agoras the role and responsibilities of each one.

Moreover, during this process in some of the sessions facilitators were also assigned for each

table. The facilitator was assigned the responsibility to facilitate the group work, supporting in this way the moderator that was responsible for the overall work. This proved to be of utmost importance for the dynamics and results of the sessions.

- Physical / Face to Face Agoras (FF Agoras): In the cities where the FF Agoras succeed, some suggested to make it a common practice in the municipality for other issues relevant for the citizens, due to its potential to expand the level of democratization of local decision making. This will allow the municipality to have more inclusive and expanded processes, making the most out of the involvement/engagement of the citizens, turning them more active, interventive and responsible. In sum, making them part of the whole process and transforming them in local changing agents of support of the municipality policy.

Recommendation: The suggestion to municipalities is to get inspired in the methodologies used for UW and develop similar ones for other issues, following the recommendations along the process to the different stages.

- Networking: The municipalities with successful FF Agoras suggest that these could be used for increasing the relationships and networks of the municipality with the stakeholders, contributing to the creation of social capital of the utmost importance for the success of municipal local policy.

Recommendation: Municipalities may develop and keep a list of contacts and profiles to be able to return to the ones more active and/or interested in specific subjects that can provide support for future participatory processes and increase participation in the ones in development.

- Innovation: Besides the FF Agoras being considered by the ones involved as novel, promoters of curiosity and with high degree of innovation, they are also by itself providers of spaces for debate favourable to the sharing and discussion of issues in different perspectives that are per se spaces for innovation.

Recommendation: Build spaces for debate that are equitable and inclusive to potentiate debate and innovation. Be sure to follow the rules of good communication along the participatory process.

- Motivation: Having CA, city representatives and technicians that are mobilizers, and being the process by itself a mobilizer, is an added value for a dynamic active participatory process. Motivated stakeholders were also identified as key for the success of the process by several respondents.

Recommendation: Take advantage of the stakeholders and actors strongly motivated and more engaged to be the vehicle of further mobilization of others. Make them mobilizers and active agents of dissemination of the process.

- Knowledge: In the cities where the FF Agoras succeed, some refer to the creation of

collective knowledge and learning due namely to the sharing of ideas and practice. Participants mentioned that the active involvement of interested parts, informal dialogues and the spirit of collaboration contributed substantially to this.

Recommendation: The construction of collective intellectual capital is essential for the process; therefore, it is advisable to assure the effectiveness of this component.

- Participatory session's implementation: The way the event was conducted was mentioned by several respondents as relevant for the results, namely that it has created a dynamic, pleasant working environment enhancing the desire to collaborate. Factors such as the possibility of flexible participation, ability to manage group work, concise presentations, timely and good presentations, constructive open discussion and the workflow were enriching even if complex. Informality was also referred as a key issue of success.

Recommendation: For future participatory sessions the suggestion is to use/apply and improve these components.

- Methodologies of the FF Agoras: In several cities the respondents reported the good work structure, the effective active involvement of the participants, the methodology to promote shared work, the organization of practical working groups, the brainstorming, the work dynamics and the development of the proposals, as positive factors for the success. They also refer as positive the use of technology for remote presentation.

Recommendation: For future participatory sessions the suggestion is to use/apply and improve these components. Moreover, flexibility and versatility are crucial for the success of the process; the organization should be ready to adjust/adapt the methodology planned to new emerging situations that might develop during the participatory session (have a plan B/C, ready). Also, the organization of the work in small groups enables a more active involvement of participants (particularly facilitating the expression of the ones that have more difficult to give their opinion publicly) allowing the sharing of everybody opinion/point of view.

- Logistic of the participatory event: the logistics was also considered relevant by some of the respondents, namely the materials, the selected location, punctuality and length of the meeting.

Recommendation: For the organization of participatory sessions the suggestion is to give attention to these factors since they can be very important for the success of the agoras, namely the delays should be avoid since it can influence the will of the participants to be involved; the first session length of the event should be shorter to allow people to experience a participatory session and open up the possibility for longer ones; coffee breaks should be available during the whole session avoiding long breaks and loss of rhythm; moreover the welcome coffee is an opportunity for sharing among participants.

- Diversity of stakeholders: This diversity of stakeholders was considered as enriching by

several stakeholders, namely because they bring to the setting of the participatory sessions a diversity of ideas and perspectives, allowing for the jointly building up of new solutions. This diversity educates also the participants to the problems that others are subject to and makes it easier to identify aspects that have to have further debate.

Recommendation: This diversity is desirable, in particular when dealing with problems in complex and uncertain contexts, since it provides a better opportunity for a more throughout joint solution it is a key that the identification/selection of the parts to be involved be given the maximum attention.

- Debate: Several mentioned the open and inclusive debate as crucial for the process, namely referring to the open and free debate to express opinions, suggestions with good participation level and a sound discussion of the issues.

Recommendation: The rules for a genuine dialogue (Habermas, 1987)[77] should recur to the Habermas requirements. If the methodology is more open to an expanded and longer debate it is of the utmost importance to assure that the discussion is registered to be used later. Once more, an adequate selection of the community activator is central to conduct and a sound debate and discussion.

- Online Agoras: The Online Agoras was considered as an opportunity, a good tool to follow the FF Agoras (Physical Agoras), namely loading/sharing/consulting documents, requiring less physical time allocated. The fact of being in each country language was valued, as well as the possibility to allow for the interaction of the participants, discussion groups, taking advantage of the development of networks and new technologies to improve participation. In sum respondents considered the Online Agoras Platform as a tool with potential.

However, many difficulties and negative points were mentioned in the analyses. Some of the respondents mentioned the difficulties to redirect news, or even people, from other social networks to the platform, and the fact of not being connected to other social networks was also pointed as negative. Some referred to it as a multiplication of social networks/platform. Others complained of the lack of interaction, updates or new contents referring also that the platform was not enough attractive. This and the need of registration, not being easily available to all citizens, discourage and make the platform not interesting to the stakeholders. Respondents ending up suggesting that the Online Agoras was not user friendly and did not had the level of functionality required. It was also mentioned that there were too many resources allocated to something with no impact.

Recommendation: Before decide to create a new platform be sure that the ones existent do not answer to the needs, it could be easier, more effective and engaging to use a popular platform. Previously to the launch test the functionalities and ask for an evaluation of the

[77] Habermas, J. (1987). The theory of communicative action. (T. McCarthy, Trans.). Volume 2: Lifeworld and system, a critique of functionalist reason. Boston, Massachusetts: Beacon Press [German, 1981].

usability to some target users and make sure to consider their opinions, it may conduct to a more user friendly product. Connecting your platform to other social networks may improve the rate of dissemination and use. Nowadays would also be relevant to create a platform APP to simplify the access from smartphones and increase interaction of stakeholders, creating a community. These new technologies have also a great potential as an alternative way to communicate and could be a reference to participatory processes and with potential to engage younger citizens.

Final Remarks

Participatory processes are a key to assure inclusion. Simultaneously, they work as tools for making more active, responsible and intervening citizens. Participatory processes can be conduct with or without success. To assure success besides the conceptual requirements, namely the ones presented in the Theory of Communication, a set of elements have to be accounted for in more operational terms. Besides setting up a collective agenda, the specificities of the place where it will occur, the schedule, the length of duration, in sum the preferences of the citizens/stakeholders.

In UrbanWINS this was a central challenge, since the coordination for the participatory process had the task to develop a methodology adequate to all the cities and that could also be replicated elsewhere. Sometimes, things could be pursued further but the participatory team had to respect the different rhythms and maintain equilibrium.

However, this was a great experience that also allowed learning and extracting lessons for the future.

Waste | Resources | Innovation