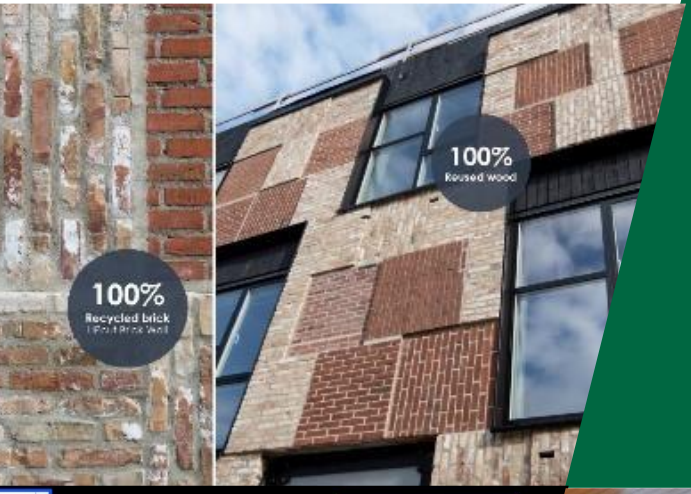
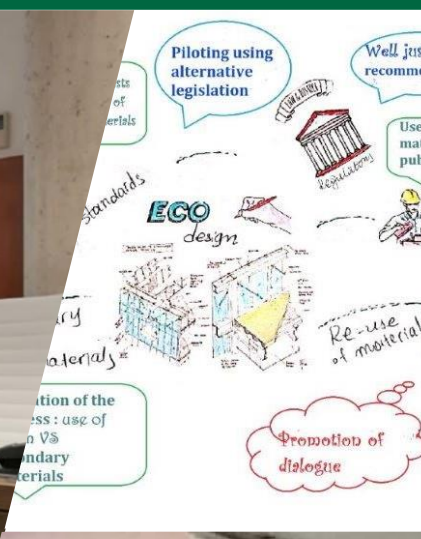
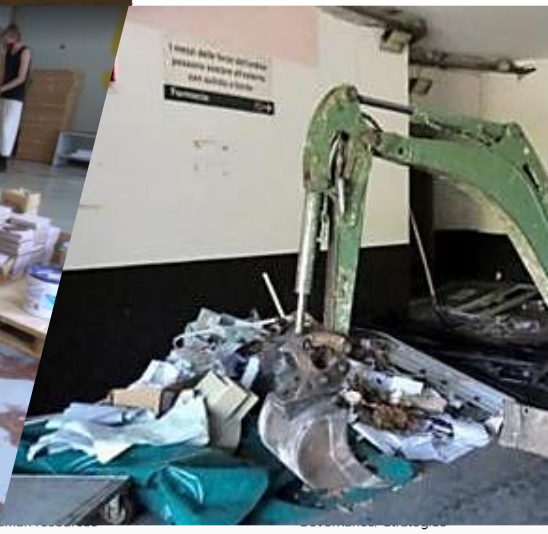
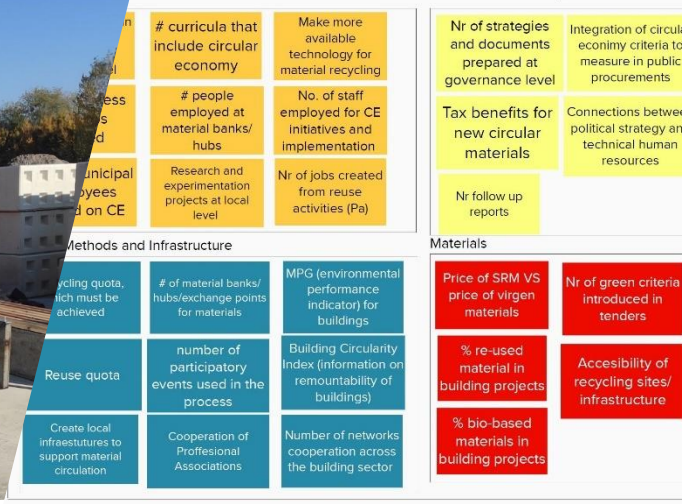
URGE

Thematic report booklet









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Insights from the URGE network: thematic report

Insights from the URGE Network and experience from the "Bayernkaserne" pilot project: Regulatory and standardisation needs as drivers to foster circular economy in the building sector

By Dr. Eleni Feleki, Lead Expert of the URGE Action Planning Network

Background

Construction and demolition waste (CDW) is the largest waste stream in the EU by weight (Eurostat, 2019a). Construction and demolition is defined as a priority area in the EU according to the Circular Economy Action Plan(link is external) (EC 2015) - one of the main blocks of the European Green Deal(link is external), Europe's new Agenda for Sustainable Growth(link is external). The Circular Economy Action Plan announces initiatives along the entire life cycle of products. It introduces legislative and non-legislative measures targeting areas where action at the EU level brings real added value. The EU policy objectives for CDW management are:

- Prevention of CDW generation
- Reuse and recycling
- Reduction of hazardous substances in CDW
- Recovery of at least 70% of non-hazardous CDW generated
- Reduction of greenhouse gas emissions from the management of CDW

Moreover, the European Green Deal (11.12.2019) highlights that reaching the target of climate neutrality in 2050 will require action by all sectors of our economy, including the construction sector.

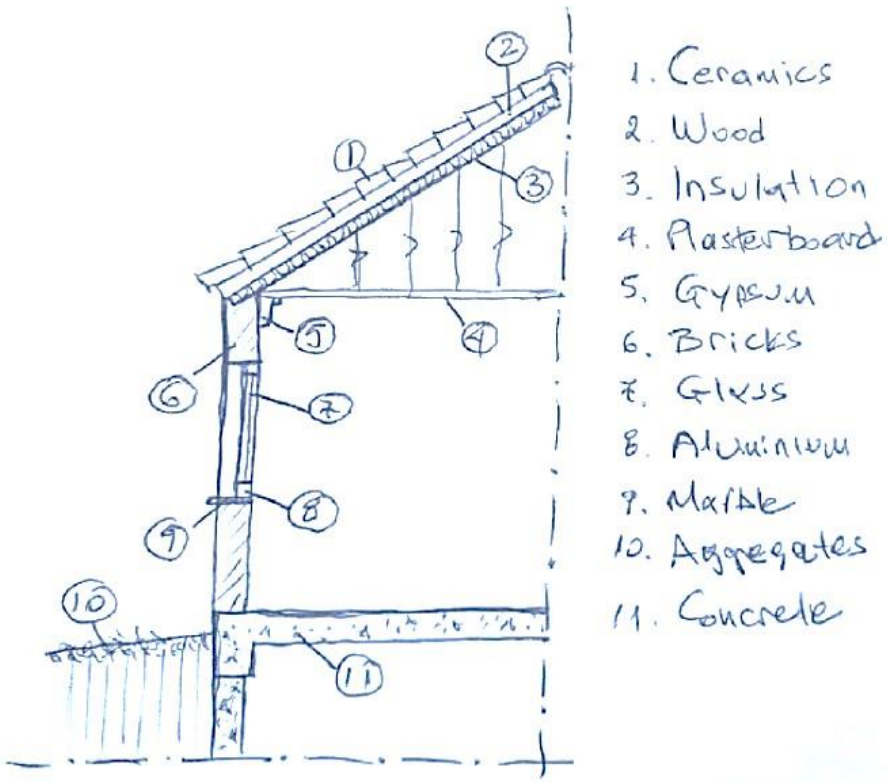
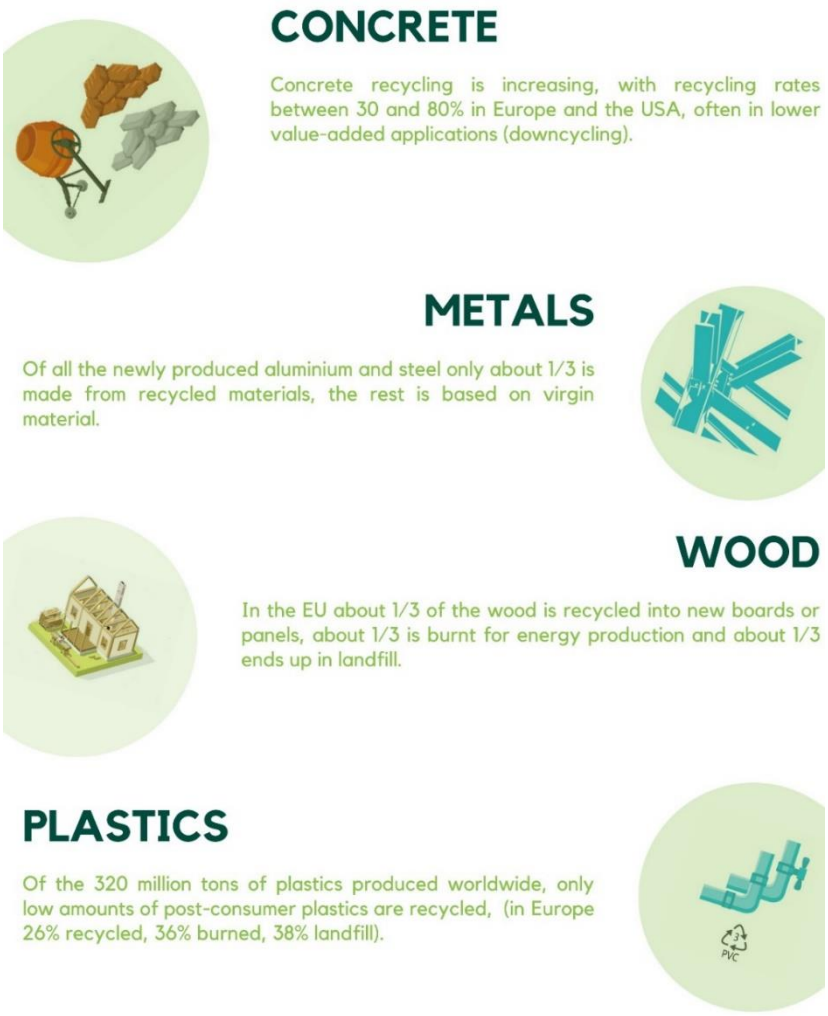


Figure 1: Bill of materials of a typical building (source: Nikos Chatzyvrettas)

Potential

Significant fractions of recyclable, reusable materials are integrated in constructions in general and particularly in buildings. A typical bill of materials, is depicted in Figure 1. Although the recycling potential of CDW is high in quantitative terms, it is still under-exploited. The mineral fraction of CDW, for example, is currently mainly being used in road foundations (downcycled). The recovery performances differ significantly between EU Member States (Eurostat, 2019b). An overview of the current situation regarding the management of some of the most important construction material streams is depicted in the following infographic. Several tools are designed, such as:

- The Protocol for Construction and Demolition waste management is introduced as a non-binding guideline, fitting within the Construction 2020 strategy(link is external) and within the Communication on Resource Efficiency Opportunities in the Building Sector(link is external)
- EU Guidelines for audits before demolition of building(link is external)
- Level(s): a common framework to assess the environmental performance of buildings(link is external)



Infographic 1: Management of material streams in the EU (source: Eleni Feleki)

The framework that intensifies the need to use CDW in a circular manner seem to be in good order and tools are designed and introduced. However, what is needed to really to put it in action?

This thematic article tackles the regulatory and standardisation needs, as operational tools in order enable the use of secondary raw materials in the construction sector, always taking consideration safety issues. The concerns and the insights expressed in this article, come from the experience and transnational exchange of the URGE APN partner cities.

Issues that hamper the reuse of secondary materials linked to standards and regulations

Although introducing green criteria in procurements of products and service would seem to be a solution to boost the market of secondary materials use in the construction sector, this is not enough. Preparatory work is needed, to prepare the framework and enable their use to a larger extent. From an operational point of view, some of the obstacles are linked to:

- Lack of European technical specifications for the use of secondary raw materials

Even if ambitious goals are set and standards exist to some extent, goals cannot be met, if detailed technical specifications are not introduced. For example, some European standards, such as EN 206: Concrete – Specification, performance, production and conformity and EN 12620: Aggregate for concrete, allow the use of recycled materials in concrete. According to the EU regulatory framework up to 20% substitution of virgin aggregates with concrete waste is allowed, as this is not considered to lower the new concrete's properties or influence its workability. However, the use of more than 50% of concrete waste raises the need for further testing (thus for new specifications) to prove the performance and the concrete is usually only suitable for certain applications leading to downcycling and not to upcycling. Undoubtably, the introduction of a full package of EU standards and technical specifications that would better reflect the EU targets needs piloting, tests, innovative solutions, so time and effort. Of course in this case, an alignment between European regulatory framework and reference to the new standards, would be required.

- Difficulties faced by Member States (MSs) to adopt to the demanding EU regulatory framework

National regulations follow the European regulatory framework. However, how ready are really all the MSs to adopt a demanding European regulatory framework that refers to new European standards? The readiness of the MS to adopt changes in the regulatory and standardisation frameworks and be aligned to the EU requirements varies. National regulatory framework updating is not an easy process. Undoubtably time is needed for the introduction, adaptation and in many cases transformation of current business models. Although MSs are in the process to adopt the EU ordinances and laws, there are still some gaps and the process depends on the prioritisation given at a governmental level. Different starting points, in terms of human capacities, materials and conditions that affect their quality, infrastructure, resistance to change existing business models, in combination with different governmental priorities are only some of the factors that can delay the transformation to a circular economy at country level and at EU level at the end. Thus, each MS's case, needs special focus and action from the part of the EU if we want to achieve at the end the common goals.

For some materials and in some MSs progress has been made to introduce national standards and regulations to enable the use of secondary materials and replacement rates that go further than the current standards might be technically feasible, only if the appropriate measures are taken – selective demolition, adapted milling processes, extra processing of the aggregates, and/or adapted water management in the mix formulations. But are all MSs able to use this ''flexibility rule'' and take these measures, in order to raise replacement rates and go further than current standards?

Concluding, there is still way to go by the MSs to adopt or harmonise their national standards and regulatory framework with the EU policy (demanding targets) and the (still voluntary) EU Directive on waste. National specifications, standards, national targets are missing or need updating.

In the frame of pilot projects held in several EU cities, tests are being conducted to investigate and validate that the specifications of products made of recycled materials are appropriate for certain uses. These tests offer valuable input towards the introduction of new or update of existing standards and regulations. Some progress is already recorded throughout the URGE Network.

Within URGE, partner cities have identified the importance of creating the necessary operational conditions to reuse CDW. The introduction of new or update of existing standards is definitely one of the lines of focus for the partnership. Below, the current situation and a pilot project is depicted, coming from the City of Munich which is one of the URGE partners.

The catalytic role of the introduction of new standards in the reinforcement of new legislation

Standards are technical documents, prepared by all interested parties (companies, consumers, workers, public authorities) on the basis of a number of principles (e.g. consensus, openness and transparency). Unlike regulations, they are not adopted by an authorised public authority but within private, independent and - in the case of European standards - officially recognised standards organisations.

Standards are a priori not binding and their application is voluntary. However, they can also play a catalytic role in the introduction of new legislation, in particular in technical regulations. If a legislator includes standards in a legal act or makes reference to them in one way or another, standards can obtain legal quality. The standards thus become a part of the requirements of as specific legislative act or of the system.

The advantages of making use of standards in legislation are manifold. Instead of being obliged to find solutions for difficult technical questions themselves, legislators can rely on the technical expertise of the standards developers and at the same time save public money. Moreover, thanks to the consensus-based, open and transparent procedure of setting standards and the subsequent broad acceptance of standards, the legislator can expect a broad acceptance of his legislation as well. Finally, standards reflect the latest 'state of the art' i.e. the latest technical developments. In order to follow the latest technical developments, standards must be regularly revised and accordingly adaptation of the legal needs to be done. The EU legislation may refer to international standards, European standards and, to a lesser extent, national standards.

Recycling of materials, under the angle of the Federal State Building Order in Germany: The case of recycled aggregates in structural engineering

The federal state Building Order in Germany, mainly consists of a Safety Law and not an Environmental Law. Thus, it is neutral with regards to the building materials. There is a generic requirement that materials have to be suitable for construction without harmful effects on health.

With regards to the recycling of concrete, the current normative requirements allow 25%-45% recycled aggregates in concrete up to a certain grade (C30/37). Asbestos in concrete structures, especially reinforcing bar spacers should be prohibited. Moreover, CDW containing asbestos may not be recycled.

At present, the use of recycled aggregates in structural engineering is very limited. Stakeholders have summarised them as follows:

- According to national legislation, only a small percentage of secondary raw materials (mainly concrete) can be used in the final product

- There is a lack of a Technical Standard, certifying the ability to use materials produced out of secondary materials and thus boosting the market
- Lack of circular criteria in procurements

Efforts to design new Technical Specifications for recycled concrete in Munich and reinforce legislation, through experimentation

In the capital city, Munich, the need to treat CDW in a circular way is very much acknowledged and promoted. Efforts are being made to influence legislation, at all levels. Efforts are being made also to change the procurement process and include circular criteria.

Influencing legislation is never an easy task. Evidence is needed coming from real ground practices. Thus, in the City of Munich, the attempt to change legislation is based on a solid case coming from the Bayernkaserne pilot project(link is external).

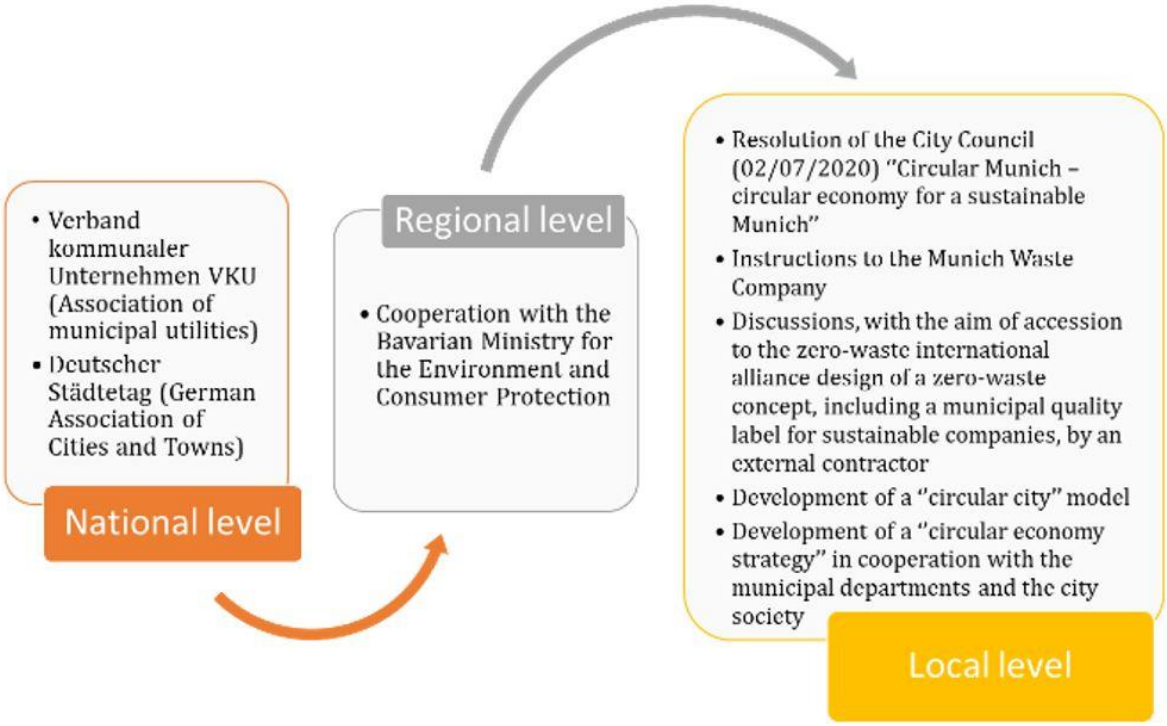


Figure 2: Influencing legislation at all levels

The Bayernkaserne project

A first concept for the production of construction materials from recycled building rubble was approved by the City Council of Munich, in July 2018 and September 2019. This approval was issued only for the project in the Bayernkaserne area. The area consists of a former military campus area of 50 acres, which is currently being transformed into a new living district. Tests are being implemented on-site, in order to investigate and validate the good performance of recycled materials, coming from the demolition of old buildings which are processed also on-site and reused for the new building constructions of the Bayernkaserne and for the area's soil rehabilitation.

The steps implemented in the site are the following:

- Cleaning of the construction site
- Design of selective renaturation with the greatest possible separation of the material
- Material preparation by breaking and sieving
- Production of recycled material (also on-site), two rounds of testing, firstly in the mixture and secondly, after the production of concrete, mechanical tests
- Construction

Thus, the recycling of concrete, containing aggregates made from 100% crushed mineral rubble, is applied at the moment in Munich, in the Bayernkaserne area, out of the great variety of raw materials that is generated, due to the demolition of the old military buildings that have been selectively dismantled.

The secondary raw materials that are generated and their uses are:

- Crushed mineral rubble as aggregate consisting of crushed concrete
- Crushed bricks, plaster, mortar, concrete
- Crushed mineral rubble as coarse aggregate
- Recycled fines (<2mm)

Newly produced concrete consists basically of the materials: depicted in Figure 3. Optimisation is held in order to improve the workability of fresh concrete.

When optimal characteristics are achieved, fresh concrete is produced on-site, and precast elements are constructed. The mechanical tests of the precast concrete elements, showed that the new materials are allowed to be integrated in the new constructions as parts of internal walls, granular subbases, ground plates, in an effort to recycle the mineral rubble as much as possible with quality of recycling concrete.

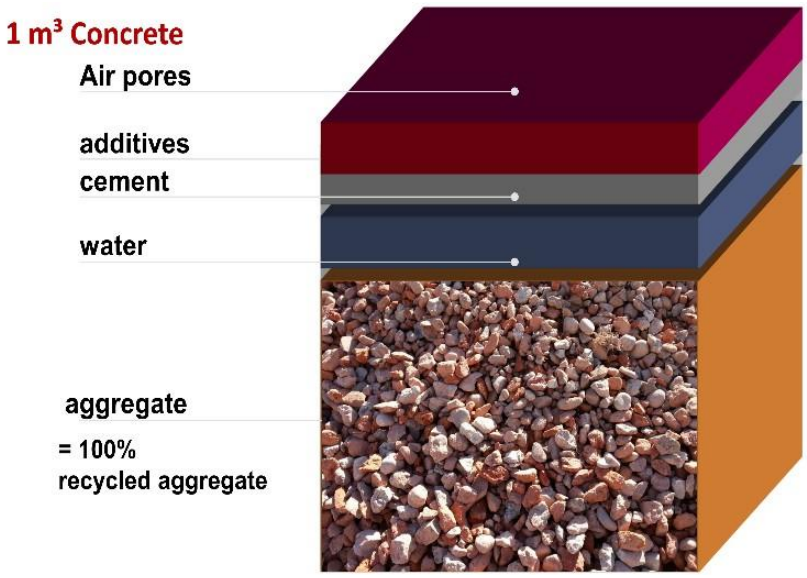


Figure 3: Synthesis of the concrete produced on-site (Source: Prof. Andrea Kustermann)

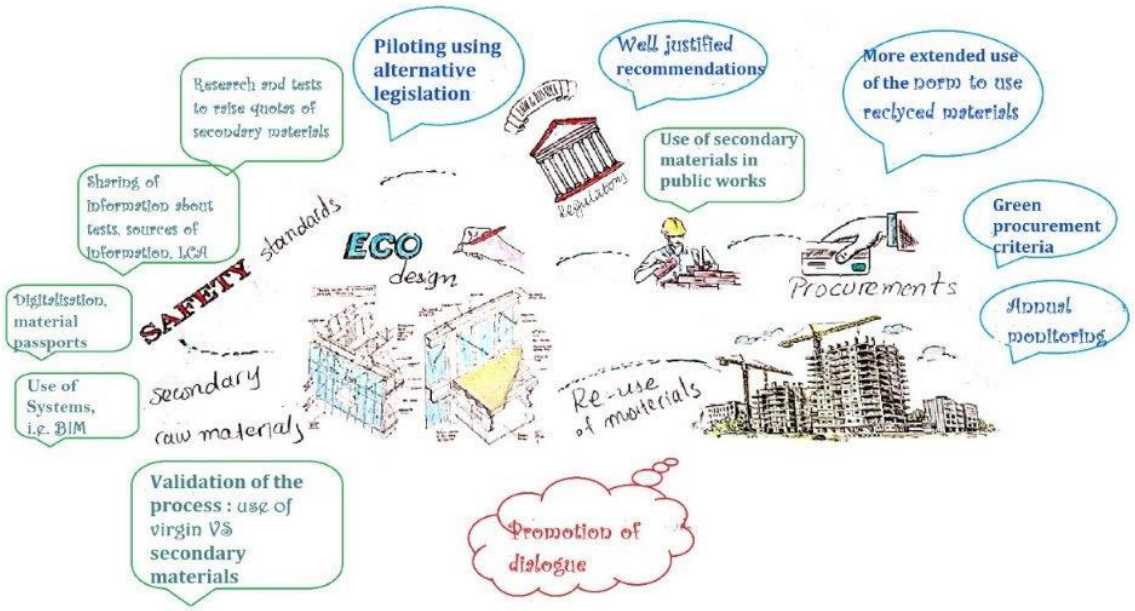
The results from the Bayernkaserne project, there are three areas of potential reuse of the materials:

- Buildings, following certain standards (i.e. DIN EN 206; DIN 1045; DIN technical report 100; DIN EN 12620; DIN 4226 T1 & T2)
- Earthworks and road construction, following: National guidelines; National ordinances; Technical contracts; Delivery conditions
- Gardening and landscaping, following specifications for large conurbations; apart from the production of concrete out of secondary materials, the soil is tested in the Bayernkaserne area and used for agricultural activities.

Although first results are positive, the whole process needs further laboratory testing.

Actions that URGE cities envisage to boost the introduction of new standards and update the EU and national regulation frameworks

The cities that participate in the URGE Network have identified the need to tackle the topics of standardisation, legislation, and procurements in order to boost circularity. According to the partners, actions that would have a big impact on the introduction of standards and regulatory framework, aiming to boost the use of secondary raw materials are depicted in the following infographic:



Infographic 2: URGE partners proposed actions to influence the standardisation and regulatory framework and boost the use of SRM in the construction sector (Source: Eleni Feleki)

A transnational thematic group has been built in the frame of URGE, dealing with the topic of use of secondary materials, enabled by technical specifications, standards and a regulatory framework. There is a lot of experimentation around concrete, soil and a lot to more to learn. Cities are interested in tackling the topics of standardisation and legislation boost green procurements, by developing integrated local action plans.

Final remarks

Standardisation plays an important role in reassuring the safe (from any point, environmental, occupational health and safety) integration of secondary raw materials in the final products, replacing the virgin ones. Standards need to be reviewed/ updated or new should be designed, in order to introduce a European CDW Directive and enable the achievement of the ambitious EU targets concerning circular economy. Then, the adoption at national level by the MSs would also accelerated.

In some cases, existing environmental certification or rating systems for new buildings (such as Level(s) from the European Commission) can offer some guidance. Those systems usually include requirements to:

- Phase out hazardous substances from the construction products and materials
- Create a logbook that identifies all products used along with their placement in the building
- Sort out CDW in fractions enabling the reuse, recycle and material recovery
- Use construction products that include a specific percentage of recycled materials.

Certification systems can provide some valuable help. They can be very useful to stakeholders with limited experience and resources, providing them with detailed and tested criteria that can be directly implemented in procurement or control procedures. Stakeholders that find it difficult to research and produce their own criteria can take advantage of such systems. Another benefit is that those systems are updated in regular periods and always follow the improvements and the development of the building sector.

There is no doubt that there are additional restrictions that hamper the use of secondary materials. Lack of information about the life cycle of materials, their properties, their technical data, their quality and presence of hazardous substances, such as asbestos, the low price of price of virgin materials in relation to the processing costs of demolition waste to meet existing standards are only some of them. URGE will continue to seek for practices implemented among the participating cities and to exchange knowledge, in an effort to foster transnational dialogue among EU experts and stakeholders.

Acknowledgements

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External contributors: Konstantinos Litsios, Product specialist in The Nordic Swan Ecolabel, Argyrios Michalakis, Strucural Engineer- Project manager, Nikos Chatzivrettas, Civil Engineer- Project manager.

Insights from the URGE network: thematic report

Insights from the URGE Network and experiences from the City of Prato: Governance model and improvement of knowledge as drivers to foster circular economy particularly in the building sector

By Dr. Eleni Feleki, Lead Expert of the URGE Action Planning Network

Background

Cities play a central role in the development of a circular economy. They act as test-beds of potential measures, by which transition can be achieved. Urban transition to a circular economy requires political will, commitment, sound governance, clear paths to follow and good knowledge. At the same time, cities are struggling between being trying to be the drivers of change and the battleground for many societal challenges of the 21st century. This has also been emphasised in the United Nations agreements of the New Urban Agenda(link is external) and the 2030 Agenda on Sustainable Development(link is external) and is now more relevant than ever due to the effects of the Covid-19 pandemic crisis.

The European Union's Urban Agenda has been set since spring 2016 with the Pact of Amsterdam(link is external) that identified the key operational intervention areas. It was made clear that change should start from:
1) Improvement of legislation (Better Regulation)
2) Sharing of best practices and improving cooperation (Better Knowledge)
3) Strengthening access and optimal use of funds (Better Funding)

This Urban Agenda is composed of 12 priority themes essential to the transformation of urban areas, each one of which dealt within a dedicated EU Partnership, bringing together different entities, aiming to implement the Urban Agenda. One of these partnerships is the Partnership on Circular Economy.

The EU Partnership on Circular Economy

The EU Partnership on Circular Economy focuses on:

- Circular consumption
- Urban resource management
- Circular business enablers and drivers
- Governance

Governance, especially at the local level, is a cross-cutting topic which is critical to put forward all the changes needed at operational level that can really boost circular economy. Policy gaps, lack of an integrated vision due to insufficient leadership and coordination, poor political commitment are topics linked to governance that have been also raised in the recent report of the OECD (2020).

Governance and enhancement of knowledge have been identified as important lines of intervention by the URGE partnership. This Thematic Report that follows the transnational exchange of the URGE partner cities on these topics, analyses the barriers and potential solutions discussed among the partnership and depicts a holistic governance model coming specifically by the City of Prato.

Barriers that hamper the development of circular economy at the urban level

Governance

An issue of great importance that has been raised by the URGE partnership, is the overlapping of policies and strategies, due to the lack of an integrated approach. This haumpers the ability to introduce a systemic approach and leads to the implementation of fragmented projects,

overlapping outputs and disruption of knowledge. Apart from silos between different municipality departments, there is also too much focus on the environmental impacts of interventions, leaving socio-economic aspects aside. Nature-based solutions, urban health and citizens' well-being, security, growth of jobs, resource efficiency, air quality, circular economy, should be given special attention holistically, covering an integrated local urban agenda that will serve a unique strategic vision.

In addition, the mandate in terms of who is responsible for the design and implementation of the circular economy strategy amongst the city administration, is not clear. And this usually leads to fragmentation of dialogues, decisions, visions, strategies, policies and plans produced by the same organisation. As result, weak accountability, loss of funds and under-exploitation of human capabilities, may encounter.

The introduction of a realistic vision and strategy for the med and the long-term is necessary in order avoid the risk of delivering isolated circular economy actions. Fragmented actions may be combatting, in many cases, with other municipality initiatives instead of complementing them. Thus the overall long-term vision is often missing. The key success factor is the introduction of a realistic, effective and integrated umbrella-strategy, supported by a SMART urban agenda. This should be accompanied by the reassurance that all entities, coming different departments, backgrounds, are involved. If so, the distribution of roles and responsibilities, maximization of synergies and funds' raising process are much more effective and complementary, serving one ultimate goal.

Moreover, clarifying a focal point (office/department), responsible for the introduction of the umbrella-strategy and of the urban agenda, is of great importance. In many cases, roles and responsibilities in setting and implementing visions, strategies, policies, plans and actions for circular economy are allocated for example to waste management, environmental planning, European funds department, failing to achieve a holistic, multi-dimensional approach. Thus, numerous different departments might be implementing circular economy activities or projects, while others might be dealing for example with urban health matters, mobility or even homelessness. Coordination should be achieved, under the wings of an inspired leader of a department that will be responsible for the governance and management of all issues that touch urban sustainability and circular economy.

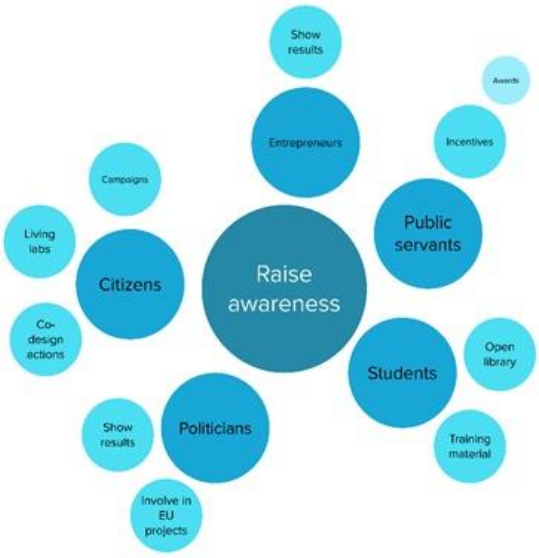
Awareness and capacity gaps

Undoubtably, acting in line with the circular economy principles calls for significant transition that needs to be initiated by people. As any human-centered transformation, time and patience are needed. A good starting point is to seek for consensus; for a common understanding on what circular economy is. This is missing up to date at least at the local level. Cultural barriers that might be prevalent within the community prevent the necessary behavioural shifts required for a transition to the circular economy. Circular-economy-related activities, might be barely conceived as valuable options to reduce consumption and therefore waste generation, due to lack of knowledge.

Most commonly, the lack of knowledge and understanding of the concept are relevant for all the players of the chain: from decision makers to citizens and from engineers to construction workers. Poor awareness of the benefits of circular economy and of good practices, forestalls cities from unlocking the potential.

In terms of capacities, municipalities fail to fully meet the needs of the circular economy transition, due to underdeveloped human resources. There is a need for well-informed technicians with specific knowledge of the circular economy, not only in the case of people involved in drafting strategies and plans at local level, but, even most importantly, in the case of technical blue-collar workers that are needed for circular construction. While informative workshops and events may often remain generic, actors from business sector, could benefit from more specific and practical input, including through peer-to-peer learning. URGE partners have exchanged deeply on ideas to raise stakeholders' engagement, raise awareness and involvement of decision-makers. Their views on how to engage stakeholders, raise awareness and involve decision-makers are depicted in the following infographics.

Infographic 1: Awareness raising (Source: Eleni Feleki) & Infographic 2: Decision-makers (Source: Eleni Feleki)



Infographic 3: Stakeholders engagement (Source: Eleni Feleki)

An effective circular economy governance model: Experience from Prato

In Prato, the green transition is at the heart of the municipal administration's program in line with the new climate goal of reducing emissions by at least 55% by 2030. This will be implemented in line with the first European climate law that the Council and Parliament Plan will adopt, together with NextGenerationEU and the 2021-2027 Budget. The Plan will include adequate measures to achieve the European objectives regarding renewables, energy efficiency, pollution control, sustainable mobility, protection of biodiversity, support for the transition to sustainable food systems and the circular economy, without leaving any citizen behind.

This integrated planning approach translates into the administrative mandate in the coordination between the Structural Plan, the Sustainable Energy Action Plan and the Climate - SECAP, Urban Forestry Action Plan, Prato Urban Jungle, PUMS, Prato Circular City and Smart City Plan, all developed in line with the Single Programming Document - DUP, which inserts Prato's policies into the Sustainable Development.

More specifically, Prato has promoted a general vision on environmental issues that has configured **the Prato Green Deal 2050**, in the logic of promoting healthy lifestyles, improving people's physical health, their relationships and the ability to take care of the quality of public

places. As part of this overall strategy, a series of steps have been undertaken and a variety of programs have been and still are developed, which are presented below. The achievements of Prato that are produced through longtime hard, collaborative efforts have Cultivated the City's participation in the EU Partnership on Circular Economy, coordinating several working groups: water reuse; urban reuse management; Pay-As-You-Throw (PAYT) system. The outputs produced by Prato in this frame are: a position paper for a legislative proposal on minimum requirements for reused water for irrigation and groundwater; Pay-As-You-Throw tool(link is external); Handbook on sustainable and circular re-use of spaces and buildings(link is external).

A series of decisions and actions led Prato to be a model for governance of circular economy

The success of Prato and its recognition at EU level among the pioneers in circular economy, lays upon the early introduction of a holistic governance model, **starting with the introduction of a solid local strategy**, respecting the Sustainable Development Goals 2030(link is external). Prato's local strategy is focused on the areas of: environmental transition; digital transition; circular transition and support; social inclusion.

With regards to circular transition, the theme has historically been relevant for Prato, since reuse has been the basis of the development of the textile district, with the creation of carded wool, the first recycled spinning. Since 1980, a centralised system for the purification of civil and industrial waste water(link is external) has been created, thanks to public-private investments. Today, the theme of the circular economy remains extremely relevant for Prato. On both the economic and urban development side, circularity has become the watchword for strategy of the city.

Prato's local strategy is further unfolded to serve the city, through an integrated, local **Urban Agenda Prato.** This leads to the next cornerstone for the city's success story: the translation of its strategy into a holistic urban agenda, which embraces all aspects of sustainability and is managed centrally by **one specific Department**, led by an engaged deputy-Mayor of urban planning, environment and circular economy.

But still, success in Prato does not lay on a one-man show, or one-department show uniquely. Prato gives a lot of credits on collaboration, co-design and co-creation. **A memorandum of understanding** titled: "Circular Cities", fosters the collaboration between the Ministry and three Cities, including Prato. The memorandum promotes concrete activities that are transversal to all territories.

The memorandum is further supported locally through the ''**Prato Circular City Project**''. Several working groups discuss about methods to foster circular activities including: product and service design; raw material procurement, production and distribution models; more efficient marketing; extension of the useful life of the products and models of reuse; sustainable consumption models and sharing economy activities; recycling of resources from waste. Such a collaboration enables the exchange of information regarding funds' raising, helps to avoid overlapping initiatives, cultivates the sense of togetherness, helps to break silos and at the end, supports the good monitoring and achievement of goals.

The URGE project is already embedded in Prato Circular City project's activities: the Integrated Action Planning process has been indicated as one of the tasks of the Prato Circular City project.

Having set the local strategy, the local agenda and the model for collaborative exchange on realistic and feasible actions, Prato puts forward concrete projects. Prato participates in numerous EU, national, regional clusters and initiatives, securing to a great extent the **funding of projects**. Examples of ongoing projects, are presented in the following section, respecting the strategy and the urban agenda of the city.

Last but not least, Prato communicates effectively the outputs of the projects. For example, the **Recò circular economy festival** aims to address best practices in the field of sustainability and renewal, through talks, concerts, theatre shows and guided tours, including family events and performances in the city's industrial districts. The festival is organised by the Region of Tuscany and Toscana Promozione, in collaboration with the Municipality of Prato.

A governance model cannot be implemented without capable human resources. A limited number of trained staff available at local government level to perform municipal functions and the difficulties in attracting competent staff, usually add constraints in the transformation process. Prato acknowledged from the early beginning the need to build capacities and skills, seek for external support and raise awareness on the issue of circularity as a key success factor. Synergies have been made with the ARCO team, part of the University of Florence, that supports the transformation of the city. There are several training packages targeting public officers, entrepreneurs, employees in the private sector developed to raise awareness and knowledge on circularity:

1. Handbook on urban regeneration(link is external)

2. Webinars organized by the Chamber of Commerce of Prato on circular economy http://www.po.camcom.it/news/eventi/2020/20201130-webinar-economia-circolare.php(link is external); https://www.youtube.com/watch?v=WvfUTR502yQ

3. University syllabus of the "sustainability of production chains" course

A quick overview of on-going projects in Prato

There are several projects that are being implemented in the frame of the urban agenda in Prato, all of them aiming to a more sustainable urban environment, putting forward health, well-being, growth and jobs. Through these projects, Prato tells us its story not only in narrative, but in a realistic way.

Figure 1: Macrolotto 0 (Source: Valerio Barberis)

The **"PIU' PRATO"** is an urban innovation project of more than 8 million Euros. The project aims to redevelop a part of Prato called Macrolotto 0. The program of interventions in this area is configured as a virtuous example of a municipal strategic action that positively affects a peripheral area, defining its new identity and improving its attractiveness. Despite the relatively central location, the zone has the characteristics of a peripheral area: buildings' degradation, lack of spaces for public use, under-allocation of services for the people, blind roads and other physical barriers. The Macrolotto 0 is one of Europe's major urban areas that houses families of Chinese migrant workers.

Figure 2: Macrolotto 0 (Source: Valerio Barberis)

More analytically, the regeneration project aims to make the area more liveable, attractive, socially and economically lively, thanks to a series of actions that aim to give value to public space. The actions are designed to recover abandoned buildings, construct green spaces, promote sustainable mobility, provide a media library and co-working spaces. In general, the area will be a meeting place and hub of social activities, serving the neighborhood and the city as a whole. Part of the buildings will be retained. The project includes the redevelopment of a former factory, with the creation of spaces dedicated to social and commercial activities: a **metropolitan market**, workshops for training courses, House of the Associations, health information office for foreign women and a cultural intermediation office.

Figure 3: Prato urban jungle (Source: Valerio Barberis)

The Prato urban jungle project, aims to re-naturalise neighborhoods, in a sustainable and socially inclusive way through the development of green areas. These urban areas with high housing and construction density will be redesigned using a green approach. The project promotes a new strategic urban planning approach with a strong co-design and stakeholder engagement focus that will support the most inclusive urban green development in the city. Through this project, it is intended to achieve 1) the regeneration of disused, under-utilised or declining urban areas and 2) the creation of green hubs in the community, high density green islands and structures/areas for multiple uses.

Figure 4: Pacchiani and Bastione delle Forche (Source: Valerio Barberis)

PRIUS project aims to re-qualify an area of 1.25 square kilometers near the historic center, subjected to marginalisation and social degradation. The renovation of Palazzo Pacchiani and the restoration of Bastione delle Forche as well as the transfer of Municipality Offices in the Palazzo are among the interventions. The project has also a social character, due to the restoration of the night shelter for homeless people. Sustainable mobility paths, improvement of urban furniture and leisure activities conclude the transformation of this historic area. The next step of the municipal administration in Prato is to promote an **updated governance model of the city**, through the creation of a management entity. The aim of this entity will be to map the open spaces and disused buildings and develop indicators with a specific reusability coefficient, making the match between various subjects and transform free spaces into new studios, start-ups, housing, laboratories, residences, etc.

Misericordia e Dolce: Sustainable dismantling of Prato's old hospital

The old hospital of Prato, "Misericordia e Dolce", was abandoned in 2014. It operated in a vast complex of ancient buildings, constructed and modified from the 13th until the late 19th century. Since the early sixties a large modern building was added, which occupied the large area of the old holding of the Hospital. The addition of a surface of 43,000 square meters destroyed a green lung of almost 4 hectares and caused a serious wound to the urban fabric of the city, tolerated only for the health facility the mighty estate gave answer.

Figure 5: Misericordia e Dolce (Source: Valerio Barberis)

In 2002, the Region of Tuscany has approved the "New Hospital" project for Prato, which finally opened in 2013. The decision to move the hospital laid upon logistic and technical reasons. The City Council immediately took into consideration the possibility of regaining the area of the old hospital to redevelop it and give it back to the citizens.

Everything started with the setting of the vision for this area, in line with the local strategy and urban agenda. The vision was to accomplish a new public place, attractive to the citizens but also to the international cultural tourism flows. The area would be converted into a new place, adopted into the historic context of great value, able to convey the image of Prato as the city of contemporaneity in Tuscany.

In 2014, a Programme Agreement was signed between stakeholders for the environmental restoration of the area. The Agreement provided that a major part of the area would become municipal and would be used for the creation of a large urban park of around 3 hectares. In addition, it was agreed that the hospital demolition process would take place selectively, in order to recover the materials to be reused, in line with the circular economy approach of the city.

In 2016, the Municipality of Prato launched an international architectural competition for the redevelopment of the area. Dealing with several administrative obstacles, the site for the selective demolition of the former Misericordia e Dolce hospital was finally delivered in August 2020.

Today, 30 people and three demolition bulldozers are working in the area. The method used, technically called strip out, provides for the selective demolition or the preventive removal of all the materials. Several critical issues were raised. About 3 linear km of asbestos lay in the structure of the former hospital. The works began with the identification of these parts, in need of special handling and safe disposal to Germany. Another issue was the spot of the site, inside the historic walls, surrounded partly by residences and partly by hospital administration offices that are still operating. The site was set up to respect noise levels. An additional point of concern was the generated dust. A washing system for the wheels of the outgoing trucks has been set up, to keep dust levels low. Experience so far shows that dust is also generated at the point when concrete is clamped. Therefore, a 40 meters pipe is installed, reaching the clamp. Water is sprayed directly on the caliper. Another point where the dust is generated is when the dismantled material falls on the ground. A continuous dust and noise monitoring plan is in place, with three dust control units. Last but not least, logistic issues have been taken into consideration. No particular traffic issues, caused by the vehicles transporting dismantled materials, are expected. The site is structured in such a way as to serve continuous flows of the disassembled materials. 30 daily-trips are scheduled and 10-15 trucks will be used to serve the flows of materials.

The sustainable dismantling of materials has already begun: doors and windows, radiators, air conditioners, electrical sockets, are extracted and weighed. The demolition company estimates a very high rate of recovery and reuse of the materials resulting from selective demolition. The materials will be handled in Italy, except for asbestos.

Final remarks

Policy gaps, a lack of an integrated vision due to insufficient leadership and coordination and poor political commitment can be overcome only through the introduction of a decentralised, community-based and participatory approach/process for the design, development and implementation of circular economy programmes. This will increase the prospects for boosting of participation, accountability and transparency and promote local involvement and enablement. Transition towards a circular economy implies investments and adequate incentives. In addition, although regulatory gaps have already been tackled through the previous URGE Thematic Report, it is important to remind that inadequate regulatory frameworks and incoherent regulation across levels of government, represent a great challenge towards putting forward the circular economy governance model. In terms of human capacities and skills, a lack of awareness and inadequate information for decision-makers to take decisions and a lack of inspired entrepreneurs and citizens that embrace sustainable consumption patterns were brought up as well. Moreover, a lack of human resources that can put forward technical solutions is is a concern for many cities. These conclusions are fully in line with the OECD survey (OECD, 2020). The percentages reflect the views of the cities that participated in the survey.

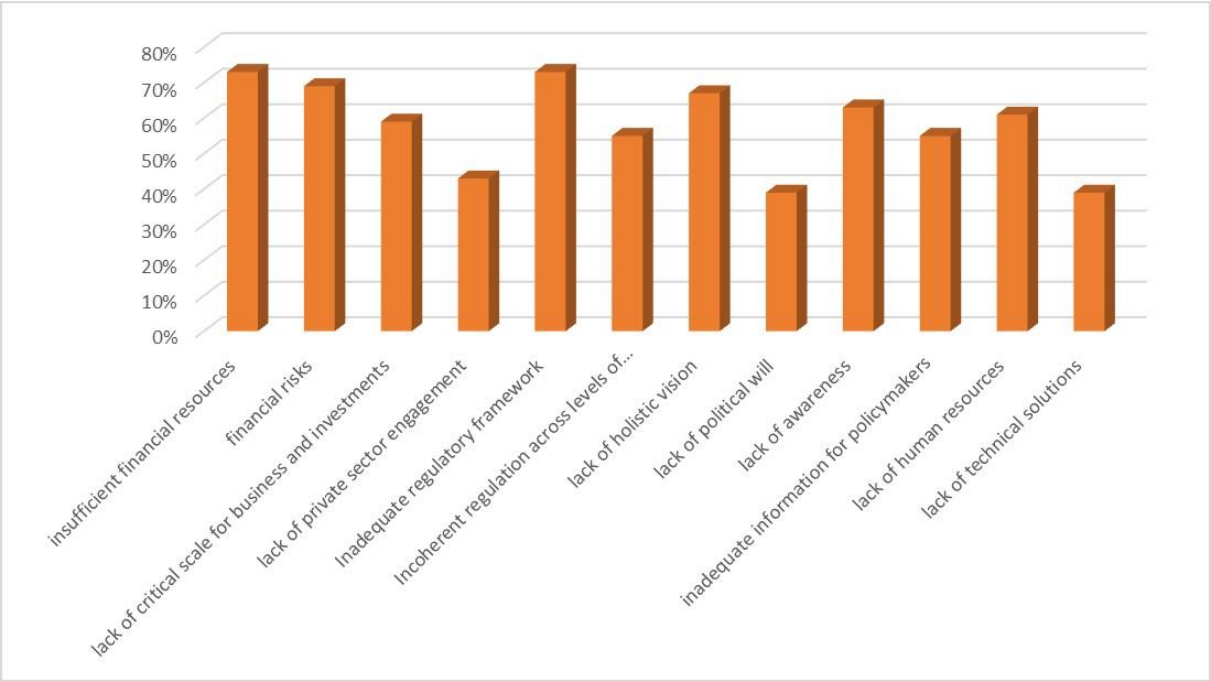


Figure 6: Barriers that hamper the boost of circular economy (Data: OECD, 2020 and own processing)

Acknowledgements

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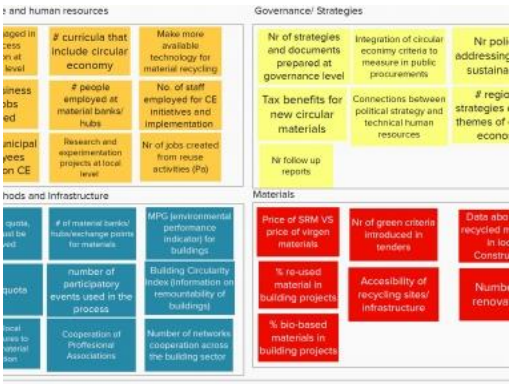
Insights from the URGE network: thematic report



Insights from the URGE network on the field of circular economy indicators: A framework for better-informed decision making.

By Dr. Eleni Feleki, Lead Expert of the URGE Action Planning Network

Introduction

The Commission's Circular Economy package (2018) includes a monitoring framework to measure progress towards a circular economy at both EU and national level. This monitoring framework consists of a set of 10 key indicators, which cover each phase of a raw material's life cycle and the related economic aspects.

Which indicators are proposed by the EC to assess progress?

The EC monitoring framework for circular economy(link is external) is composed of ten indicators, some of which are disaggregated into sub-indicators, capturing four key areas of the Circular Economy Action Plan.

Table 1: Indicators included in the EC Circular Economy monitoring framework

Key areas	Indicators
Production & consumption	1. EU self-sufficiency for raw materials 2. Green public procurement 3. Waste generation a. Generation of municipal waste per capita b. Generation of waste excluding major mineral waste per GDP unit c. Generation of waste excluding major mineral waste per domestic material consumption unit 4. Food waste
Waste management	5. Recycling rates a. Recycling rate of municipal waste b. Recycling rate of all waste excluding major mineral waste 6. Recycling/recovery for specific waste streams a. Recycling rate of overall packaging waste b. Recycling rate of plastic packaging waste c. Recycling rate of wooden packaging d. Recycling rate of electrical and electronic waste (e-waste) e. Recycling of biowaste per capita f. Recovery rate of construction and demolition waste
Secondary raw materials	7. Contribution of recycled materials to raw materials demand

	a. End-of-life recycling input rates b. Circular material use rate 8. Trade in recyclable raw materials
Competitiveness/ innovation	9. Private investments, jobs and GVA related to circular economy sectors a. Gross investment in tangible goods b. Number of persons employed c. Value-added at factor cost 10. Number of patents related to recycling and secondary raw materials

The indicators are calculated based on existing information from Eurostat, the Raw Materials scoreboard and the Resource Efficiency scoreboard. **Eight indicators are already present in other European frameworks as well.** The other indicators are under development: 'Food Waste' (also foreseen in the revision of the EU Waste Directive) and 'Green Public Procurement' (GPP that may depend on the inclusion of relevant requirements like reparability, durability and recyclability that will be present in public contracts and procurements).

The CE monitoring framework also uses material flow analysis (MFA) with Sankey diagrams to give an overview of material flows in the EU. The diagrams show aggregated information of metallic and nonmetallic materials, fossil energy, and biomass providing an initial guide for a more detailed MFA.

Although several countries have developed circular economy strategies at a national level, few of them have set up a monitoring framework (OECD synthetic report, 2020). Generally speaking, many of these indicators focus on waste management. For example, in France, the "10 Key Indicators for Monitoring the Circular Economy" launched in 2017, includes a set of 10 indicators for waste management, consumer demand, behaviour and supply from economic stakeholders.

SDGs and the EC framework for monitoring circular economy

At the heart of the "2030 Agenda for Sustainable Development" lay the 17 Sustainable Development Goals, (SDGs) which are an urgent call for action by all countries in a global partnership. In this context circular economy is recognized for its importance towards eliminating waste and the continual use of resources as it aims to keep products, equipment and infrastructure in use for longer, thus improving the productivity of these resources.

CE and SDGs are both relevant pillars for our sustainable development. The question that raises is: *To what extent are circular economy practices relevant for the implementation of the SDGs?*

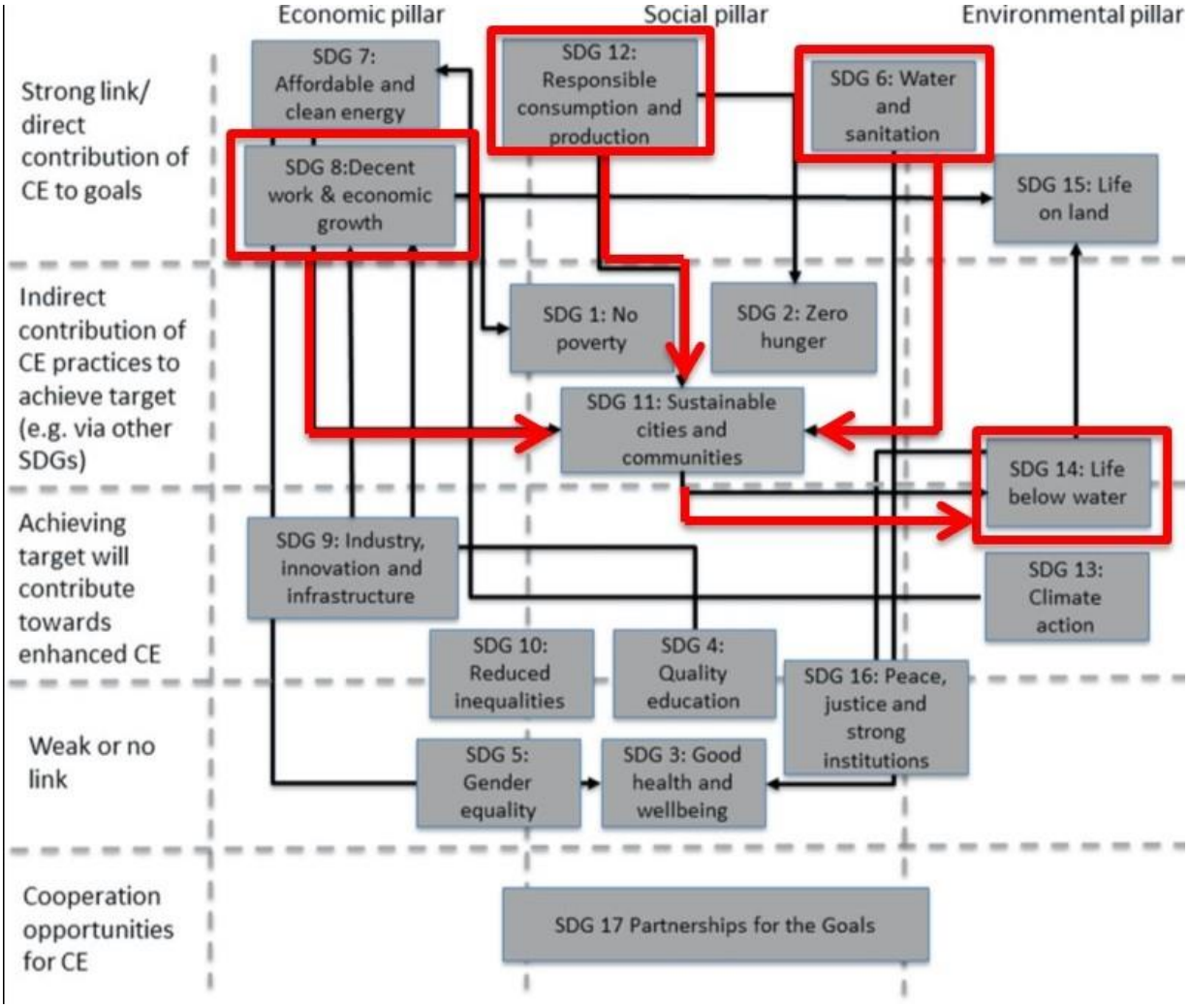


Figure 1: Interaction between SDGs and CE practices. Source: Schroeder et al., (2018)

Based on the scientific work of Schroeder et al. (2018), indicators included in the SDG framework have been classified according to their ability to address circular economy. The classification has been made using the following categories: (1) direct/strong contribution of circular economy practices to achieve each SDG (2) indirect contribution (3) progress on SDG drives the uptake of circular economy practices (4) weak or no link and (5) synergistic opportunity to promote circular economy practices. Although circular economy is closely related to SDG 12 Sustainable Consumption and Production, CE practices and principles are transversal. The strongest relationships and synergies between CE practices and SDGs lie within SDG 6 Clean Water and Sanitation, SDG 7 Affordable and Clean Energy, SDG 8 Decent Work and Economic Growth, SDG 12 Sustainable Consumption and Production and SDG 15 Life on Land.

Taking into consideration the classification of SDGs according to their ability to address circular economy practices, the SDGs have also been grouped (Schroeder et al., 2018) according to economic, social, and environmental pillar they reflect, results are depicted in Figure 1, where the red arrows between the SDGs indicate the main interactions and connections between the SDGs in relation to circular economy practices.

SDGs and the construction sector

Innovative business and refurbishment practices in construction sectors interact strongly with Goal 11 Sustainable Cities and Communities, especially enhancing the results of the target 11.6: Reduce the adverse per capita environmental impact of cities by 2030. To scale up refurbishment and repair practices globally, international standards can play an important role. In this sense, a new European approach to assess and report on the sustainability performance of buildings, throughout the full life cycle with a circular approach has been introduced: Levels(s), bringing minimum numbers of indicators, with maximum leverage to deliver sustainability taking into consideration the need to foster CE.

SDGs and Level (s)

Level(s)(link is external) is an assessment and reporting framework that provides a common language for sustainability performance of buildings. Level(s) promotes lifecycle thinking for buildings and provides a robust approach to measuring and supporting improvement from design to end of life, for both residential buildings and offices.

Figure 2: SDGs and the built environment.

Level(s) is divided into three areas, each with its own subject matter and desired outcomes

- Resource use and environmental performance during a building's lifecycle
- Health and comfort
- Cost, value, and risk

Level(s) provides a set of indicators and common metrics for measuring the performance of buildings along their life cycle. As well as environmental performance, which is the main focus, it also enables other important related performance aspects to be assessed using indicators and tools in the áreas presented above.

It is structured as follows:

- Macro-objectives: An overarching set of six macro-objectives for the Level(s) framework that contribute to EU and Member State policy objectives in areas such as energy, material use and waste, water and indoor air quality.
- Core Indicators: A set of 16 common indicators, together with a simplified Life Cycle Assessment (LCA) methodology, that can be used to measure the performance of buildings and their contribution to each macro-objective.

Table 2: Set of indicators and macro-objectives in Level(s)

Thematic areas	Macro objectives	Indicators			
Resource use & environmental performance	GHG emisssions along a buildings life cycle	Use stage energy performance (kWh/m2/yr)	Life cycle Global Warming Potential (CO_2 eq./m2/yr)		
	Resource efficient and circular material life cycles	Bill of quantities, materials and lifespans	Construction and Demolition waste	Design for adaptability and renovation	Design for deconstruction
	Efficient use of water resources	Use stage water consumption (m_3/occupant/yr)			
Health and comfort	Healthy and comfortable spaces	Indoor air quality	Time out of thermal comfort range	Lighting	Acoustics
Cost, value and risk	Adaption and resilience to climate change	Life cycle tools: scenarios for projected future climatic conditions	Increased risk of extreme weather	Increased risk of flooding	
	Optimised life cycle cost and value	Life cycle costs (€/m^2/yr)	Value creation and risk factors		

Use of Level(s): Case studies

Slovenia offices

In a country with few certified green buildings, this was a fantastic learning experience but a challenge. To collect the bill of materials was difficult, and availability of supporting evidence of product performance such as EPDs was another challenge - so more focus on this data is critical. There was no common language between architect, assessor, contractors, suppliers on what they wanted to achieve, meaning communicating Level(s) widely so that common goals start to emerge is key.

Figure 3: EXPERIENCE CENTRE - Knauf Insulation. Source: Taking action on the TOTAL impact of the construction sector. Luxembourg Publications Office of the European Union 2019.

Finland residential

Cooperation across the construction value chain will be key. Benchmark buildings are needed to verify performance, and the guidance and reporting will need to be streamlined so information is all brought into once place and is more user-friendly. Digital tools will also be needed to simplify Level(s) reporting.

Figure 4: LIGHTHOUSE JOENSUU - Stora Enso. Source: Taking action on the TOTAL impact of the construction sector. Luxembourg Publications Office of the European Union 2019.

Spain office

Level(s) involves significant effort, but in Spain, its roll out is replicated across existing buildings. Currently, there is a lack of standardisation of the data that are needed - this is super important - to be able to benchmark and have a picture of the building stock and the definition of processes, products, equipment and systems in existing buildings - but this is the future and this is what Level(s) can provide.

Figure 5: Headquarters of the Ministry of Territory and Sustainability of the Catalan Government and the Housing Agency of Catalonia. Source: Taking action on the TOTAL impact of the construction sector.

The EU partnership for CE indicators framework (local level)

The EU Urban Agenda has also identified indicators that can be useful for cities to assess their transition to the circular economy. (CE strategy at urban level: OEDC indicators to set and implement CE strategy at local level(link is external)). It introduces 140 indicators for circular economy transition in cities(link is external) including two overarching indicators on GHG and the availability of a circular economy strategy at the local level.

The OECD synthetic report

The recent OECD synthetic report includes an inventory that provides an overview of circular economy measurement frameworks. The OECD Inventory of Circular Economy Indicators (forthcoming) collected 474 Circular Economy - related indicators, between 2018 and 2020. There are categorised into five main categories (economy and business; environment; governance; infrastructure and technology; and jobs), 33 sub-categories and 11 sectors. In the selection of indicators per sector, there are several examples that might fit into URGE. (i.e. indicators about built environment, resources and materials etc). Indicators that fall under the built environment sector:

- Construction works with circular design
- Financial resources mobilised for experiments on the building sector

- Voluntary agreements signed to reuse of building components

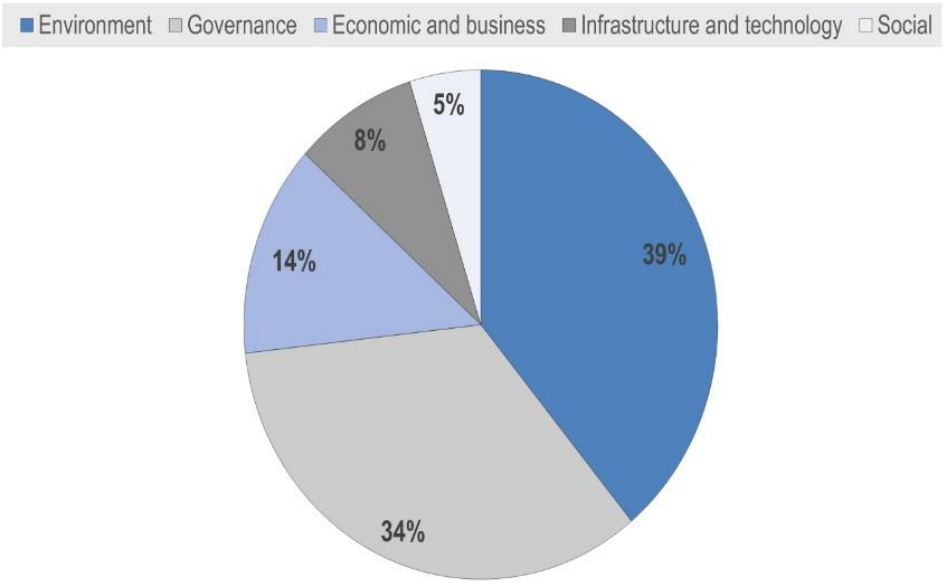


Figure 6: OECD examples, indicators by sector. Source: OECD, 2020

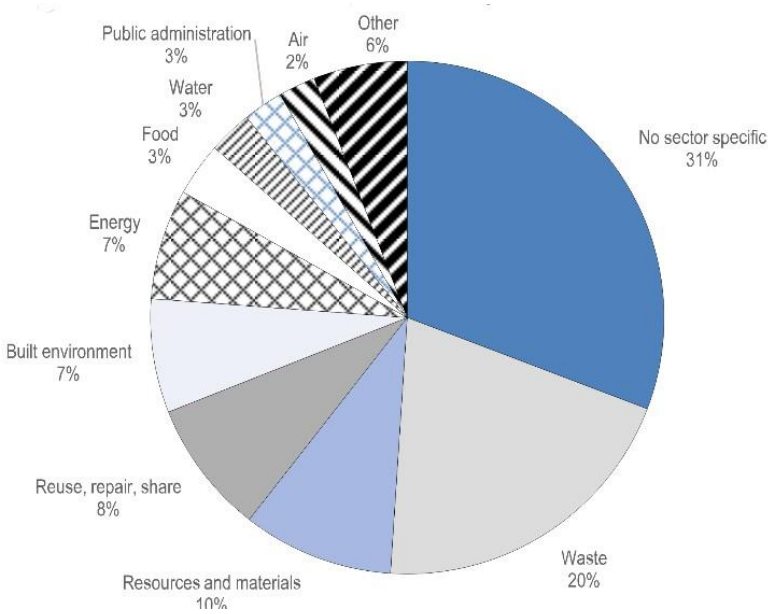


Figure 7: OECD indicators per category and sub-category. Source: OECD, 2020

Selected indicators for setting and implementing a circular economy strategy

When developing a circular economy strategy, it is important to take into account the co-ordination across municipal and regional departments, the involvement of stakeholders for an inclusive and participative process, select several projects for the achievement of established targets and identify sources of funding. When the strategy has been set and implemented, key results concern the creation of businesses and jobs, the number of products procured according to circular criteria, as well as environmental conditions such as waste diverted from landfill.

The tables below depict the key indicators contained in the OECD Survey on the Circular Economy in Cities and Regions (2020) for (i) setting and (ii) implementing circular economy strategy indicators.

Table 3: Setting the CE strategy indicators. Source: OECD Survey on the Circular Economy in Cities and Regions (2020) for setting and implementing CE strategy indicators.

Type of indicator	Indicators for the circular economy strategy: inputs, process and output
Process	No. of public administrations/departments involved
Process	No. of stakeholders involved
Input/process	No. of actions identified to achieve the objectives
Input/process	No. of projects to implement the actions
Process	No. of projects financed by the city/regional government/Total number of projects
Process	No. of projects financed by the private sectors/Total number of projects
Process	No. of staff employed for the circular economy initiative and implementation within the city

Table 4: Implementing the CE strategy. Source: OECD Survey on the Circular Economy in Cities and Regions (2020) for setting and implementing CE strategy indicators.

Type of indicator	Indicator for the circular economy strategy: inputs, process and output
Environmental output	Waste diverted from landfill (T/inhabitant/year or %)
Environmental output	CO_2 emission saved (T CO2/capita or %)
Environmental output	Raw material avoided (T/inhabitant/year or %)

Environmental output	Use of recovered material (T/inhabitant/year or %)
Environmental output	Energy savings (Kgoe/inhabitant/year or %)
Environmental output	Water savings (ML/inhabitant/year or %)
Socio-economic output	No. of new circular business (e.g. companies, start-up, etc.) created to implement the circular economy initiative
Socio-economic output	No. of businesses (e.g. companies, start-ups, etc.) adopting circular economy principles
Socio-economic output	Economic benefits (e.g. through additional revenue and costs saving) (EUR/year)
Socio-economic output	No. of employees of new circular business
Socio-economic output	No. of jobs created from circular activities
Governance output	No. of companies coached by the city/region to adopt circular economy principles
Governance output	No. of contracts awarded by the purchasing department of the city/region that include a circular economy criterion/ Total number of contracts
Governance output	City/region % of public investment dedicated to the circular economy initiative/total public investment by the city/region

Circular economy monitoring frameworks introduced by European cities

Several circular economy indicators are monitored by European cities as a result of their strategy. Their main purpose is to assess how the city is performing towards the achievement of targets. Specific examples refer to the cities of Amsterdam, Paris, Turku and Porto.

An example is depicted, coming from the city of Amsterdam that monitors three main indicators: value retention, economic and ecological impacts. These three indicators, which have been developed by a programme of the Ministry of Infrastructure and the Environment of the Netherlands, are comparable with the national level.

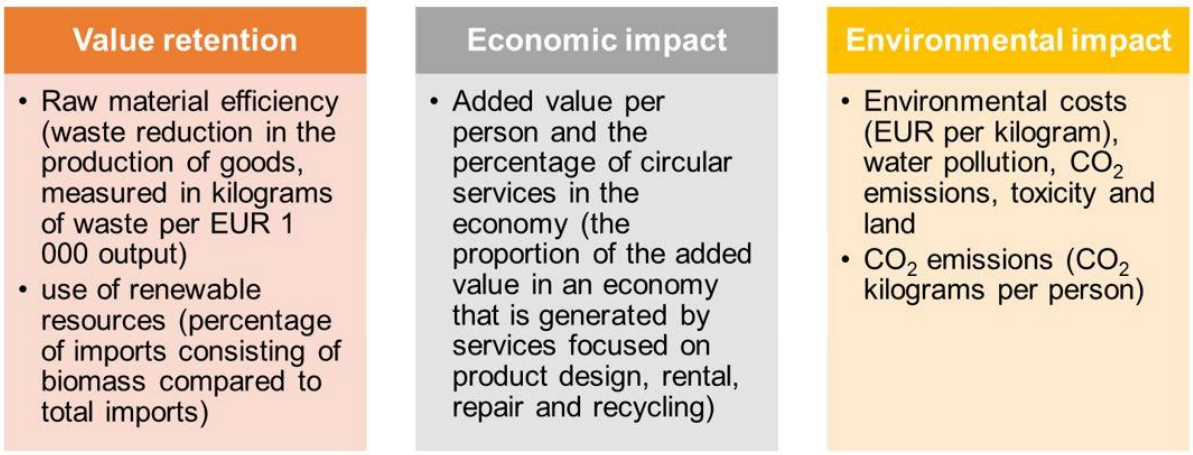
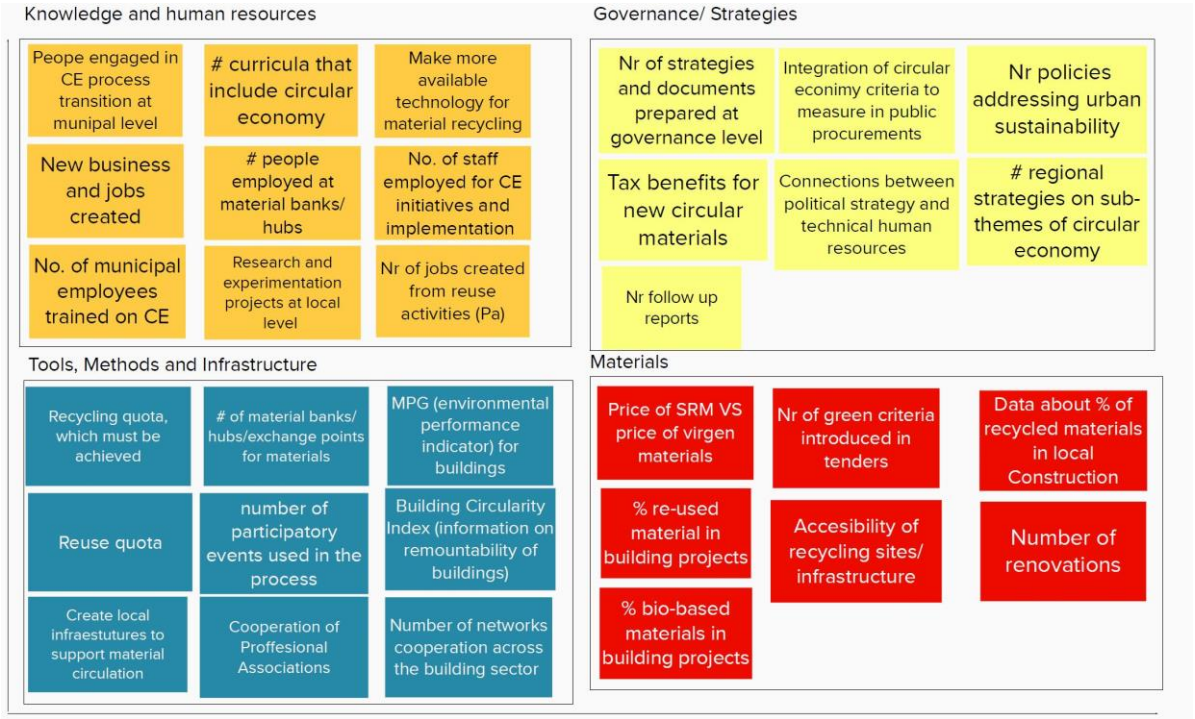


Figure 8: CE indicators in the city of Amsterdam. Source: Circle Economy et al. (2016), "Circular Amsterdam - A vision and action agenda for the city and metropolitan area", https://www.circle-economy.com/resources/developing-a-roadmap-for-the-first-circular-city-amsterdam(link is external)

Other cities that monitor circular economy indicators are Munich and Tilburg, mostly focused on waste (e.g. residual waste, waste separation, waste recovery through inclusive recycling programmes, recycling rates and monitoring of results from recycling programmes). More information about the frameworks used by European cities to monitor circular economy are available here: Indicators applied at local level(link is external) (OECD).

Which indicators did the URGE partners propose?

During the URGE transnational meeting digitally held by OESTECim, the URGE cities reflected on indicators that they would include in their monitoring frameworks, at local level, to measure circular economy. The results of the brainstorming activity are depicted below.



Infographic 1: Indicators proposed per line of intervention

Conclusions

Introducing a local framework of indicators is most often a great pain for decision makers. The ultimate goal of monitoring is usually not obvious, integrated approach is missing, data is usually missing or not reliable and last but not least, there is usually a freedom to include or exclude indicators from the local monitoring framework, according to the willing of the decision maker, introducing thus great objectivity to the results. The scope and also the calculation method for each indicator in a framework, must be well agreed and documented (Feleki et al, 2020; Feleki et al, 2018).

Indicators that can be included in a monitoring framework can be classified based on the needs they serve (indicatively) as follows:

1. To assess the governance model integration and performance
2. To assess the environmental impact from the substitution of raw materials' use with secondary materials taking always into account at least GHG emissions from transportations
3. To assess socio-economic impact from the implementation of a circular economy strategy, through for example the introduction of new business models, the assessment of training and awareness raising activities, the social impact and many more
4. To monitor the materials that are produced/ imported/ consumed at a certain area either locally or regionally and to map the points of production and consumption to enable effective industrial symbiosis

Based on indicators' results, better-informed decision making is achieved and actions are agreed, prioritised and implemented. Urban-level indicators support the implementation of

policies and decisions in areas such as procurements, integrated resource management, raising of awareness, designing efficient materials' flows, business models to raise growth and jobs. Additionally, in our case, in order to serve circular economy-approach in the built environment, indicators can also zoom on a specific category of a material for example concrete, wood, bulky waste or other.

Of course, the question of data existence is always present, but lack of data to monitor an indicator that is needed in order to meet the scope of the framework or to meet the strategic goals, should not be a reason for excluding this indicator at first place.

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Special thanks to the team from the City of Granada for their valuable contributions to this topic: Professor Montserrat Zamorano, Dean of the Civil Engineering Faculty University of Granada, Carmen Diaz, University of Granada, Agustin Castillo Martinez, City of Granada & URGE local coordinator.

Resources

1. "Measuring progress towards a circular economy in the European Union – Key indicators for a monitoring framework", EC. Available at: https://ec.europa.eu/environment/circular-economy/pdf/monitoring-framework_staff-working-document.pdf.

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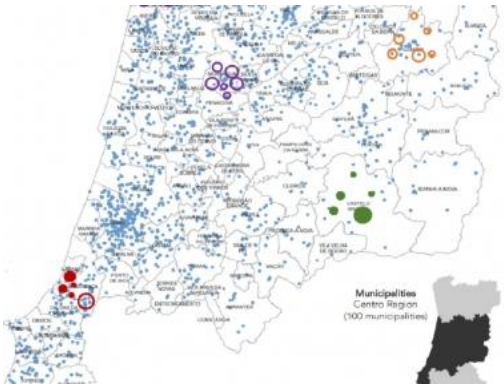
Insights from the URGE network: thematic report



Insights from the URGE network and experiences from the Intermunicipal Community of the West Region in Portugal on the mapping of flows and industrial symbiosis in a circular economy.

By Dr. Eleni Feleki, Lead Expert of the URGE Action Planning Network

Cities and Resource Management

The circular approach is comprised of two cycles of materials:

a. The biological cycle in which residual materials return to nature safely after use and thus generate living systems such as soil

b. The technical cycles that recover and restore products, components, materials at high quality levels, via the implementation of strategies like reuse, repair, manufacturing in order to be able to keep the loop going and retain the economic value as much as possible

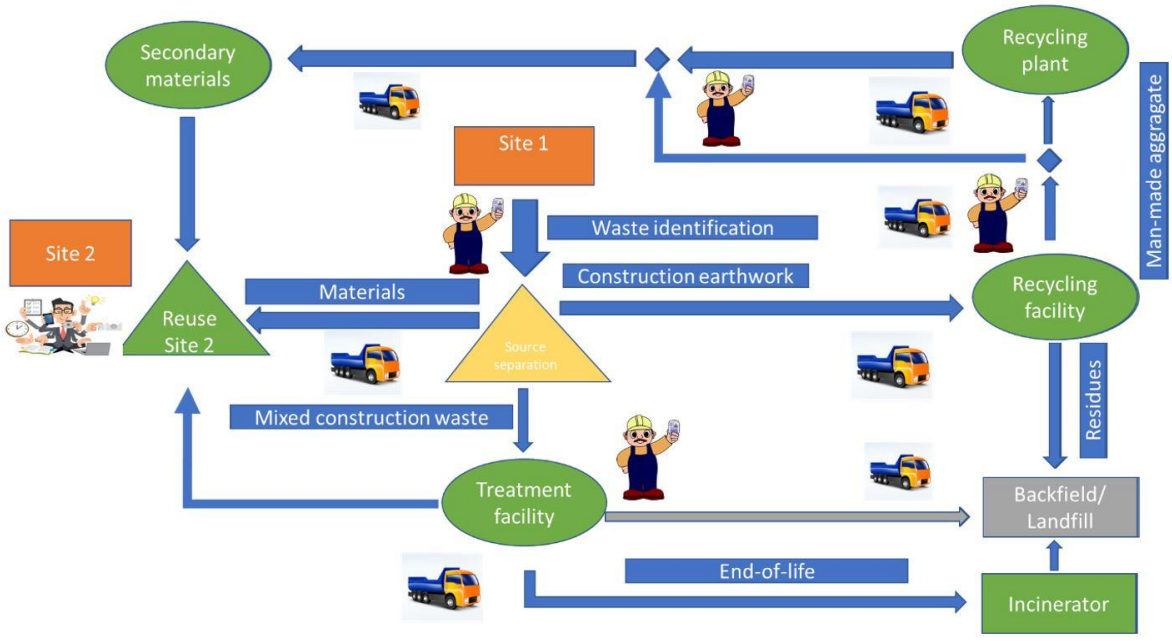


Figure 1: The complexity of the management process

For cities to be able to facilitate the transition towards a circular economy, a better understanding of these cycles is necessary. This means that the flows of resources, waste, materials are imperative to be understood and mapped, as this is the first step towards fostering industrial symbiosis.

Figure 2: The need for information

Having knowledge of these streams and of their characteristics allows a city to determine and apply appropriate interventions, aimed at improving resource management procedures, leading to improvement of efficiency and sustainability. Implemented interventions under this scope lead to the elimination of what is disposed, to a maximisation of the time that materials are kept into the economy and to a prolongation of the materials' value, taking also into consideration other aspects, such as the assessment of the ability to reuse them on-site, or their transferring in near-by sites to be either used or even processed. The reference to the urban metabolism model has become a key element in re-directing resource flows sustainably. **Mapping of material flows and stocks within the city is needed, in order to increase circularity.**

Material flows

Circular Economy is defined as a state in which 'the value of products, materials, and resources is maintained in the economy for as long as possible, and the generation of waste is minimised. In this context, it is essential to understand an economy's societal metabolism, i.e. to quantify the amount of materials flowing in and out and monitor how they are used in society in order to draw the level of circularity.

Therefore, the Commission's Circular Economy package (2018) includes a monitoring framework to measure progress towards a circular economy at both EU and national level. This monitoring framework consists of a set of **10 key indicators,** which cover each phase of a raw material's life cycle and the related economic aspects.

Urban metabolism

The recognition of the concept of urban metabolism (UM) is given to Wolman (1965). At the time of its creation, UM was thought to be a supportive tool in the development of sustainable cities and communities. But now, there are much more applications, like sustainability reporting, mathematical modelling for policy analysis and urban design.

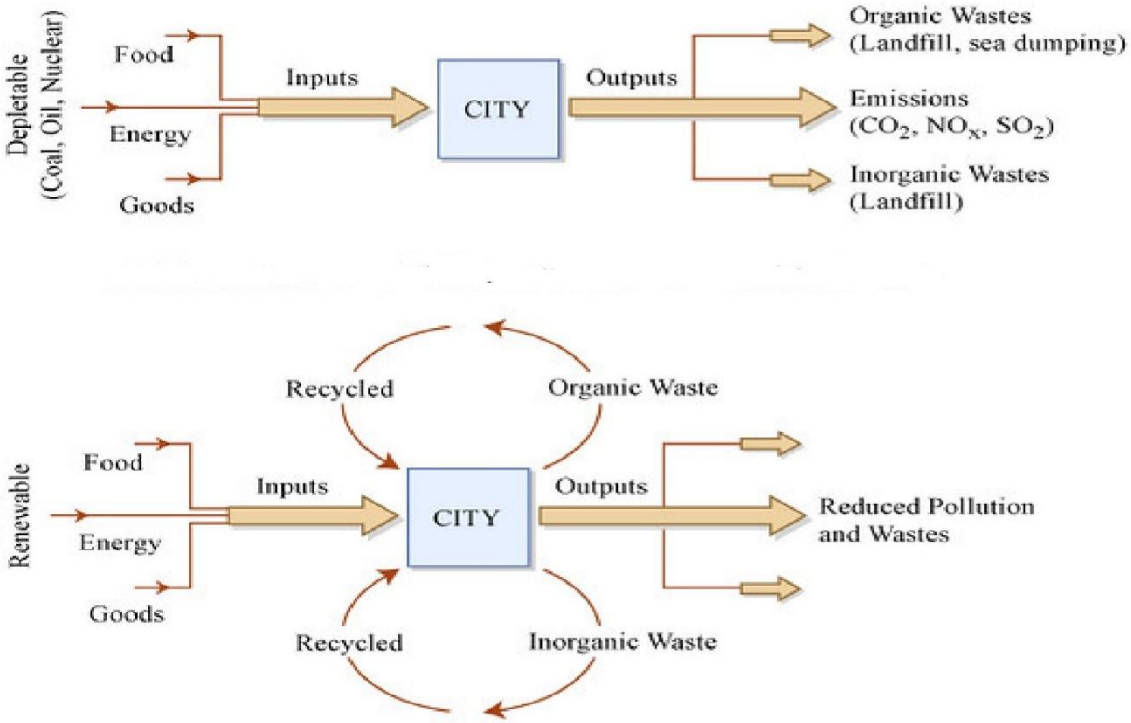


Figure 3: Urban metabolism in a linear vs. circular city

Material flow analysis is the systematic assessment of materials and their stocks and flows over time and space within a defined system. This analysis has proven to be reliable on a national scale, but analysis focused on smaller areas are necessary to gain a better understanding of how material consumption can be controlled and reduced. If this is achieved, opportunities for CE design and for CE progress monitoring will raise.

In models that attempt simulation of urban metabolism, it is essential to identify metabolic actors and to sub-divide them into increasingly precise elements. These can be for example sectors of the economy (i.e. the construction sector). Next, the metabolic flows between these precise elements are identified and assessed. This allows the development of more sophisticated urban models that can lead to optimisation of processes, in line with the principles of CE and can foster industrial symbiosis.

Establishing a robust method to quantify urban material flows, in order to characterise the urban metabolism of different cities worldwide, has been attempted but there are still some remaining methodological gaps (Rosado et al, 2014):

- Lack of a unified methodology
- Lack of material flows data at the urban level
- Limited categorisation of material types
- Limited results about material flows as they are related to economic activities

Action Plan for Circular Economy (APCE): The case of Portugal

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Leading the transition

[Action plan for circular economy in Portugal: 2017-2020]

At the end of 2017, Portugal approved the APCE (Action Plan for Circular Economy), a strategic model of growth and investment founded on the efficient usage of resources and on diminishing environmental effects.

APCE's origin lies on international arrangements and deals, such as the Paris Agreement, the Sustainable Development Goals, and continuous settlements with the European Union.

The plan presents three levels of action: (i) national cross-cutting actions that consolidate some of the actions of several governmental areas for this transition; (ii) sectoral agendas, especially for sectors that are more resource-intensive and export-oriented; and (iii) regional agendas, which should be adapted to the socio-economic specificities of each Portuguese region.

In these regional agendas, local participation will be endorsed, either by municipalities, intermunicipal communities or metropolitan areas. These entities should adapt the guidelines of CE within their scope and to the best of their abilities. On this level of action, CE converges with the valorisation of the territory, having taken into account the work of regional agendas in some regions, but also emerging topics in the national and European context.

Action plans for a circular economy recently created a need for characterisation of the regional economic metabolism to be included in the new regional agendas.

The concept of regional economic metabolism is supported by the analogy between the consumption of resources and the production of waste by the socioeconomic system (economic metabolism), and the metabolism of living beings and ecosystems (ecological metabolism). This means that the metabolism is characterised by a set of inflows and outflows of materials, energy, and water, as well as consumption, use and storage. The quantification and subsequent analysis of these flows allows for the identification of synergies between the consumption needs of economic activities and the availability of materials to integrate productive cycles, identifying economically profitable opportunities for regions (Action Plan and Regional Agenda for Alentejo's Circular Economy).

Taking resource inputs, extractions, and imports into account, as well as analyzing outputs, such as exports and emissions in the environment (Figure 4), is a fundamental need in efficient resource conservation planning.

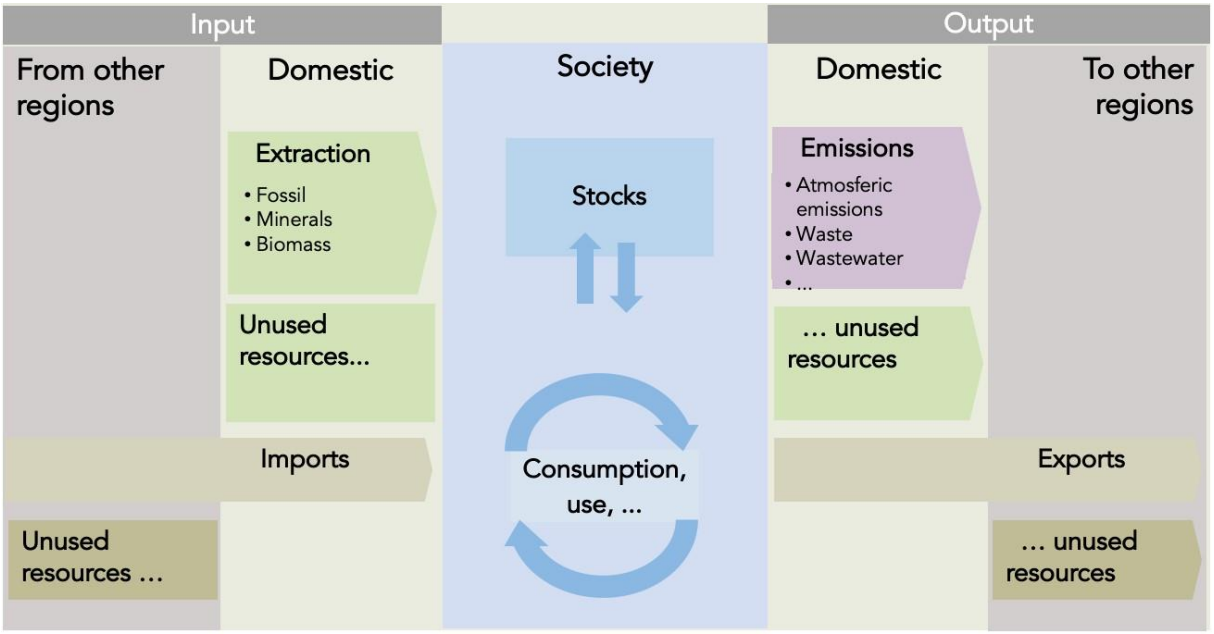

Figure 4: Components of a regional economic metabolism analysis.

However, there are few models available to calculate and represent the material flows for a region, they either don't allow the inclusion of subregions, or they are not prepared to account for a large number of material categories.

In this context, **some material flows modelling initiatives were developed in Portugal** to assess the urban metabolism of a region, with the main objective of supplying information that allows to: (i) promote the CE of the region; (ii) promote a "smart" region (i.e., resource efficient); and (iii) promote investment.

Case study: Monitoring and mapping flows in the Centro Region in Portugal to boost industrial symbiosis

According to the APCE, each region should prepare a Circular Economy Regional Agenda, **including an economic metabolism analysis**.

Given the importance of the construction/building sector in the country, as it is responsible for 1/3 of the waste being produced in Portugal**, metabolism analysis for construction materials has become imperative.**

The importance of indicators

The framework for a material and energy flow analysis uses indicators and identifies opportunities to optimise the management of natural resources and energy. So, the modelling of regional economic metabolism indicators is a key task to identify inefficient use of natural resources and energy.

These indicators are important tools in monitoring and developing measures to improve resource management, the development of a circular economy, and to promote territorial and industrial symbiosis. In addition, they provide an integrated view of the movement of materials through the economy (and the territory), which is important for regional socio-economic development. Indicators are monitored at three stages: input (from other regions and domestic), use phase and output. The flow indicators are in accordance with Eurostat.

Is it easy to start?

A case study of southern region of Portugal, showcased **the huge effort required, in terms of data collection**. A wide range of stakeholders was consulted aiming to collect data on circular economy.

Is it worth it?

Through the analysis, it is easier to understand what is the metabolism; identify what are the most important materials in the value chain in terms of circular economy. Through this information, there is **an opportunity for industrial symbiosis.**

The REMET-UA model

A symbiosis model was developed in the central region of Portugal. Symbiosis mapping can lead to scenarios of cooperation between producers of waste and consumers and can feed design strategies. After mapping it is essential to identify relationship between all parties (including producers and consumers) in order to enable communication channels between them and go towards symbiosis.

In this context, the REMET-UA (Regional METabolism) model, version 1.0, was developed by a joint venture between the University of Aveiro and the companies Simbiente – Environmental Engineering and Management and Quaternaire Portugal.

The model makes it possible to identify feasible and logistic opportunities for the efficient use of resource between regional agents, based on the knowledge of quantities of material and sub-products in each location.

The REMET-UA model provides an economic analysis of material flows based on the methodology defined by Eurostat and has been developed according to three prerequisites:

i. scale, the model can be adapted to any spatial scale (region, city, municipality, etc.)

ii. supported by the Microsoft Excel format, in order to guarantee the application of the model through an intuitive, user friendly, and linear interface for the user (interoperable model)

iii. interregional interactions, which means that the model quantifies the interactions between NUTS (Nomenclature of Territorial Units for Statistics) III sub-regions, representing them according to the user's needs.

The REMET-UA model was developed to assess the regional economic metabolism of the Alentejo Region. **It allows to identify business opportunities and circularity potential within a region and between different regions.**

Characteristics of the REMET-UA model

a. Focused (specific material flow analysis to seek opportunities of circularity)
b. Scalable (capable of adapting to any territorial scale and flexible to alterations according to user needs)
c. Participative (implementable with help from regional agents)
d. Evolutionary (to allow its evolution since the first phase of development)
e. Interpolated (developed in Microsoft Excel, allowing ease of use and integration with other tools)
f. Regionalised (ready to have into account interactions between NUTS III sub-regions)

In addition, the model was developed in a participatory way, allowing, on one hand, the involvement of regional actors in the collection of information, and on the other, the dissemination of concepts and the promotion of a collaborative spirit for future developments.

This model was designed by the following steps:

1. Identification of interregional flows.
2. Monitoring of indicators (quantitative and qualitative).
3. Collection of data indicators (total values and per capita), allowing the user to assess the results for all materials or for a selected material, in each subregion.
4. Identification of top three materials extracted and produced in each subregion.
5. Creating links between actors to foster industrial symbiosis.
6.

Benefits

a. It possible to graphically represent the inputs and outputs of the economy of a region, and to gauge basic indicators set from the Eurostat methodology, calculating the materials that are stored or wasted, and which can lead to new opportunities
b. It is flexible and allows adaptation to any territorial scale, and for the user to add new categories according to need and the availability of data
c. Enables to identify the relevant sectors in terms of consumption and the strategic sectors for the development of the region
d. Enables to define the average reference values and the origins of goods and products, internal flows in the various production and processing chains, and internal consumption and outputs of goods and products of the region

Constraints

The main constraints were the scattered available information, its lack of detail, with variable degrees of confidence, few data available at the NUTS III level (or with more detail), and a high time required for the collection of information (not systematized) in different entities.

Metabolism in Portugal: Current state

Raw materials use for the construction sector

At the moment, no periodically assessed indicators exist to measure how fully circular an economy is.

However, it is possible to trace the metabolism of an economy – how it has evolved in terms of extraction, productivity of use, and recycling and emissions/effluent performance.

Portugal's economy shows a slow metabolism, as it tends to accumulate materials. It extracts and imports more raw materials than the amount of finished goods it exports, accumulating stock in materials, above all in real estate (e.g. buildings and infrastructure).

And in terms of value?

Material productivity has evolved more slowly than Spain or Ireland – countries which in 2005 had the same level of productivity. In 10 years, Portugal improved by 23% (the European Union (EU) by 30%).

During the financial crisis, domestic materials consumption fell and GDP stagnated. Material and energy efficiency were promoted, a positive measure which continued to be encouraged, but without any disruption in material productivity. From 2014, consumption of non-metallic minerals and biomass grew as the construction sector started to pick up. In 2015, non-metallic minerals (e.g. sand) accounted for 73% of the 145 million tonnes of materials extracted in Portugal.

In terms of efficiency of resources?

In terms of water use efficiency, only 65% of what is captured is effectively used and reuse is still residual when compared with other Member States (however, specific legislation was recently approved to encourage water reuse for non-drinking purposes, raising the ambition to improve this situation in the coming years; interesting examples are already implemented for golf courses irrigation, for example) . In energy, and despite the focus on renewable sources with a lessening of dependency on external energy, production and transportation is still essentially dependent on imported fossil fuels.
Since 2005, GHG emissions have fallen due to better prevention and control technologies, less polluting fuels and energy production, and improvements in the energy efficiency of processes. The trend in 2015, however, is for rising emissions as a result of economic growth and the use of coal to produce electricity.
Sectoral waste production also fell in the last 5 years (35%), in line with falling production and consumption; but **the construction sector predominates**. This situation is also likely to improve in the medium term, since the Portuguese government established the politic and economic compromise of reaching a carbon neutral economy until 2050.

The construction sector in Portugal is responsible for the greatest share of production in all sectors as a whole (40%) and in addition registered an increase in waste production per GDP unit generated. So it is no surprise that in a preliminary study conducted by the working group

using the Ellen MacArthur Foundation methodology, construction is one of the priorities, along with transport (e.g. logistics), agriculture, forestry and the food industry. The Rebuild 17 project (funded by the EEA Grants mechanism) is other example of the construction sector potential for Circular Economy in Portugal (in this case, applied in Azores, an European outermost region). **There is room for progress. For example, manufacturing spends 53% of turnover on raw materials, so reducing this amount, even if only by a small percentage, has a major impact.**

Application and results: Symbiosis mapping in the Centro region in Portugal

Taking into account the database of industrial establishments (NACE code, businesses size measured in number of employees, location identified through postal address); the Coordination and Development Regional Commission of Centro promoted a project that aims to pin a resources' selection and characterization and its production and consumption locations, in order to find territorial symbiosis' potential and design new value chains.

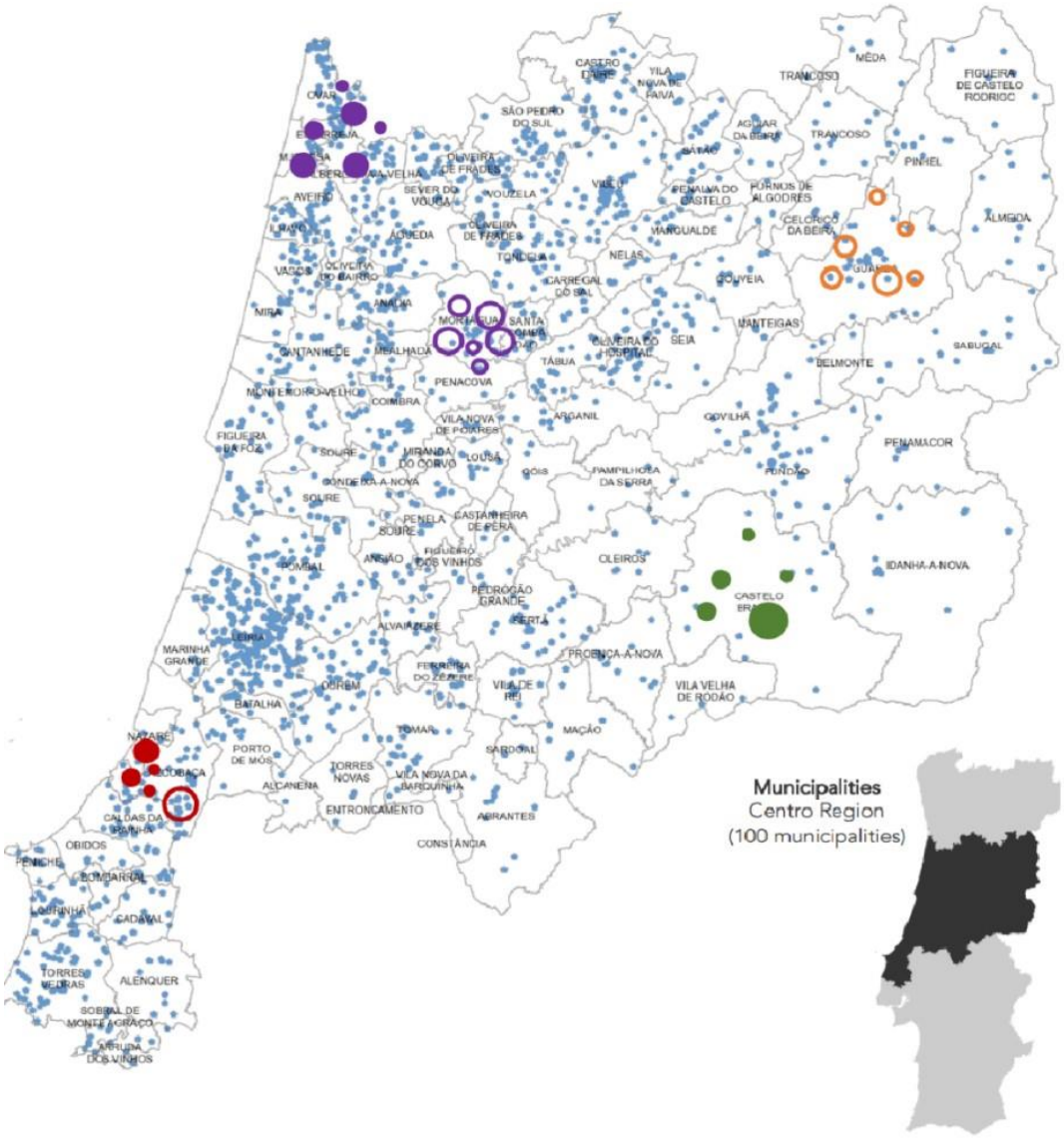

Figure 5: Industrial symbiosis map in the Centro Region in Portugal

Throughout the process, undertook by a joint venture between Simbiente – Environmental Engineering and Management, the Chalmers University and the Polytechnic Institute of Viana do Castelo, algorithms are used to translate postal codes into geographic coordinates and NACE/ size into type and quantity of waste and other resources. By using this model, different strategies can be designed and served through the mapping and implementation of this symbiosis model in the region, depicted in Table 1.

Table 1: Strategies raised from the application of the model

1. Joint synergies between producers and consumer of secondary material type 1	producers of waste / subproduct 1 consumers of waste / subproduct 1
2. Boosting of establishment of secondary material type 2 consumers in the region	producers of waste / subproduct 2 no consumers identified
3. Boosting of establishment of secondary material type 3 producers in the region	no producers identified nearby consumers of waste / subproduct 3
4. Study business models for boosting collaboration between producer and consumers of secondary material type	producers of waste / subproduct 4 consumers of waste / subproduct 4

Acknowledgements

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Insights from the URGE network: thematic report

Circular economy in the built environment, approached from different perspectives: academic, design, architectural, construction, civic and the role of infrastructure for materials' storage, Destination circular: The case of Copenhagen.

By Dr. Eleni Feleki, Lead Expert of the URGE Action Planning Network

Introduction

Circular economy requires entire systems to be designed depending upon numerous stakeholders (Pedersen and Clausen, 2019). This calls for active collaboration between all the stakeholders in the circular supply chain (Leising et al., 2018). Several studies have indicated that the limited willingness to collaborate within the value chain is one of the barriers (Kirchherr et al., 2018), turning the transition to a circular environment into a difficult task. Stakeholders, acting at different stages within the cycle, will need to establish new ways of working, to seek for new business partners, to assign new roles, and accomplish new kinds of collaborations (Aminoff et al., 2016). Therefore, the success of construction projects that focus on circularity relies to a great extent on establishing efficient collaborative networks within the value chain that facilitate closing of resource loops. The role of researchers, acting closely with designers, architects and constructors in facilitating collaboration is crucial. This collaboration needs to be maintained and enhanced during and after the lifecycle of products, components, buildings and materials. As to close the loop, research, design, construction that address the end of use cycles and end-of-life scenarios become even more important. To date, there is little knowledge concerning how different perspectives can help boost circularity. This thematic article touches the issue of circularity in construction projects, from different perspectives and enhances the importance of collaboration among everyone involved.

Circularity assessment and architectural design: The academic perspective

Which buildings have the opportunity to contribute with the largest increase in value? Which buildings are closest to providing ideal results, if treated within the circular economy approach? How can we adapt our transformation strategies and urban development based on the potentials of the buildings?

Answers are attempted through academic research conducted in the frame of the "Circular Construction In Regenerative Cities" project (CIRCuIT)(link is external), funded by Horizon 2020 programme. Answers are achieved through mapping of transformable neighbourhoods and buildings. Seven distinctive approaches have been identified in the Copenhagen case:

i. analyses of building stock patterns
ii. analyses with planning data and/or urban indicators
iii. qualitative analysis based on stakeholder discussions
iv. multi-method approaches, multi-criteria decision-making

v. models, identifying 'natural' adaptive reuse potential
vi. calculating transformation capacity indicator

Data availability is a major driver for the selection of a method in practice.

Multi-criteria decision making model

The idea behind MCDM (Multi Criteria Decision Making) is to weigh criteria and their sets of indicators in relation to a predefined ideal situation.

Buildings and urban areas are complex systems. The actual relation between the technical state of the building (for instance assessed via technical due diligence) and the social behaviours of the users is worthy investigating.

MCDM is one of the methods for assessing and visualising improvement potentials for buildings and urban areas taking into account sustainability criteria and performance indicators. Performance indicators are already relatively common in the construction industry and are used to evaluate and provide insights about a variety of different aspects. Examples of indicators used for buildings are energy labels that place them on an energy scale, provided that a series of technical data is available. This makes it easy to visualise the performance of a building in terms of energy balance in relation to the best label value (ideal situation). In principle, MCDM models work like that, measuring the distance to an ideal situation, which in this case is the energy label with the lowest energy consumption. More advanced MCDM must be able to handle many different indicators and be able to weight them as well. What is important is to be able to give a numerical value (for instance on a scale).

To date, there is a large increase in the prevalence of advanced MCDMs, which are used for sustainability certification of buildings. However, these sustainability certification systems are more developed as an evaluation tool rather than a planning/ decision-making tool for potentials in the planning phase. There is a need for new MCDM models that can be used to evaluate transformations and renovation potentials for existing buildings and urban areas in the early planning phases. In order for this to be possible, it is necessary to identify an ideal situation, and indicate which indicators are important in order to be able to evaluate the potential for transformation of both buildings and in an urban environment, as well as how these indicators should be weighed against each other. A realistic approach is to look at which data is available and choose indicators accordingly taking also into consideration the cost and labour needed for their calculation.

Once the most important indicators have been identified, data must be aggregated, normalized and weighed, so that the performance is assessed. The idea is that the MCDM model will then calculate the distance of the existing system to the ideal solution. If the distance to the ideal solution is important, it is necessary to make many changes to approach the desired ideal solution and answer the questions posed before
A repetitive process might also be needed in order to improve or adjust the strategy for the ideal or for the applied design strategies, as shown in Figure 1.

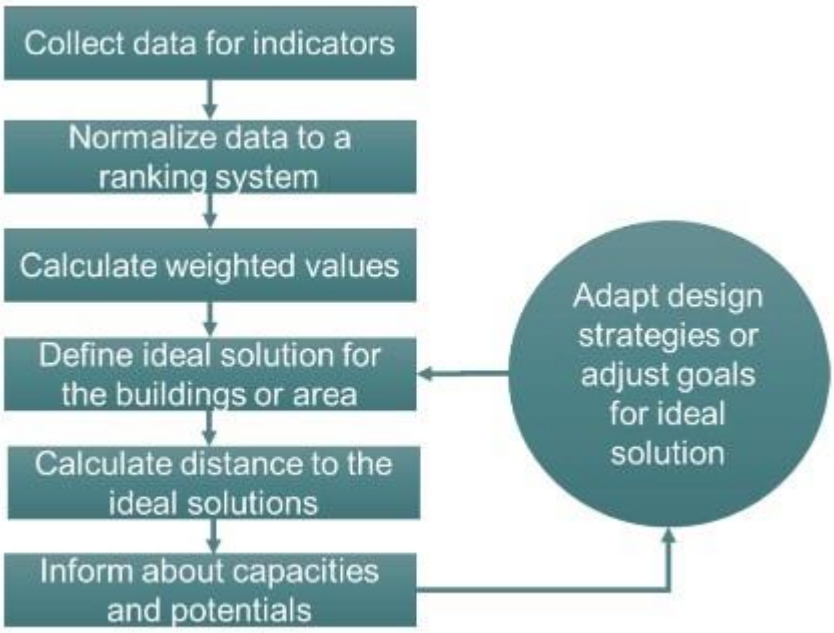


Figure 1: MCDM to adopt design strategies or to adjust goals for ideal solution (source: CIRCuIT project)

Application

A real case scenario of a MCDM case study has been carried out in the Tingbjerg suburb in Copenhagen, in the frame of the CIRCuIT project and showed how MCDM model can be used to assess and visualise the renovation potential of the buildings located in this area, by evaluating the individual building indicators together with indicators for the urban environment. Results are visualised in Figure 2. Colours depict the renovation potentials. The renovation potential is visualised as the distance from the ideal situation, where the ideal solution has the value of 1. The buildings with dark red colours are therefore the ones farthest away from the ideal solution. These are the buildings that will give most environmental, social, and economic value in case of renovation or replacement. Buildings with the lighter red colours are closest to the ideal situation and are therefore already either in good condition or contribute already through minor improvements.

It still remains to validate the practice through more case studies in different locations in order to identify which building and city level indicators have the greatest impact on the renovation and transformation potential, as well as how they should be weighted and how the ideal situation can be defined. More information here: https://www.circuit-project.eu)

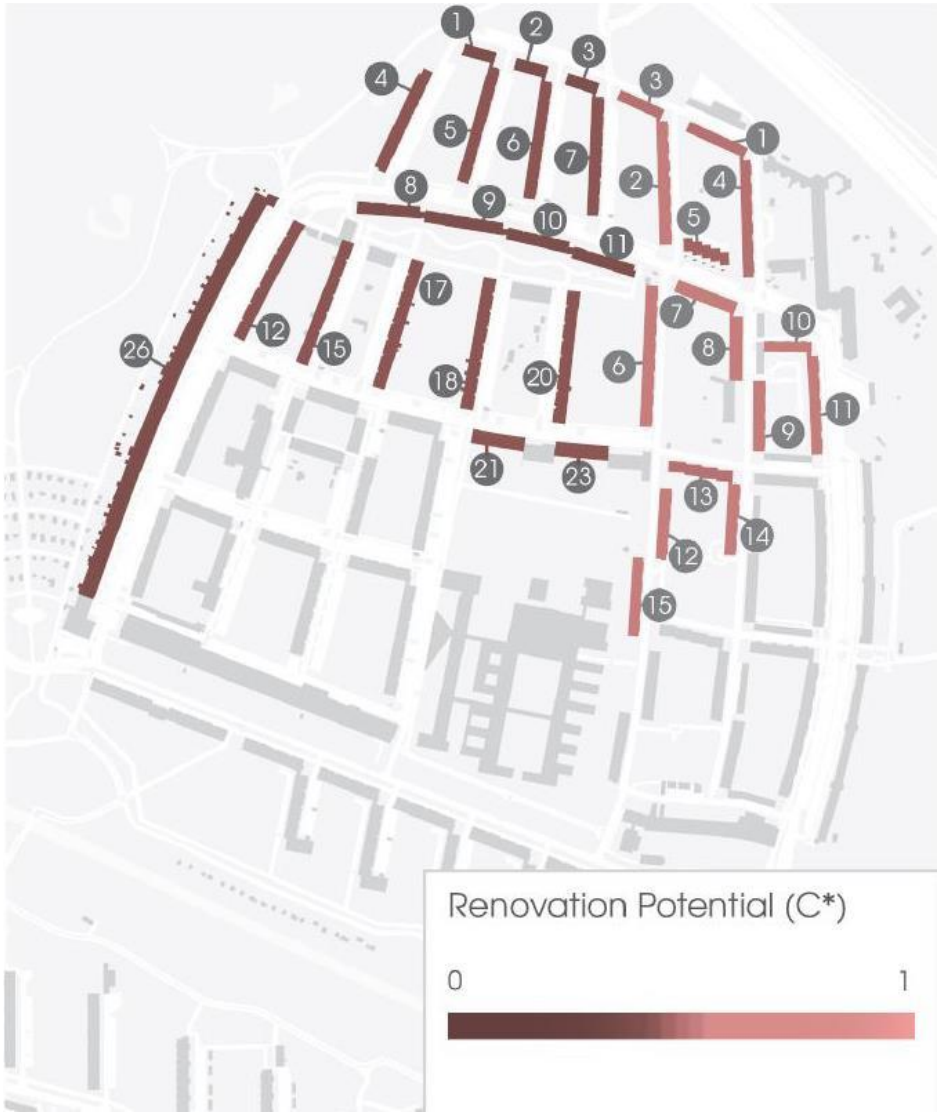


Figure 2: A real case scenario of a MCDM case study has been carried out in the Tingbjerg suburb in Copenhagen (source: CIRCuIT project)

Screening the site: An architectural perspective

Although Denmark, is thinking green, citizens are heavily consuming in relation to other countries. American standards in terms of way of living have introduced a living model that the more you consume, the more successful you are. The approach should change and eliminate the amount of raw materials that are used, by trying to exploit as much as possible secondary materials and design/build with what we have got (material driven design).

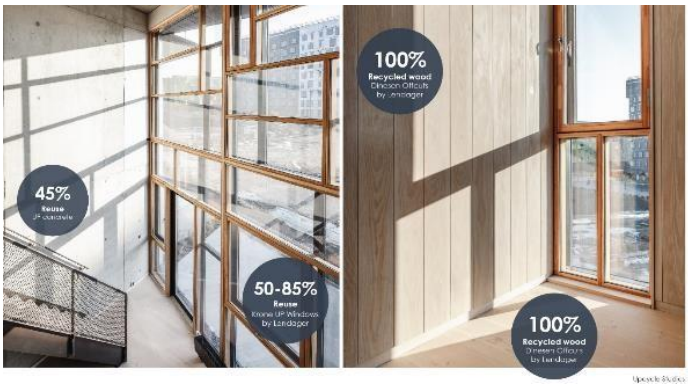
Although it might seem easy to take materials and reuse them, this is impossible in some cases, as certified engineers, documentation, certified materials, etc, are needed. All these are ''add-ons'' to the current process, which makes the end-product more expensive. In that case, we need to alter the final goal (i.e. instead of envisioning the building of a high-construction with reused materials, build a lower-construction). Another alternative is to downscale the quality of reused materials, but even then, we need to follow certain standards. Unfortunately, the regulations respond still to a larger extent to the linear economy, which of course flavours the use of raw materials that in most cases are characterised by the same physical parameters, whereas reused materials are different.

Architects play an important role in introducing techniques and showcasing paradigms of constructions that are mostly relying on secondary rather than on raw materials. In Denmark, several projects are already under way, using for example 74% glass from a demolition site, soil from the metro, residue concrete from metro etc. Even in deconstruction phase, architects play a crucial role as they foresee the removal of materials, like glass, in a way that it can be reused in another construction. Reused materials can make their own statement in new constructions, to be make people aware that everything is possible.

Although there are several examples of projects with secondary materials used in Denmark, scaling up is still necessary. It is too expensive to implement the approach in small contracts, as the reality is that standard materials cannot be easily competed. It takes time and effort to persuade the owner to dare for a circular economy construction.

Figure 3: Studios designed and built out of secondary materials in Denmark

Buildings following the circular economy approach cost 8-10% higher than ''traditional'' constructions. However, circular constructions were perceived positively by the byers in Denmark. Currently, new opportunities open for Denmark as the volume of secondary materials that is allowed to be reused in the construction is raising. There is new legislation that allows higher percentage of concrete for example that can be reused.



According to the architectural perspective, another reason to reuse is to ruin this notion that everything needs to be perfect in terms of aesthetic. New ways to design and construct are put forward by architects in Denmark. There are a lot of uses for secondary materials (ie wood and plastic, for conference tables). Some examples are depicted below.

Figure 4: Studios designed and built following circular economy approach in Denmark

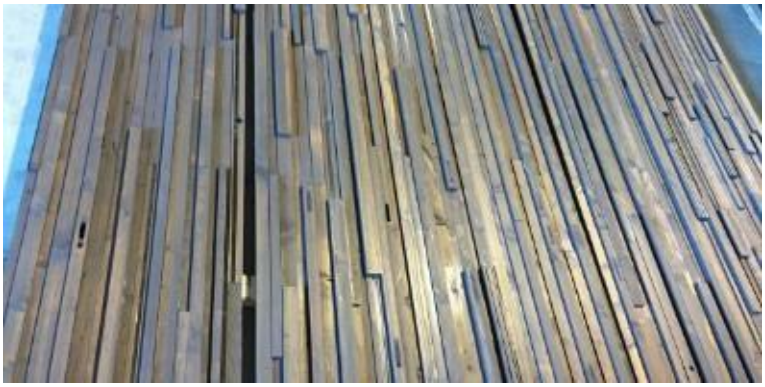
Wooden panels

To be able to upcycle wood waste into new products the specific waste fraction must be subjected to several processes and quality assurance tests and analyses.

For the project Copenhagen Towers in Ørestad, in Copenhagen, 60,000 linear metres of wood have been upcycled that otherwise would have been wasted. The wood comes from window frames, doors, floors and old scaffolding wood. The wood has been collected by a collaborator

who has localised and categorised the material, so that wood can be traced back to its source.

Window frames and doors have been split in such a way that the wood can be planed and cut into regular-sized strips. The strips have then been sent to be fireproofed to be able to comply with the strict fire regulations for indoor cladding. The wood is fireproofed to class B, S1-D0 by using Burnblock, a 100% organic and nontoxic fire retardant.



The wooden stripes are mounted on a back plate in such a way that the wood strips create a varying surface. The mounted wood is then treated with natural paint that is toned with natural pigments. The finished panels are 500mm wide and come in varying lengths of up to 6000mm without any visible seams.

Figure 5: Wood panels out of secondary materials

Concrete floor and bricks

To be able to upcycle concrete waste the specific waste fraction must be again subjected to several processes and quality assurance tests and analyses. Architects in Denmark are proud to be able to supply upcycle concrete that is documented to conform to all standard requirements to concrete. The same applies in the case of bricks.

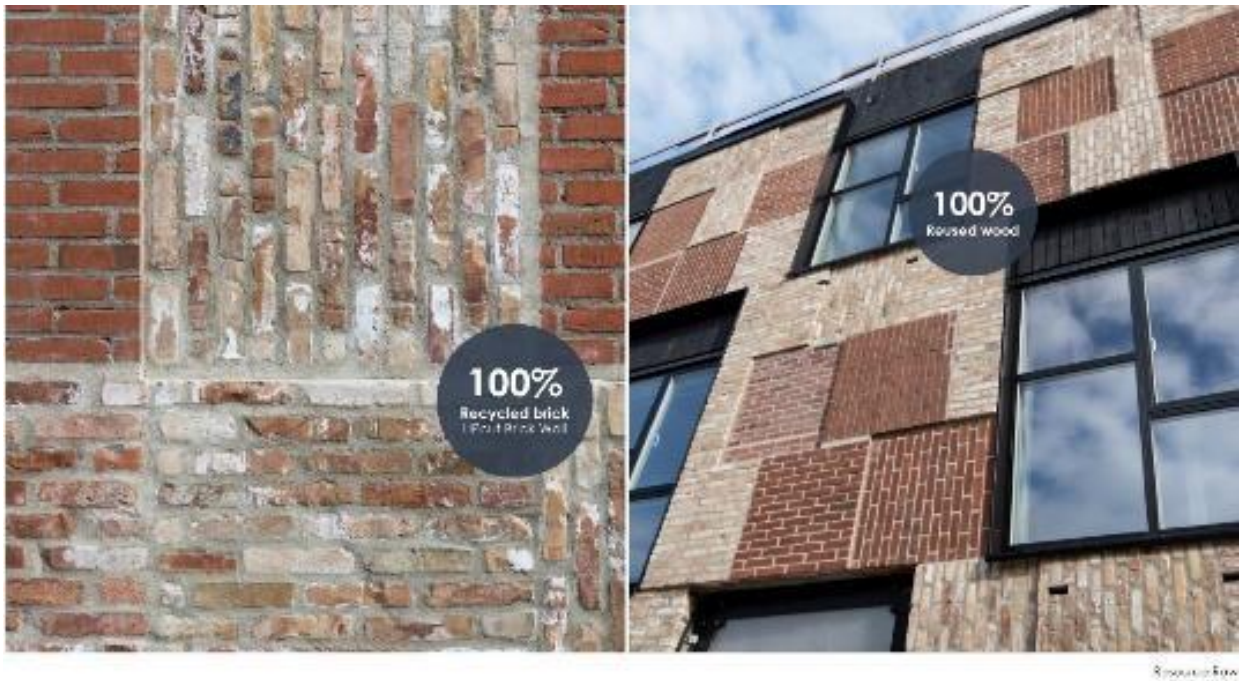


Figure 6: Building facade with secondary bricks in Denmark

Pet bottles

Huge amounts of PET bottles are collected, washed, sorted, and granulated, heated and extruded to raw PET fibres. A machine puts layer after layer of PET fibres in the same direction and felts the individual fibres together to form larger felt areas. The very thin PET felt layers are then pressed onto each other in thicker layers to create a stable and robust sheet of PET felt, ready for subsequent processing. PET felt is an environmentally friendly material since it consists of 100% recycled bottles. PET felt has a very soft, felt texture with a slightly rough surface.For the project Copenhagen Towers in Ørestad, Danish architects were asked to raise the sustainability profile of the project by covering the interior surfaces with upcycled materials. Not only should the materials be sustainable, but they should also fit seamlessly into a high-end, exclusive office setting.

Figure 7: Use of PET bottles to raise the sustainability profile in Copenhagen Towers

The background for the development of the acoustic panels and their design was the assignment to create a suspended ceiling made of recyclable materials. It should act as acoustic regulation, have aesthetic qualities and be visibly as well as measurably sustainable. The specially developed acoustic ceiling panels consist of a back plate onto which PET felt is mounted in an optimised geometry with high acoustic performance. The panels display a compressed sine-wave shape.

The PET felt used for the acoustic panels has both sound dampening and sound absorbing properties. The felt can be used for acoustic regulation in office settings, institutions as well as in homes. The felt in itself has strong aesthetic and tactile qualities, and our supplier works to 'cradle-to-cradle" standards. More information: Lendager Group

Development perspective

In September 2019, members of the city council in Copenhagen decided that all building projects had to be analysed for the potential of adopting the circular economy approach (following the academic perspective presented above). Currently, there are nine active projects, while four are in the drawing board as well. Seven out of nine projects have received increased

financing to work with circular economy. The city has defined 29 principles around circular economy and applies them in the projects. Starting with the definition of priorities, ambitions, goals and strategies, potential actions are targeted and implemented.

Figure 8: Nine projects following circular economy approach in Copenhagen

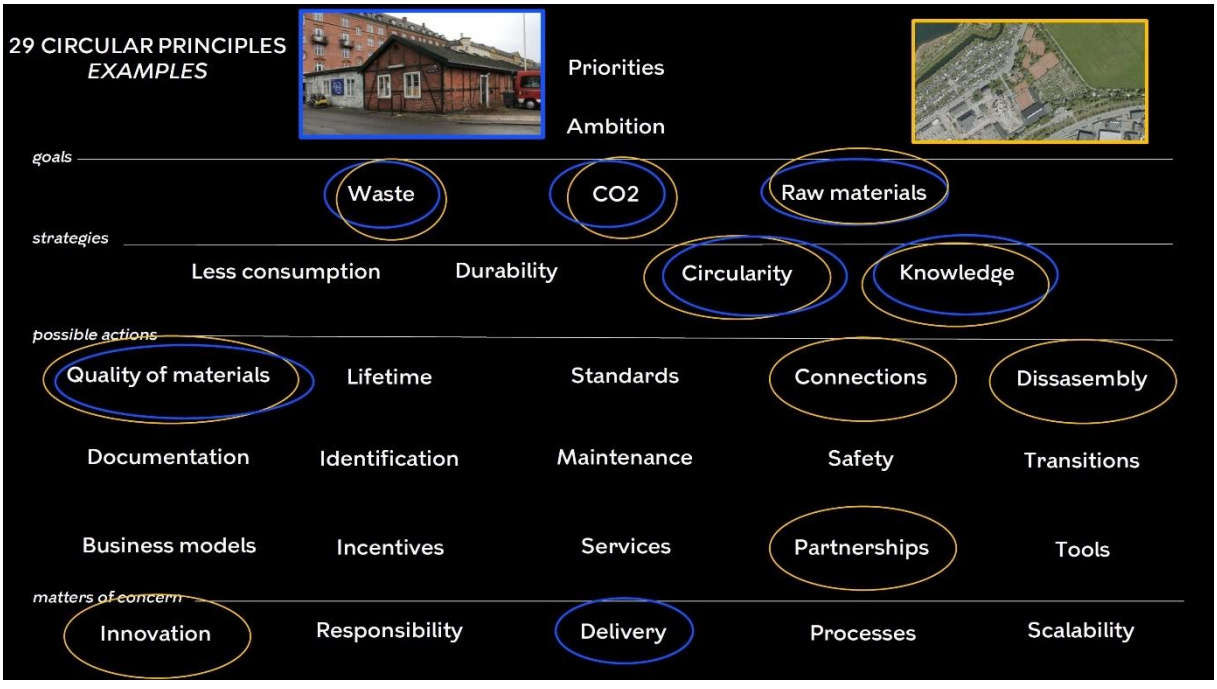


Figure 9: Principles around circular economy

There is still a list with various products or processes that Copenhagen is exploring to exploit in coming projects:

- Concrete: recycling demolished concrete
- Cross laminated timber (CLT): use of this promising material
- Mineral wool: How is the circularity and how can we substitute?
- Bricks: reuse of bricks, already has a CE mark in Denmark
- Steel: reuse instead of recycling by melting the steel
- Roof tiles: Can we get at CE mark like with the bricks?

The city is closely collaborating with academics, to identify the projects with the biggest potential and apply circular economy practices as well as with architects, to draw their knowledge and expertise and maximise the use of secondary materials.

Closing the loop

None of the above would have been possible if secondary materials were not available.

Figure 10: KMC South Harbour, South Harbour Reuse Station and Petersplads Municipal Infrastrusture

KMC South Harbour

KMC North Harbour is a material bank: a site for materials (soil) for reuse, only from Municipality works. It is also a treatment facility, where contaminated soil is processed. KMC has operated since 1997 and is 95% owned by the municipality.In the last 6 years, a lot of new buildings were built, creating the need to dispose soil, so in North Harbour new land is artificially constructed. With the new soil, the harbour has been expanded, new dwellings and recreational areas (30000 people live and work in this new area) were introduced. Revenues from selling that new land financed the city metro. In the next years, a huge island of 2000 m2 will be built, with 80 million tons of disposed soil, where 35000 more people will live and work.

Figure 11: KMC South Harbour

Another reason for building the island is to protect the city storm surges through building new islands in combination with dikes.

Moreover, materials are gathered in the area, crunched, and sorted to produce:

- Concrete / Asphalt (0-32 mm) Min 60 % concreate / Max 40 % asphalt Suitable as base layer in road constructions for heavy traffic
- Asphalt (0-16 mm)100 % asphalt Suitable as base layer in bicycles path and pavements
- Asphalt (0-8 mm)100 % asphalt Suitable right beneath tiles in pavements

The South Harbour Reuse Station

The South Harbour Reuse Station in Copenhagen acts as a living lab for future reuse stations, where reusable building materials, doors, windows, and everyday consumer goods are sorted for reuse and sold directly to citizens and companies.

The reuse station is equipped with a large storage facility, where reusable items are stored. Some of the items are sold directly at the reuse station's own reuse builders' merchant while others are stored for bulk sale directly to local companies via local tenders. In addition, the reuse station acts as an incubator for new circular economy business models. Local entrepreneurs and innovators work at the reuse station's own workshop to develop new products based on the incoming materials. More information, available in the reuse station's website(link is external) (only in Danish).

Which is the role of active citizens? The Circular Courtyard Programme

A co-creative innovation process has been put forward in Copenhagen, in cooperation with citizens. The innovative process was focused on the recycling of rainwater, as a resource and circular economy, aiming to reduce climate footprint and enhance liveability.

Figure 12: Co-creative innovation process in Copenhagen

The project deals with the design of a courtyard in a building complex located in South Harbour. Solid coatings, sheds and furniture have been cleared to ensure the climate and cloudburst-proof farm and to create a new context and openness in the courtyard. In the design phase, the extent to which playground equipment and old materials from sheds and coatings can be recycled has been assessed. Most of the farm's self-sown and shrub-like trees have been felled to make room for the farm's edge and rainwater management.

The smaller trees and shrubs that were worthy of conservation have been excavated and deposited for replanting in the new patio. The climate edge has been produced by recycled concrete, which was mixed with sand-blasted bricks, glass or similar to produce a living surface. Recycled wood has been used for terraces, facade cladding, sheds, and benches. The patio was designed and built using recycled building materials. Fields of recycled tiles have been laid on the footpaths and in the greenhouse as an aesthetic and natural coating. The greenhouse was primarily carried out with recycled windows. A rainwater lake with biological purification where children and adults can play with the water was constructed. The technical rainwater system in the courtyard was built by HOFOR (Copenhagen Utility Company). The whole construction site was fossil- and emission- free.

Through the innovation and involvement process, the residents received help in identifying exactly the parameters that they thought would create the good backyard garden for them. The innovation process also had another important function, which was to open the residents'

horizons for innovative initiatives and ambitious solutions, which they would not have thought of or been interested in.

When the thoughts of circular economy and recycling were brought forward, the residents were therefore ready to think differently, and the implementation of this approach gave them even more ownership of the project, as it became more meaningful not only within their own yard, but also did a difference in a larger perspective.

The different techniques that were used to involve the residents are summarized below:

- Interviewing the residents
- Start- up event
- Innovation workshop with residents
- Innovation workshop with professional partners
- 3 sketch and project development workshop
- Residents' meeting with presentation of the project proposal
- Consultation and support study
- Ongoing dialogue and sparring with the yard- group
- Final celebration with the Mayor

The management model for leading such kinds of projects, with the linear management approach losing ground, is the meta-governance integrated approach, where the middle governor needs to reassure that communication with citizens is well defined, but more importantly, to handle relations (not posing direct control on them) and the dynamics between the different actors. The meta-governor acts like a mediator of processes. In order to make this model work, trust is needed to be built in prior. Also, this model ensures that knowledge is shared between different actors, it empowers citizens and produces sustainable results over time.

In order to establish the climate edge, approximately 500 tonnes of recycled concrete made of crushed concrete from the yard is used. Compared to new concrete, this results in an estimated CO_2 saving of 7.4 tonnes.

The project team was composed by the City of Copenhagen, architects, engineering and construction company, property owners and citizens. Especially the citizens, who are members of the owners associations, were an essential stakeholder group for this project to succeed.

Material Depeche: The Bornholm case

A small island occupying an area of 588.36 km^2 with a total population of 39,439, occupying an

area of 588.36 km^2, turns off the incinerator in 2032 and will treat all waste as a resource. Everything that the locals and the tourists call waste today, will be used again, or have a new life in other products. The waste vision is part of Bornholm's overall green strategy "Bright Green Island"(link is external).In approximately 13 years, in the year 2032, a new green reality awaits in Bornholm. The waste system, as known today, with containers for combustible waste and waste incineration in large furnaces, will be gone. Waste such as cotton swabs, armchairs and carpets will no longer be thrown into the incinerator, but instead, have new life as recycling, or become part of another product. Better sorting will be implemented, new and smarter technological treatments will be installed and dialogue with the users, both locals and the thousands of tourists who visit the island every year, will be put forward.

According to Jens Hjul-Nielsen, manager at BOFA, Bornholm's municipal waste management company, this island is an obvious place to develop competences in green transition and circular economy. The island has a fully developed infrastructure and a population that corresponds to approximately one per cent of the Danish population. Experience and knowledge can, therefore, be transferred to similar projects in Denmark and other places in the world (https://bornholm.info/en/bornholm-shows-the-way/(link is external)). More information about Bornholm's ambitious waste vision is available here(link is external).

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Insights from the URGE network: thematic report

Start small: The journey to scale. Experiences from the URGE: Circular Building Cities Network.
By Dr. Eleni Feleki, Lead Expert of the URGE Action Planning Network

Introduction

Too often we speak highly of an ideation process and its importance to take decisions. We focus on the co-creation part and we appreciate very much existing methodologies that we stakeholders' groups can follow during an ideation process. Stages, like the divergent, convergent, part, fancy digital platform tools have replaced the traditional whiteboards and matrixes to identify and engage all relevant actors, are of great importance.

The question is, *What do we do with these ideas? How can we really know that they are effective? How can we assess that theoretically?* The truth is that ideas are of little use if they stay on a nice board. Their merits can be really evaluated (and valued) only in the case that they take flesh and blood, especially when others start talking about them. Putting an idea on the ground, in a way that its merit can be assessed, is definitely very challenging. The idea should be reframed into something specific, measurable, achievable, relevant and timebound. Questions like: *How is this idea translated into something concrete? How will we assess it will be effective (enough)? Are there enough funds? Is it relevant enough to the visions and aspirations that it addresses? Are there time constraints?* raise only after we decide to put an idea into practice.

People are usually afraid to commit to something concrete, as no one wants to fail. But, *how do we define failure? Proving that an idea is not going to work on the real ground, is it really a failure, or a success?* It is true, that a lot of "good willers" will wait in the corner to put into question skills of people involved, design of the project and so on.

This is where small-scale experimentations can be put forth. Start small. This will be your journey to upscale. A small step towards bringing real change. Turning an idea into something concrete, working with whatever we have available and trying to be as creative as possible, will help improve and will smooth the road to upscale, or even, will call for a "THIS mission: aboard – change the parameters - test again if needed". This is also a success. Maybe even a bigger one.

In the frame of the URGE: Circular Building Cities Action Planning Network that is financed by URBACT III Programme, 9 partners have committed to design integrated action plans, following a participatory approach with stakeholders and have them approved if possible, by politicians. These partners have a common ambition, to putting a stepping stone towards green transformation, through boosting circular economy practices, in the building sector. The local process was led by 9 inspired local stakeholders' coordinators, committed to hold ideation

process, keep stakeholder members engaged all along, co-decide on actions to be included in the local action plans and describe them in the most SMART way.
Taking advantage of the programme's innovation, to provide the possibility to test an idea and refine the action plans, before their finalisation and approval, several URGE partners have designed small-scale activities. Small-scale activities are implementation-related activities dedicated to testing a new approach. Small-scale activities designed in the frame of URGE, are addressing the local vision, are part of the integrated local action plan, are designed building upon transnational exchange of knowledge and experiences and aim to achieve intelligence, through lessons learnt to better prepare for scaling up. This article illustrates small-scale activities undertaken by the City of Munich, REA (Riga Energy Agency – part of the City of Riga) and Nigrad d.o.o. Another article will follow soon, illustrating small-scale activities of the City of Kavala and Granada.

Talent in Munich

Even though Munich does not formally implement a small-scale using budget from the Programme, there is a side mini-project in the context of the "Bayernkaserne" project, that meets the requirements and serves as a test balloon, playing and experimental field.

The Bayernkaserne project

The Bayernkaserne(link is external) project is a hard investment that will serve to raise awareness, train and educate a lot of actors around the construction chain. The broad vision is to upscale this project's results into a strategy, establishing the concept of circular economy in all construction projects in the city of Munich. In the course of this project, the city of Munich plans to recycle, reprocess if needed and reuse materials coming from deconstruction. Demolition material will be mostly used as a supplement for the production of R-concrete and for various substrates. Studies, in view of using recycled materials have shown that the use of recycled materials in road construction and landscaping meets the standards. Attention needs to be paid to include the studies' outcomes in order to enable the reuse of materials for new constructions. One mean to achieve that, put also forward in the City of Munich, is the inclusion of circular economy criteria in municipal procurements. More measures have been investigated by the group of local stakeholders (URBACT Local Group), always studying the case of the Bayernkaserne project.

Figure 1: Bayernkaserne project in Munich (City of Munich)

Although the Bayernkaserne project had been planned before the kick starting of the URGE project, the URBACT participatory approach was adopted both at the local level but also at transnational level, ''feeding'' URGE partners with knowledge and vice versa.

The basic elements of the roadmap to achieve the aim

Munich aims to boost the use of 100% recycled concrete in building constructions, which requires time and a lot of effort. The elements that were clear from the beginning were the following:

i. The role of the City towards this transition is of overarching importance and for this reason, a municipal property has been chosen to hold experimentations: the Bayernkaserne former military area, owned by the Municipality
ii. The need to reassure that the new material (R-concrete) is safe for reuse in new constructions. For this reason, a laboratory was set up in the Bayernkaserne area, where different mixtures were tested, to come up with the appropriate recipes. The close collaboration with the University of Applied Sciences of Munich and with technicians was fundamental.
iii. Raising awareness and building early trust with the market, constructors and builders, is critical. For this reason, as soon as the first tests' results were available, proving that R-concrete concentrates the appropriate specifications to be safely reused into construction projects, an informative session with the biggest market players was realised.
iv. The need to institutionalise the change. For this reason, a City Resolution has been drafted and is submitted for approval by the City Council. The City Resolution states clearly that new building constructions put forward by the Municipality, need to use R-

concrete. This requirement will be placed also in the municipal tenders. Achievable, realistic targets in terms of the quota of R-concrete that will be required to be embedded in the construction projects as a requirement in the tenders, is currently under decision.

v. The need to build trust with the smaller building companies. Smaller building companies and individual builders are persistent to the change as they fear that the new material might not be appropriate for specific parts of the construction process. More than that, they fear that they will not be able to find recycled concrete and comply with the new specifications/requirements of the municipal tenders.

With the approval of the City Resolution and the tests proving that 100% recycled concrete is appropriate for use in construction projects, an important step to influence regulations at national level will be achieved.

While the City Resolution is being finalised and till its final approval in May 2022, the URGE URBACT Local Group has brilliantly decided to put forward a smaller scale experiment, withing the Bayernekaserne project, in order to deal with the needs to build trust, raise awareness and provide a visible and realistic example that a construction can be built, using R-concrete.

This small-scale experimentation has been implemented with the involvement of Munich University and its students, to dispel the concerns of developers and contractors, while also students have been provided with hands on experience and practical knowledge.

The small-scale action of Munich: Construction with R-concrete produced out of 100% recycled aggregate

In practice, architecture and civil engineering students at Munich University, under the supervision of Prof. Dr. Andrea Kustermann, Prof. Thorsten Stengel and Prof. Christoph Dauberschmidt, Faculty of Civil Engineering, and Prof. Arthur Wolfrum, Faculty of Architecture, jointly built a sample pavilion with a floor area of 20 m². This consists of R-concrete with 100% percent recycled aggregate. The pavilion demonstrates the range of design possibilities of R-concrete. The interdisciplinary groups of civil engineering and architecture students designed and built 4 columns, with different surface structures, illustrating the design possibilities from rough to fine, plastic, playful or strict.

Figure 2: Small-scale action in Munich: sample pavilion of R-concrete (City of Munich)

How to succeed by daring to fail: A brave example from Riga

Riga is the capital of Latvia, home to 614,618 inhabitants, which is a third of Latvia's population. A beautiful city that possesses a lot of unused buildings and spaces. The old Town of Riga has beautiful, but old buildings that are in need of renovation. Riga envisions to boost circular economy and is one of the most active partners of the URGE Network, in terms of undertaking and implementing actions already during the life time of the project.

The small-scale action of Riga: An exchange point for construction materials

One of the overarching needs that have been identified by Riga Energy Agency (REA), partner in the URGE project, is the lack of a point, where people can leave and/ or retrieve building materials in order to reuse them, mostly in small renovations: A materials' exchange point. The seed was planted through the transnational exchange meetings, where the establishment and operation of material exchange points was transferred as a good practice, from the City of Copenhagen, partner city in URGE, as well as from the City of Oslo, partner in a ''sister'' URBACT Network, Resourceful Cities.

Riga decided to test the operation of an exchange point, for building materials in order to assess the feasibility to upscale this action. In parallel, guidelines for the replication of materials' exchange points have been developed.

The aim and benefits

The aim of the exchange point is to promote the sustainable use of construction materials, thus reducing both construction waste and the extraction and consumption of new resources. Exchange points allow consumers to receive the required materials in exactly the required quantity free of charge or at an affordable price. Such construction material exchange points help to use resources sustainably, relieve the waste management system, protect the environment and fulfill their social function. Exchange points promote a change in the habits of the population and are an important component of the infrastructure of the circular economy, which enables every citizen to implement the concept in their daily lives. Such points also reduce inequalities and help the most vulnerable groups in society to improve their living conditions. The operation of such exchange points may be based on different operating principles.

The implementation of the first building materials' exchange point in Riga has been tested in the frame of the URGE project. This activity coincides with the tasks of the Latvian Action Plan for the Transition to the circular economy and supports the local Integrated Action Plan, introduced in the frame of URGE.

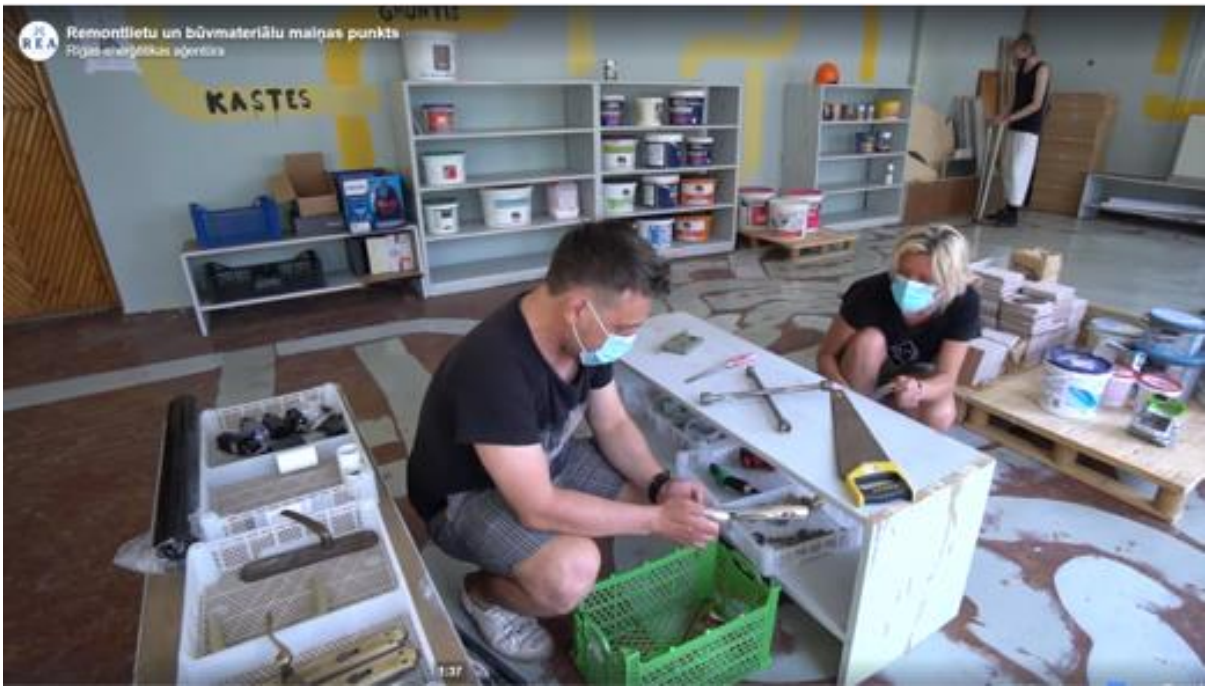

Figure 3: Small-scale action in Riga: exchange point for construction materials (Riga Energy Agency)

Citzens have been part of the experiment from the early beginning

The implementation of this small-scale activity, was launched at the end of 2020, with a survey of citizens to find out their views and expectations from the establishment of an exchange point for building materials. It was concluded that such an exchange point was not only theoretically useful, but even highly anticipated by the citizens. Many valuable suggestions for the implementation the exchange point were also received.

At the beginning of 2021, the URBACT Local Group gathered to analyse and plan the implementation of this small-scale activity through different scenarios.

The role of the NGO: FREE RIGA

Until 31 August 2021, FREE RIGA association installed and managed the first exchange point for building materials in Riga, at its premises at Viskaļu street 36. They also developed a visual identity and a website. The main findings lead to the introduction of guidelines for the establishment and operation of such exchange points elsewhere.

Limitations and drawbacks

During the implementation of the small-scale activity, several limitations and difficulties encountered and the managers had to adapt to the situation and change the initial settings. For example, the initially planned inventory of materials that would be available at the exchange point's website, proved unfeasible due to the wide variety of materials. There was an intention to also set up temporary repair services, a rental point, organise workshops, but such possibilities were explored without practical implementation, both due to the limitations of the pandemic and to the need to provide the premises with appropriate adaptation and safety

instructions, which required for additional investments. However, these limitations did not hamper the establishment and operation of the materials' exchange point.

Raising interest at national level

The small-scale activity received great public recognition through REA and FREE RIGA information channels, but did not reach a very wide audience at first. Later, nationwide media such as Latvijas Radio 1 and TV3 were involved, as well as Riga's largest house manager, Rīgas namu pārvaldnieks LLC, which placed information about the exchange point for building materials and repair tools at the monthly management invoices, delivering it to 100,000 mailboxes. During the trial, the exchange point gradually gained more and more public response. At least 2 months after the closure of the exchange point, residents continued to call the exchange point, wanted to use its services, and expressed the need to keep the exchange point permanently.

Figure 4: Exchange of construction materials in Riga (Riga Energy Agency)

Exemplary use of Cohesion Policy funds from Maribor, addressing the local circular economy strategy

Nigrad doo, is the only industrial partner of the URGE Network and is in close collaboration with the Municipality of Maribor to boost circularity in the building sector. Nigrad is also a partner at the CINDERELA project (H2020), where a pilot production plant to produce secondary raw materials, is established. With this pilot production plant, the project aims to demonstrate the technical, technological, and administrative possibilities of processing and using various non-hazardous construction waste as well as some other waste types to produce more sustainable construction products.

Following the pilot production and the lesson learned during the CIDNERELA project, the secondary raw materials produced in the pilot construction plant are being applied for the small-scale activity of the URGE project.

The small-scale action of Maribor: Micro-urban fixtures out of recycled aggregates

In the frame of the small-scale activity for the URGE project, Nigrad produces micro-urban fixtures out of recycled aggregates that can be used as benches with a bicycle rack.

Figure 5: Small-scale action in Maribor: production of micro-urban fixtures (Nigrad Maribor)

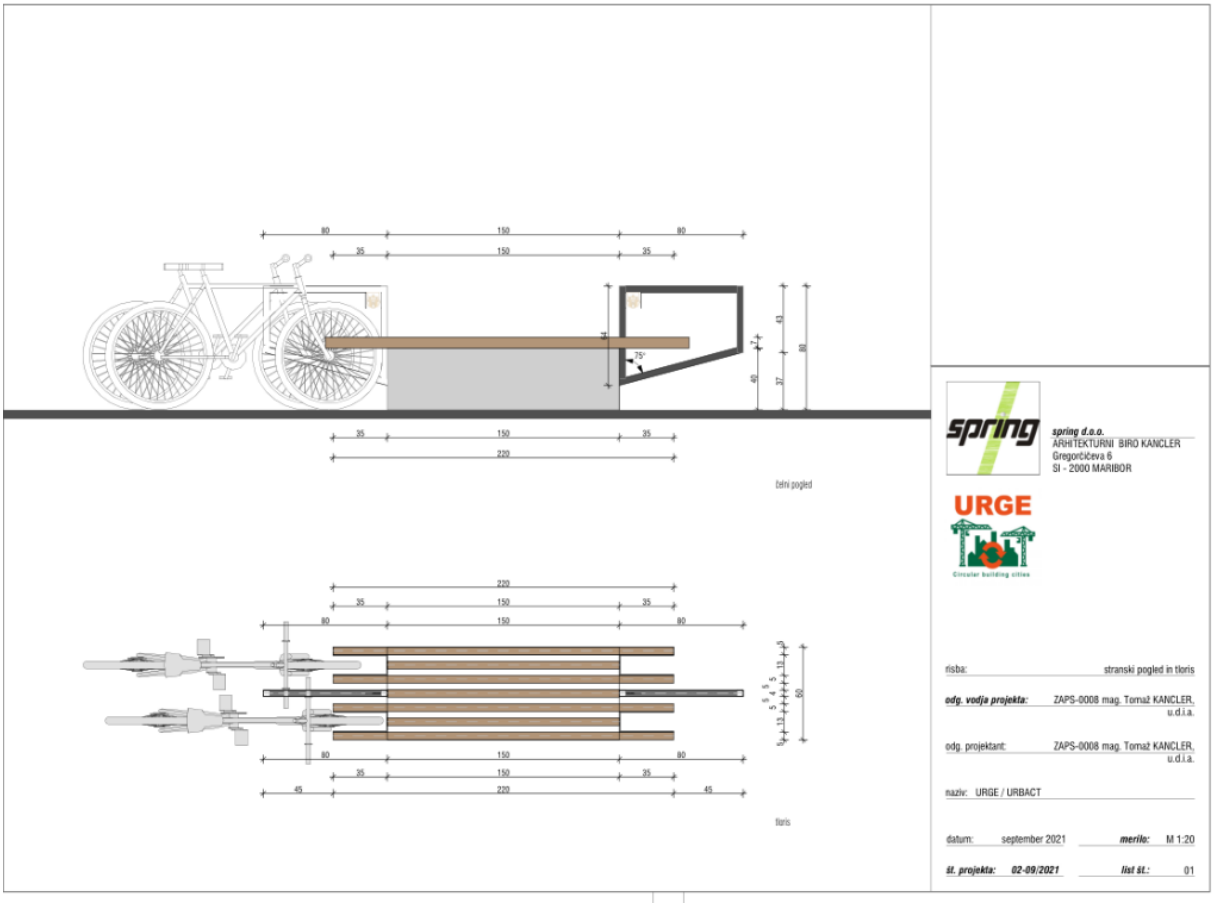

Figure 6: Technical drawing of micro-urban fixtures (Nigrad Maribor)

Benches combined with bicycle racks is a stylish and practical solution for decorating a city park, city centre or placing it near a school or a kindergarten. These benches will be made of recycled materials. Old benches, are deconstructed and the ''old'' concrete'' after tests, implemented in the pilot production plant, is transformed into ''green'' concrete, used in the benches. Apart from concrete, reusable wooden parts and scrap out of metal profiles of the old bunches, are being tested and reused to form the new bench and its bicycle racks.

The message

Due to its characteristics, the architecture of a bench is interesting because it shows us lessons related to simplicity and the different possibilities to reuse. More than that, Nigrad aims to raise awareness and ''educate'' citizens and market players on the potential uses of recycled materials. In the meantime, Nigrad is working closely with ZAG, which is a standardization institute situated in Maribor, holding tests of secondary raw materials and preparing for making them marketable products, safe and appropriate for upcycling uses.

Testimonies by small-scale activities' key persons

"The URBACT methodology for integrated action planning helped us to systematise the approach that we knew from a theoretic point of view that we had to follow. Building integrated stakeholders' group to co-design the action plan, was very helpful. More than that, participation in the transnational consortium of URGE gave us the great opportunity to benefit from sharing knowledge and experience with cities that face the same needs and have the same ambitions. That was helpful and engaging for our stakeholders" Daniel Rank, Munich URBACT Local Group Coordinator

"I highly appreciate the methodology of the URBACT programme, because it helped to bring the most important stakeholders at the table and provided with essential tools for the development of the Integrated action plan. For the city of Riga URGE has been an amazing source of inspiration and ideas for the transition to the circular economy. We learnt experiences from partner cities and gathered knowledge from experts involved in the project to support the development of the integrated action plan and its implementation. Implementation of the small-scale activity (Construction Material Exchange Point) gave us confidence that this is a must-have facility in Riga. We learnt that there are much more constraints and difficulties to overcome that we couldn't predict before. This piloting will let us avoid costly mistakes that could lead to failure on a larger scale. All our lessons learnt are gathered in the concept note that is free to use for anyone across Latvia who wants to develop something similar.", Ieva Kalnina, Riga Energy Agency URBACT Local Group Coordinator

"The URBACT methodology for integrated action planning helped us to systematise the approach that we knew from a theoretic point of view that we had to follow. Building integrated stakeholders' group to co-design the action plan, was very helpful. More than that, participation in the transnational consortium of URGE gave us the great opportunity to benefit from sharing knowledge and experience with cities that face the same needs and have the same ambitions. That was helpful and engaging for our stakeholders" Nuša Lazar, Nigrad d.o.o. URBACT Local Group Coordinator

Further reading

Bayernkaserne video: https://youtu.be/mZnALW8t1C4(link is external)

Munich URGE Case Study: https://stadt.muenchen.de/dam/jcr:9156906d-05da-47a1-9ebb-79624912d1fa/Case%20study_Munich%20URGE.pdf(link is external)

Riga video: https://youtu.be/sLezgOr-Rj4(link is external)
website of the exchange point: https://www.remontmaina.lv/(link is external) -
Guidelines for the development of similar exchange point https://drive.google.com/file/d/1lDqAVy84j_I2eNXXV9tJow6btqzRV7uS/view(link is external)

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Insights from the URGE network: thematic report

Start small: The journey to scale. Experiences from the URGE: Circular Building Cities Network – part II.

By Dr. Eleni Feleki, Lead Expert of the URGE Action Planning Network

Introduction

In the frame of the URGE: Circular Building Cities Action Planning Network that is financed by URBACT III Programme, 9 partners have committed to design Integrated Action Plans (IAPs), following a participatory approach with local stakeholders and have them approved by City Councils. These partners have a common ambition, to put a stepping stone towards green transformation, through boosting circular economy practices, in the building sector. Transnational exchange was intense throughout the project life time. Transnational knowledge was transferred at the local level and vice versa. This process was led by 9 inspired local coordinators, committed to form the URBACT Local Groups of stakeholders from various levels and fields, hold the problem analysis and ideation process with them, keep them engaged all along, co-decide on actions to be included in the IAPs and analyse them in a SMART way. And so much more than that.

Taking advantage of the programme's innovation, to provide the possibility to test an idea and refine the actions, several URGE partners have designed small-scale activities. Small-scale activities are implementation-related activities dedicated to testing a new, not necessarily innovative, approach. Small-scale activities designed in the frame of URGE, are addressing the local vision, are part of the IAPs, are designed building upon transnational exchange of knowledge and experiences and aim to achieve intelligence, through lessons learnt to better prepare for scaling up. This article illustrates small-scale activities undertaken by the Municipality of Kavala (Greece) and Municipality of Granada (Spain).

How to succeed by daring to fail: A one of a kind example for the Greek reality from Kavala

Utilization of Secondary C&D material in public works' procurements

One of the core thematic areas of URGE has been the ability to re-use materials that derive from construction or deconstruction projects, in a sense to upscale the materials, rather than downscale them. In Greece, the utilization of secondary materials in public construction works in the sense of upscaling is still far away, due to several factors, one of them being the national legislative framework. This gap is clearly spotted also in the "National Strategy for A Circular Economy" document, dated December 2018.

Figure 1: Historically preserved tobacco warehouses in Kavala (http://efimeridakavala.gr)

Why does this gap affect local authorities?

The role of local authorities as enablers of circular economy enhancement is well acknowledged by the OECD Report (2020). A powerful tool in the hands of local authorities in order to enhance circular economy has a name and a surname. It is called ''public procurements''. But, the absence of clear guidelines and technical standards at national level, poses significant hurdles on local authorities when it comes to the design of tenders including circular economy criteria. Such criteria could be (significant and measurable) utilization of secondary materials in public constructions replacing virgin materials. The Municipality of Kavala is one of the partners of the URGE project and since the very early start of the project, they have developed a very ambitious and clear roadmap to deal with this gap and raise the local need, to the national level.

Building upon a strong legacy

The Municipality of Kavala has been partner in the ''Making Spend Matter'' URBACT Transfer Network, thus the Municipality had already good knowledge of the power and impact of public procurements and an experience of working in a participatory and integrated approach with players from different levels of governance. The URGE Network gave Kavala the opportunity to explore the topic of public procurements from another point of view, through the lens of the environmental and economic dimensions of sustainability. Thus, in Kavala, they have decided to develop a small-scale activity to investigate the inclusion of explicit terms and criteria in public (municipal) procurements, targeting construction works. Criteria refer specifically to the utilisation of recycled/recovered C&D materials in public works, in replacement of virgin

materials. The small-scale activity initiated a study and the ultimate aim is to push the boundaries of the current legislation and raise the challenges to the national level.

Figure 2: View over Kavala (Oystein Leonardsen)

The "research" questions

Defining clear, concise, and focused research questions is an essential step in getting started with a project. In the case of Kavala, the research questions that would be addressed through the small-scale activity implementation, were developed as follows:

- What are the legal and/or institutional provisions hindering the utilization of C&D recycled materials in public procurements for construction projects?
- Under which prerequisites can quota for recycled C&D materials' utilization be introduced in public (municipal) procurements for construction projects?
- How can green procurements lead to increased recycled C&D material utilization?

The relevance to the Integrated Action Plan (IAP)

Small-scale activities need to be in line with the actions that are included in the IAP, to provide some first insights about its feasibility, impact, potential drawbacks, so that risks are minimised during implementation. In this sense, the small-scale activity that has been designed in the case of Kavala is in line with the following aims of Kavala's IAP:

- Preparation of the framework for boosting the market of secondary materials and resources through procurements
- Knowledge enhancement, communication for awareness-raising, sensibilization, training and education

The small-scale activity

Initially, the feasibility of the proposed activity was discussed and validated with relevant members of the ULG, mainly C&D waste management companies. The case of construction or reconstruction of a rural road project was deemed as feasible. C&D waste management companies provided available secondary materials. Technical specifications for the tender document were initially drafted by the ULG and were communicated/proposed to a Ministerial Committee, consisting of four different Ministry representatives, responsible for drafting specifications for integrating C&D waste materials in public works. Taking into account all the discussions at the different levels, the Department of Technical Services of the Municipality will produce a final tendering document that will include the requirement of integrating recovered C&D waste in a municipal public infrastructure project, namely a rural road construction/ reconstruction, either as a sub-base course or as a 10 cm thick "improvement layer" before laying out the sub-base course. At this point, the discussions are still on going, undoubtably, although is not the best upcycling example, it is a first very important step, in order to open the dialogue for circular criteria in procurements, which serves well the role of a local authority in boosting circularity.

Figure 3 and 4: Secondary raw materials (Eleni Feleki)

Key players, on board since the early beginning

In Kavala, the ULG is consisted of organizations and individuals with experience and a dynamic presence in the construction/ deconstruction sector. The ULG's goals were to allow participation, facilitate knowledge exchange and co-design the tendering document. Through ULG's operation, the plan to implement the small-scale activity was agreed, the inputs needed were identified, the technical specifications of the tender were developed, and the tender has been finally prepared and brought into the attention of the Ministerial Committee for discussion. The entities that compose the ULG of Kavala reflect the integrated approach and address several governance levels, sectors, academia and citizens. They are depicted in the scheme below.

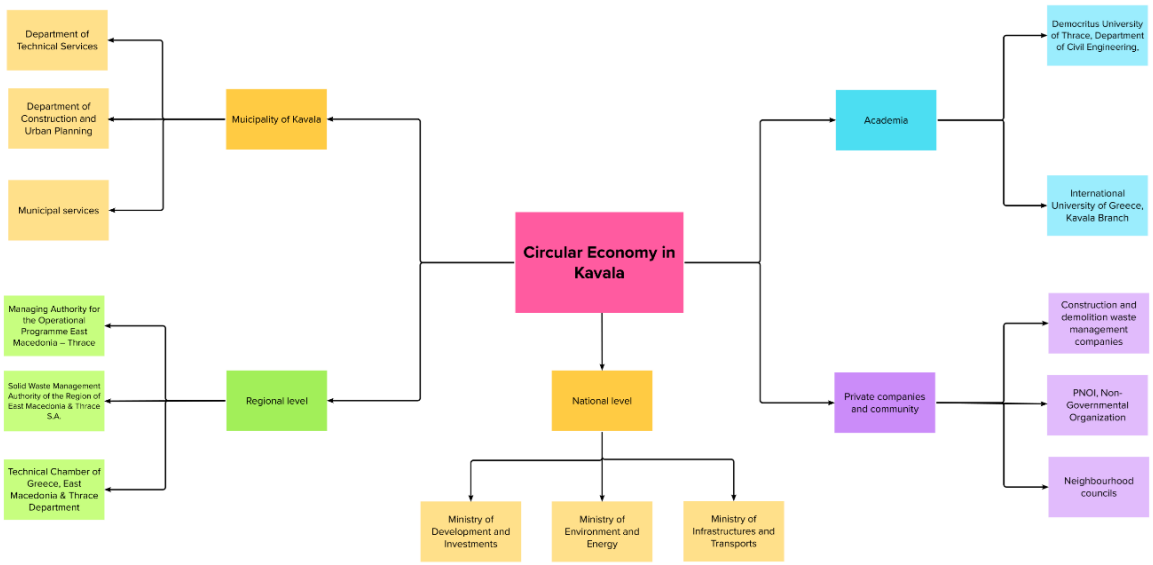

Figure 5: Local stakeholders in Kavala

Lessons learnt: the role of the market

Participation of private companies from the early stages of the project proved invaluable, as they provided the project team with expertise gained from their active involvement in numerous public and private construction projects. In addition, they indicated fields of improvement in the tendering regime and provided technical knowledge on materials that can have alternative uses and which otherwise would end up as informal backfilling materials.

Limitations and drawbacks

One of the main limitations that the project-team had to overcome was the lack of relevant legislative provisions and the minimal practical experience in similar projects at the national level. However, the participation of private waste management companies in the ULG in meetings from the early stages of the project proved to be very enlightening. Another limitation is the fact that the reuse of recovered C&D waste products in various construction projects is more expensive than simply using "virgin" materials. Thus, the process might look financially unattractive compared to “traditional” construction. It is important to accept and communicate, on a fair basis, that a rise in the construction project budget may be expected, at least before a streamlined process is installed.

Circular Granada

Construction in Granada -even though being one of the most important economic sectors of the city- is still mainly following the traditional linear model. Most of small and midscale works are often carried out by “old school” family companies, with no R&D Department. while training

programmes on circular economy are missing. Professionals themselves, are also in need of circular economy training, since there is a gap in the education on this topic, both in Universities and in professional associations. Therefore, as a starting point for implementing circular economy criteria, it was necessary to focus on awareness and training of the players in the sector, in order to make the first solid steps in the green transition staircase of the city.

The URGE DemoDay: The first meeting ever held in Granada related to circular economy in construction

During the lifetime of the URGE project, several good practices were detected among all actors involved in local constructions. The idea of showcasing them in a way which could also serve as a small-scale activity, gave to birth the "*URGE DemoDay*": the first meeting ever held in Granada related to circular economy in construction.

Figure 6, 7 and 8: URGE DemoDay in Granada (City of Granada)

The results

The URGE DemoDay proved to be extremely motivating for the ULG members. In order to keep the momentum, the City decided to organise DemoDays in Granada more systematically. Thus, as a result of this small-scale activity, and according to all feedback, a firm commitment is born to hold thematic meetings and discussion panels twice a year in Granada. These are now included as actions of the IAP of Granada. The URGE DemoDay helped also to engage

politicians into more effective actions to boost circularity in Granada. Their deeper engagement in the project was also achieved thanks to their recent participation to the political event and sit visit that was hosted by Copenhagen in the frame of URGE. In the frame of the URGE DemoDay, decisions were taken to enlarge the eco-point and reform the municipal waste plant.

Start small to think big later: The long-lasting effect

The small-scale activity gave room for inspiring discussions and as the relevant stakeholders were present, a clear opportunity is born for the city. Therefore, the organization of the small-scale activity, backed by transnational exchanges throughout the lifetime of URGE, have enriched and influenced Granada's IAP. After the opportunity of testing the organization and impact of the meeting, it's been possible to pulse local resources and to think about the continuity of the ULG by replicating periodically an improved version of the event on a yearly basis.

Testimonies by small-scale activities' key persons

"It was major assistance and groundbreaking experience of us taking part in URGE project. In particular, the methodology of the URBACT programme helped us to see circular economy in the construction sector in an integrated approach, attract and engage stakeholders, dedicated to the cause and provided us with essential tools for the development of the Integrated action plan. For the city of Kavala, URGE has been an amazing source of knowledge and know-how for the transition to the circular economy. We shared our anxieties and experience in tested solutions presented by our partner cities and got professional guidance from our Lead and ad hoc experts resulting in a consistent and feasible integrated action plan. Implementation of the small-scale activity gave us and was the first attempt at a national level to include recycled material in a public tender—a small step, significant progress, however. In a country, we lack a legislative framework in the field. We are experiencing more obstacles than expected and the market is not ready to support the change yet. Thus, we tried it out and elaborated an action plan towards mainstreaming circularity. We consider ourselves lucky to have our stakeholders engaged and our policymakers supportive!" Io Chatzivaryti, Senior Advisor to the Mayor in EU projects, Municipality of Kavala, URBACT Local Group Coordinator

"URBACT methodology has been crucial for us to detect and prioritize our needs, and to get the best inspiration from the exchanges with other cities. Furthermore, getting all construction agents together as stakeholders is the most solid foundation we could achieve to set circular economy criteria in the sector, through our Integrated Action Plan. Our small-scale activity (first ever meeting in our city related to CE in construction) gave us the opportunity to check and foresee the kind of actions that we can hold in future to raise awareness and training, and to strengthen the bonds between all stakeholders: government, professionals, University and companies." Ángel Luis Benito Pérez, Architect of Municipality of Granada and URBACT Local Group Coordinator

Further resources concerning the cases of Kavala and Granada

Granada: City video Granada: Circular building cities - YouTube(link is external)

Kavala: City video Kavala: Circular building cities - YouTube(link is external)

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