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Cities as Living Labs – Increasing the impact of investment in the circular economy for sustainable cities

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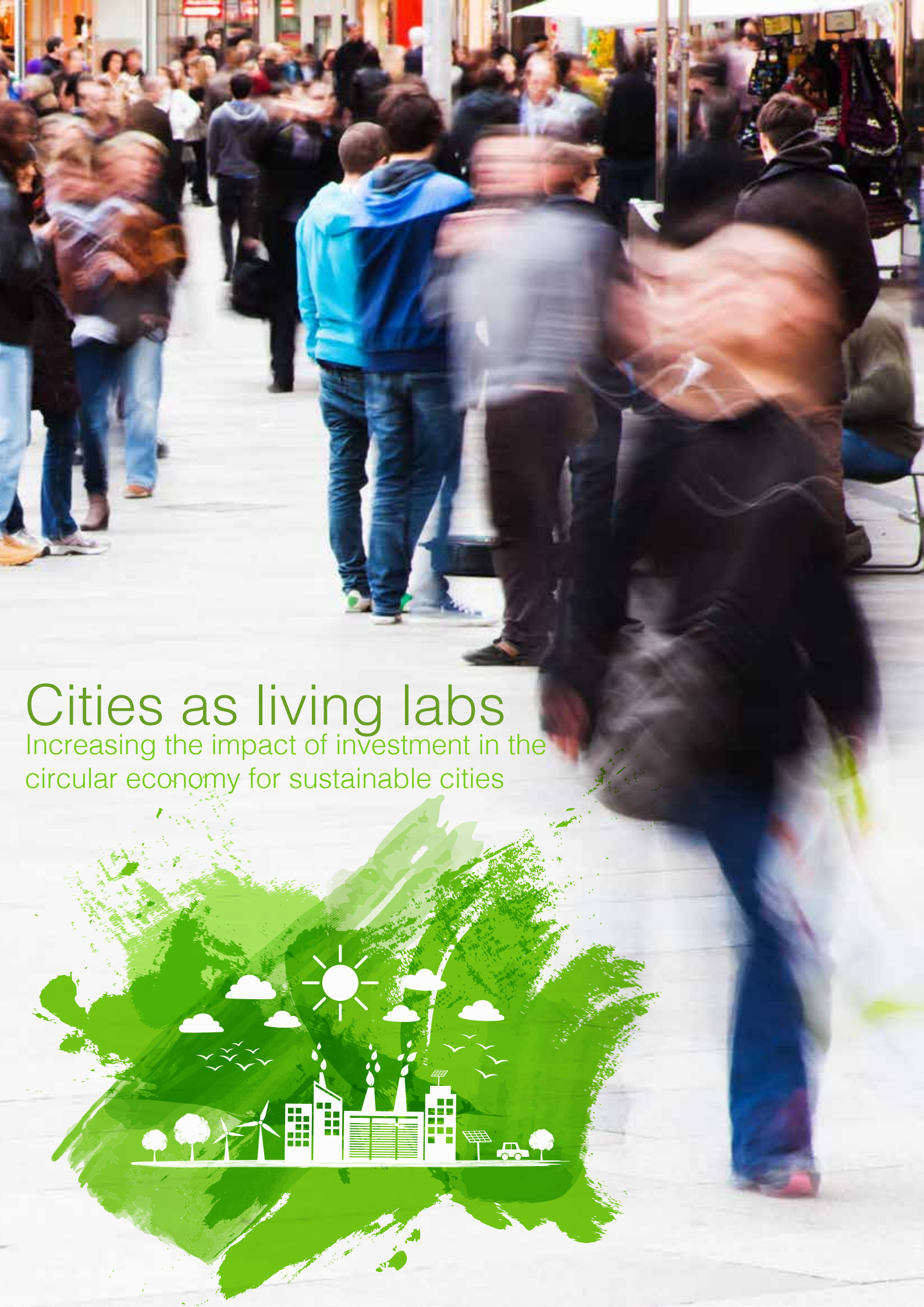
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Cities as living labs

Increasing the impact of investment in the circular economy for sustainable cities



Executive summary

Aim of the study. From innovation system and policy development point of view, it is vital to understand the impact and added value of EU-funded projects especially in context of the complex societal challenges such as circular economy in cities. By definition Circular Economy (CE) promotes resource minimisation and the adoption of cleaner technologies while maintaining the value of products, materials and resources in the economy for as long as possible and minimizing waste generation. Living Lab (LL) is an open innovation ecosystem based on a systematic user co-creation approach that integrates public and private, research and innovation activities in communities, placing citizens at the centre of innovation with the help of various approaches, instruments, methods, and tools.

By using publically available data sources and case studies the aim of this study is:

- A) to evaluate how cities have elaborated and implemented urban strategies in context of following three circular economy (CE) dimensions: 1) sustainable use of resources, natural and cultural capital, 2) circular mobility and 3) resource efficient buildings and urban spaces and
- B) to describe if and how the cities mobilise and interact with the various system innovation (SI) dimension including the Living Labs and
- C) relating to A and B get a better understanding of the impact of EU funding especially from Horizon 2020 and the 7th Framework Programme projects focusing on circular economy at city-level in context of Living Labs.

Data collection. Data sources included well known web services focusing on urban strategies, circular economy or Living Labs, as well as FP7/H2020 and Interreg Europe projects which included local authorities as beneficiaries or having other role such as lighthouse city, follower city, benchmark city, observer city, demonstration city, case study city or pilot city. Furthermore, on the basis of urban strategy and EU-project activity results grounded on the above secondary data sources, 15 European cities were asked to participate in a short survey in order get a better overview of their Circular Economy strategies and projects. On the basis of the survey results, the following five cities were selected for case studies to make sure that variety in social, legal, and cultural settings could be covered: Helsinki (FI), Manresa (ES), Lisbon (PT), Eindhoven (NL) and Riga (LV).

Key findings. As a result a strong correlation with Urban Strategy intensity and FP7/H2020-project participation was detected as well as a moderate correlation with Interreg Europe funding and Urban Strategy intensity. Instead Living Lab activities had only weak correlations with FP/H2020-project activities and urban strategy intensity measures and very weak correlation with Interreg Europe projects. Therefore it is argued that currently Living Labs seem to be underutilized resources in urban strategy development or Living Lab projects (and other similar co-creation activities) are carried out by actors who have not been officially certified by European Network of Living Labs (ENoLL).

Certain geographical regions in Europe appear to execute more intensive urban strategy than the others and are typically covering all three circular economy dimensions including sustainable use of resources, circular mobility and resource efficient buildings and urban spaces. The most active urban strategy cities in Europe include Brussels, Barcelona, London, Amsterdam, Vienna, Turin, Paris, Glasgow, Milan Copenhagen, Bologna, Gothenburg and Madrid. Majority of these cities had also participated in FP7/H2020 or Interreg Europe projects in various roles. The collaboration network

between cities relating FP7/H2020-projects can be considered as a decentralized, but not as distributed social network. As a result there are limited number of cities which hold an important role in the network and could be considered as potential knowledge and information hubs. Furthermore when the projects are generating new connections, they are typically adding only actors which do not have themselves extensive prior connections to additional cities or the these projects are mainly taken place between cities which have already previously collaborated.

The operational and ecosystem conditions as well as city goals relating Circular Economy (CE) and Living Lab (LL) activities and systemic innovation dimensions varies. Therefore, it could be challenging to implement “one size fits all model” in order to push cities towards Circular Economy (CE) and Living Lab (LL) activities.

In some cases Living Lab activities are tightly connected to city administration (e.g. in Helsinki the local Living Lab is an innovation unit within the Helsinki City Group) whereas in other cities there is no administrative connection between city and Living Lab (e.g. in Manresa the local Living Lab is hosted by research institute which helps city administration to gain EU-project funding). Furthermore, there are also indications that national and regional level strategies are influencing on a city level to move towards formal Circular Economy strategy. However, currently cities have not typically defined specific strategies for Circular Economy, but they are now actively working on circular economy plans which are soon to be formally released. Therefore, a window of opportunity is currently open for influencing on cities strategic decisions.

In spite of the missing formal Circular Economy strategies, cities have had targets for the Circular Economy in different programmes in different levels. Yet the circular economy as a term is not used and terms such as cleantech or sustainable development are more commonly applied.

The case study interviews revealed that Circular Economy as a term is still a bit blurry concept, which also need a clarification in order to transfer cities to Circular Economy. Situational awareness relating Circular Economy at city level is currently hard to collect and maintain due complexity of the action and a great variety of diverse stakeholders. In practice operational activities relating Circular Economy within a city are scattered across different administrative units as well as to external business units such as energy or transportation companies.

Therefore stronger emphasis on dissemination and capacity-building is needed to enable peer to peer learning between cities across the Europe. Our five case studies indicate that a lot of good case examples exists, but at the moment finding a cross-European information is very laborious process. Furthermore as identified the FP7/H2020 projects are grounded on decentralized, but not as distributed collaboration networks. This structure put pressure on the cities which have participated on multiple projects and belong to the core of the collaboration network to take a lead in dissemination activities and share their knowledge to less advanced cities. This stresses also a need for a better knowledge sharing infrastructure for EU-funded projects, which includes also national and regional level EU-funded projects such as structural or cohesions funds. Currently the information is scattered across the unstructured project websites, which are developed for short term project dissemination needs instead of being a part of European wide open data and open science knowledge platform.

Policy recommendations. The findings of this study calls a need for synergies in the strategies and funding at EU, national, regional and local levels in order to enable longitudinal, transversal and holistic funding and research programmes. This could reduce the fragmentation in funding, research and urban development programmes, where long term commitment is required. The long term perspective very important in innovative Urban Circular Economy planning, since often a single project is not sufficient effort to establish and implement a permanent operational activity in a complex setting which includes various stakeholders. The results also indicate that EU-funding is somewhat biased towards certain cities (and regions) while also cities as beneficiaries in EU-projects focusing on Circular Economy and Living Labs are currently less weighted comparing to private and research sectors. Innovation in Circular Economy requires a systemic approach where cities must act as key facilitators by stimulating co-creation, co-design and co-implementation with different actors and citizens at both the local and the international level. There is a need to promote new business models and alternative sources of funding at city level such as cooperatives, public-private partnerships, and crowd-funding where also citizens themselves can play an active role while establishing a platform for social innovations. In order to generate a systemic change, improved coordination across multiple levels of government is required to ensure collaboration between the different policy domains and actors. Role of capacity building and knowledge sharing is crucial at city and European level in fostering the systemic innovation processes. Apparently the creation of open data sources and digitalization is essential to enable these co-creation processes and innovation across Europe. The open data sources should also act as a foundation for formal Circular Economy development monitoring and reporting, which must be grounded on a common definition in order to translate specific strategies into actionable implementation plans and associated financing strategies at EU-, national, regional and city-level.

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1 Introduction

Innovations are vital to European competitiveness and therefore the EU is investing significantly in research and innovation through various funding instruments such as Framework Programme for Research and Innovation. From innovation system and policy development point of view, it is vital to understand the impact and added value of these investments especially in context of the complex societal challenges such as Circular Economy (CE) in cities. Circular economy promotes the idea that waste-output from one actor can function as a valuable input to another actor e.g. in terms of raw material or energy and lead to environmental benefits by reducing intake of virgin material and/or reduced emissions (Graedel and Allenby, 1995). By definition circular economy therefore promotes resource minimisation and the adoption of cleaner technologies (Andersen, 2007) while maintaining the value of products, materials and resources in the economy for as long as possible and minimizing waste generation (European Commission 2015). The ultimate goal in circular economy is to generate economic growth without environmental pressure.

According to European Network of Living Labs (ENoLL), Living Lab (LL) is an open innovation ecosystem based on a systematic user co-creation approach that integrates public and private research and innovation activities in communities, placing citizens at the centre of innovation. In this study LLs are considered as early markets for innovative products and services by consisting of advanced, risk-resilient consumers, innovative public/private procurement with open innovation dynamics. Furthermore from an EU-level perspective, LLs existing in various locations across Europe offers a different social, legal, and cultural settings to explore and test innovative solutions in variable environments.

The number of LL have been steadily growing since the launch of the ENoLL about ten years ago. Historically there have been nearly 400 officially recognised LLs across the world and currently there are 170 active Living Lab members in ENoLL. However, compared to traditional innovation research themes such as product, process, market or organizational innovation derived from Schumpeter (1934) typology, the maturity and evolution of LLs research is still in infancy. Many LL studies have more or less grounded on single or combination of few case studies which is typical approach when a particular research stream is still evolving strongly. Furthermore, the studies focusing on the impact of LLs at the city level are rare. Few pioneering studies are existing such as a comparative case study of three Asian and two European cities by Hu et al. (2016) and a snapshot of five case studies how the Urban Living Lab (ULL) concept was operationalised in urban governance for sustainability and low carbon cities (Voytenko et al. 2016).

As a result it is argued that there is a significant research gap relating (comparative) studies which are evaluating LL approaches and impact at European level. Therefore the aim of this study is to A) map cities which have elaborated and implemented urban strategies relating the circular economy by using publically available data sources and B) to describe how the cities mobilise and interact with Living Labs.

2 What is Circular Economy?

Circular economy promotes resource minimisation and the adoption of cleaner technologies (Andersen 2007) while maintaining the value of products, materials and resources in the economy for as long as possible and minimizing waste generation (European Commission 2015). Recently Ghisellini, et al. (2016) conducted an extensive review of the circular economy literature in order to define the main features and perspectives of circular economy. According to Ghisellini, et al. (2016) the so called 3R's Principles – Reduction, Reuse and Recycle – are especially related sustainable use of resources in the case of circular economy (see also EC-European Commission, 2008).

- **The Reduction principle** refers to reduce resource consumption and waste emissions
- **The Reuse principle** refers to “any operation by which products or components that are not waste are used again for the same purpose for which they were conceived”
- **The Recycle principle** refers to “any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations”
- Furthermore Ghisellini, et al. (2016) continued that the circular economy roots are in ecological and environmental economics and industrial ecology and both top-down national political objectives and bottom-up environmental and waste management policies have been applied. In all the implementation of circular economy is still in the early stage and it's mainly focuses on recycle rather than reuse although an important results have been achieved especially in waste management. Transition towards circular economy requires the involvement and capacity of all actors of the society to create suitable collaboration and exchange patterns. Therefore the implementation of successful circular economy strategy calls out Living Labs, which can be seen as a systematic way to engage various stakeholder to develop new solutions in a real-life environments. Albeit, many dimensions for circular economy can be defined and identified, in this study a circular economy in cities is argued to cover one or several of the three following dimensions: **1) Sustainable use of resources, natural and cultural capital** by controlling finite stocks, balancing renewable resources, optimise resource yields and foster system efficiency in the resource management (including waste management, urban mining, up- and re-cycling, new business models); **2) Circular mobility** by offering more choices of mobility and promoting vehicles which can be shared, electrified, autonomous, multi-modal and recycled/looped (including efforts to decrease congestion by fewer and better-used cars, service innovation and new business models in the so called sharing economy) and **3) Resource efficient buildings and urban spaces** which can generate, rather than consume, power and food and have green infrastructure with durable, mixed-used buildings, designed in a flexible way and constructed with looped and non-toxic materials.

However, as typically in undeveloped and infancy concepts, there is no uniform definitions available for circular economy and many rivalling, overlapping and even contradictory definition have emerged overtime. Importantly, this is not only generating confusion when debating about topic, but in some cases it can also isolate different themes although in practice they are investigating very similar phenomenon but using different notation. For this reason in this study we are not limited to circular economy term, but instead are using more loose definition which are related to circular economy such as:

circulation of material(s), compact product(s), compost(ed), consumption, cultural capital, cultural landscape(s), disposable packaging, disposal, eco-efficiency, efficient household appliance(s), emission(s), enhance, environmental impact(s), environmental protection, extended producer(s) responsibility, fewer resources, finite stocks, food reduction, green label(ling), harmful substance(s), hazardous waste, landfill prevention, landfill waste, less energy, less labor, lightweight product(s), mixed material(s), natural capital, noxious substance(s), one-way packaging, persistent environmental challenge(s), plastic waste, polluter pay principle, preserve, primary energy, procurement of resource(s), rare earth metal(s), recovery, recyclable(s), recycling, re-cycling, reduce packaging, remanufactured product(s), renewable resource(s), repair, resource conservation, resource efficiency, resource efficiency, resource management, resource recovery, resource reduction, resource yields, resources saving, returnable packaging, shared responsibility, simpler lifestyle, simplified packaging, solid waste management, sustainability, sustainable solution, system efficiency, take-back product(s), transaction cost(s), transport cost(s), unrecyclable, up-cycling, urban mining, waste directive, waste disposal, waste management, waste management policy, waste reduction, waste treatment, virgin material(s) and zero emission.

3 What is a Living Lab?

As typically in new emerging scientific domain, clearly uniform definition for Living Labs is not available. According to European Network of Living Labs (ENoLL) which is the international federation of benchmarked Living Labs in Europe and worldwide, a Living Lab is an *“open innovation ecosystem based on a systematic user co-creation approach that integrates public and private research and innovation activities in communities, placing citizens at the centre of innovation.”*

Lately also a more precise term Urban Living Labs (also Urban Labs) have emerged to describe a city or regional level Living Lab, which is the main focus in this study (Friedlich et al., 2013). Correspondingly to Living Labs many definitions exists also for Urban Living Labs (Juujärvi and Lund, 2016). Voytenko, et. al. (2016) suggested the following definition for Urban Living Labs: *“Urban Living Labs are a form of experimental governance, whereby urban stakeholders develop and test new technologies, products, services and ways of living to produce innovative solutions to the challenges of climate change, resilience and urban sustainability.”*

In all there has also been few attempts to review existing Living Lab concepts and definitions (e.g. Følstad, 2008b; Dutilleul et al., 2010; Schuurman et al., 2012) latest being dissertation by Leminen (2015) which identified about 70 different Living Lab definitions and concluded that “Living Labs”, “Living Laboratories” and “Living Labbing” terms are used interchangeably. As a result of this review (Ibid.) the following four characteristics for Living Lab s were defined:

- Living Lab s are real-life environments where:
- various stakeholders from public–private–people partnerships (4Ps) taking part to Living Lab activities,
- in a systematic way instead of an ad hoc approach
- by using various approaches, instruments, methods, concepts, conceptualizations and tools.

- The number and thematic areas of Living Labs have been steadily growing since the launch of European Network of Living Labs (ENoLL) about ten years ago and currently there are 170 official recognised Living Labs across the world running projects and enagging with theInternational Network. For this study the list of ENoLL's effective members, associated members and adherent Members were used, in order to identify Living Lab locations. According to ENoLL's thematic classification the following Living Lab themes are especially interesting for our study purposes:
 - **Smart cities & Regions -theme:** Having a strong commitment towards its citizens to enhance the quality of life, by mobilising the creative power of triple/quadruple helix parties and citizens/end users all together. Opening up the cities and regions themselves as a real-life testing ground for products and services with an added value that meet the needs of the citizens. Main focus areas of the thematic area: 1) Enabling and boosting the Urban Agenda, using citizen driven innovation processes, 2) Focus on the Smart Specialisation Strategies between European Regions in order to enable necessary transformation to make cities smarter and more sustainable, 3) Strong collaboration with public bodies, bottom up and grassroots movements.
 - **Energy -theme:** Local environmental solutions in dense city areas with focus on citizen involvement and multi-functional solutions that contributes to a sustainable city development – both nature based and traditional. The idea is to use regional and local demand to develop, demonstrate and deploy new energy and resource efficient solutions to climate and energy. Main focus areas of the thematic area are: 1) Focus on energy- and water supply, climate mitigation and adaptation, citizen involvement and behavior and climate adaptation, 2) Environmental and Sustainable Smart Cities, Smart Grids, 3) Lighting and smart urban technologies; and 4) Noise pollution
 - **Mobility theme:** Empower the citizens using different mobility solutions and integrate them into the innovation process, motivating them to participate, putting the right tools in place to enable a bottom-up dialogue, and translating ideas into sustainable commercial products or services. Main focus areas of the thematic area: 1) Develop physical infrastructure and adequate services necessary to help citizens in the region switch from private to public transport, 2) Validation of shared mobility solutions, especially apps, 3) Practical cross-border applications in the whole of Europe, 4) Integration and interoperability of different mobility related service.

4 Research methodology

4.1 Objective of the study

The aim of this study is following:

- (A) By using publically available data sources and case-studies, to evaluate how cities have elaborated and implemented urban strategies in context of following three circular economy (CE) dimensions: 1) sustainable use of resources, natural and cultural capital, 2) circular mobility and 3) resource efficient buildings and urban spaces
- (B) to describe if and how the cities mobilise and interact with the various system innovation (SI) dimension and especially the Living Labs
- (C) *relating to A and B* get a better understanding of the impact of EU funding especially from Horizon 2020 and the 7th Framework Programme relating to circular economy at city-level in context of Living Labs.

4.2 Definition of a City

In 2012, the OECD and the European Commission published a new definition of a city (Dijkstra and Poelman, 2012)¹. This new definition is based on the presence of an ‘urban centre’, a new spatial concept which is purely based on population size and density instead of functions, funding or feudal history which can lead to problems when conducting cross-country comparison. To qualify as an ‘urban centre’, city must have a density of more than 1 500 inhabitants per sq km and more than 50.000 inhabitants. Importantly, the “urban centre” can stretch beyond the boundaries of city and it is then called as “a greater city”. In all there are 32 “greater cities” in Europe which includes ten capitals and 23 other large cities as well as 908 “urban centres²”. In this study we are using simplified “city-term”, which can refer to “urban centre” or “greater city” depending on the location.

Furthermore, this study mainly focuses only on cities having over 100.000 inhabitants (N=517) and therefore cities having below 100.000 inhabitants (N=391) are omitted unless data sources are revealing interesting case studies from these cities. However, our sample can include also cities less than 100.000 inhabitants in urban area since in some data sources a city is defined by administrative border instead of urban center. In Table 1 the comparison between number and percentage share of cities and number of inhabitants between different size categories are presented which will reveal the maximum sample size.

¹ http://ec.europa.eu/regional_policy/sources/docgener/focus/2012_01_city.pdf

² The list of cities can be downloaded here: <https://circabc.europa.eu/w/browse/59bfa33a-8f4b-413d-8552-ac0a93ad7e5f>

Table 1: City size classification based on Eurostat population categories

Size definition based on urban center	N	% share of N	Total number of inhabitants	% share of inhabitants
Over 3 million inhabitants	7	1.4%	30.847.331	17.1%
1 to 3 million inhabitants	24	4.6%	38.637.600	21.4%
250.000-1 million inhabitants	130	25.1%	56.338.444	31.1%
100.000-250.000 inhabitants	356	68.9%	55.081.986	30.4%
Total	517	100%	180.905.361	100%

According to this classification the two largest cities in the EU are London (ca. 8.2 million inhabitants) and Paris (ca. 6.7 million inhabitants) and the following five cities have an urban centre over three million: Berlin (3.5), Madrid (3.2), Barcelona (3.2), Naples (3.1) and Milan (3.1). The following 24 cities have 1 to 3 million inhabitants: Athens, Greater Manchester, Roma, Birmingham (West Midlands urban area includes also Dudley, Sandwell, Solihull, Walsall and Wolverhampton), Bucharest, Katowice (Górnośląski Związek Metropolitalny, includes also Bytom, Chorzów, Gliwice, Ruda Śląska, Sosnowiec, Tychy and Zabrze), Lisbon, Hamburg, Budapest, Vienna, Warsaw, Stockholm, Munich, Lyon, Dublin, Prague, Copenhagen, Sofia, Brussels, Lille, Liverpool, Marseilles, Helsinki and Cologne.

There are 130 cities which have 250.000 to 1 million inhabitants and 356 cities which have 100.000 to 250.000 inhabitants. Albeit, the number of larger cities (over 1 million inhabitants) are representing only 6 percent of all cities, population wise they are covering nearly 40 percent of all cities in given target group. As a result, the sampling of cities in each group is aiming for somewhat balanced division between different size categories in order illustrate the possible similarities and differences between the defined groups.

4.3 Sample selection

A balanced sample population of at least 50 cities in Europe is elaborated according to the methodology described hereafter.

- 1) City has utilized various actions with objectives to achieve one or several of the prior defined three dimensions of a circular economy. This indicates that city has an official urban strategy which is being implemented.
- 2) Sample cities represent different sizes in terms of population according to following the population categorisation: A) cities having 100.000-250.000 inhabitants, B) having 250.000-1 million inhabitants, C) having 1 to 3 million inhabitants, and D) cities larger than 3 million inhabitants.
- 3) The geographical location of the cities in the sample includes cities in Central Europe, Western Europe, Eastern Europe, Southern Europe and Northern Europe. Furthermore, cities from Asia, Africa, North-America, South-America and Australia continents are also included into sample if they present innovations or urban strategies aiming at a circular

economy. Unfortunately there are several different approaches³ to define European sub-regions and therefore a country can belong to a different sub-regions depending on a classification schema. As a result various country grouping do not fully match and therefore in this report we our own classification which notifies also city location. The county level classification is presented in Appendix 2: Geographical classification of Countries.

- 4) Finally, the filtered list of cities was verified by the CEMR Experts on Circular Economy and Living Labs experts of the ENoLL to assess the relevance of the selected cities in a national context and suggests additional cities if needed to make sure that all interesting cities were included into sample. As described prior, the main aim of this study is to get a better understanding of the impact of EU funding especially from Horizon 2020 and the 7th Framework Programme relating to circular economy at city-level in context of Living Labs. Therefore, the geographical focus is in EU28 countries as well as in Horizon 2020 associated countries.

4.4 Data sources

The data for this study was collected between January to March 2017. Depending on the data source the following approaches were utilized to indicate the activity of the city: A) a city has a membership or signatory profile or is a member of initiative or B) city had at least one of the following roles in a project: 1) beneficiary, 2) lighthouse city, 3) follower city, 4) benchmark city, 5) observer city, 6) demonstration city, 7) case study city or 8) pilot city. Data sources were classified into EU-funding and urban strategy categories as follows:

EU-funding: CORDIS database – the European Commission's primary web portal for results of EU-funded research projects – was used to identify all the relevant FP7 and Horizon 2020 projects which thematically focuses on circular economy and/or Living Lab themes. Furthermore, also Interreg Europe project funding which helps regional and local governments across Europe to develop and deliver better policy evaluated at city level.

Urban strategy activity: The following known web services focusing on urban strategies or circular economy were evaluated to detect the maturity of urban strategy in city: 1) Covenant of Mayors for Climate and Energy, 2) Sustainable Cities Platform, 3) Urban Innovative Actions (UIA), 4) The European Green Capital Award, 5) The European Green Leaf, 6) European Innovation Partnership on Smart Cities and Communities Market Place, 7) The Circular Europe Network, 8) The Reference Framework for Sustainable Cities (RFSC), 9) The European Capital of Innovation Award (iCapital), 10) The Open & Agile Smart Cities initiative (OASC), 11) The Ellen MacArthur Foundation, 12) ICLEI - Local Governments for Sustainability, 13) Eltis, 14) C40 Cities Climate Leadership Group, 15) EUROCITIES and 16) European Network of Living Labs (ENoLL). A detailed description of the listed web services is provided in Appendix 3: Description of web services focusing on urban strategies used for data collection.

³ <http://www.emis-project.eu/sub-regions.html>, <https://stats.oecd.org/glossary/detail.asp?ID=303>; <http://unstats.un.org/unsd/methods/m49/m49regin.htm>

4.5 Construction of key measures

A circular economy (CE) activities in cities was measured via following three following dimensions:

- 1) **Sustainable use of resources, natural and cultural capital (CE_RESOURCE_MGMT)** including controlling finite stocks, balancing renewable resources, optimise resource yields and foster system efficiency in the resource management such as waste and water management, urban mining, up- and re-cycling and related new business models.
- 2) **Circular mobility (CE_MOBILITY)** including public transportation and various choices of mobility promoting vehicles which can be shared, electrified, autonomous, multi-modal and recycled/looped
- 3) **Resource efficient buildings and urban spaces (CE_BUILT_ENVIRONMENT)** which can generate, rather than consume, power and food and have green infrastructure with durable, mixed-used buildings, designed in a flexible way and constructed with looped and non-toxic materials in various scales (e.g. city district or individual building).

The following a measures were defined to describe if and how the cities mobilise and interact with the following four system innovation (SI) dimensions:

- 1) **Innovative solutions (SI_IS)** in including (A) technology-based solutions highlighting new or existing technologies, (B) research institutions, universities and innovative firms role in the process, and (C) new business models and industrial symbiosis.
- 2) **Living Labs (SI_LL)** including (A) citizen's involvement and social innovations, (B) public procurement of innovation and (C) open innovation and value chains business models using private procurement or linking the city to and business enterprises in the region, to cities in other regions or countries or elsewhere in Europe or globally and (D) the attractiveness of the city for innovative firms aiming at financing or testing their innovations in the city.
- 3) **Enablers (SI_E)** including (A) financing instruments, (B) regulatory innovation, (C) Big Data and digitalisation and (D) enabling physical and digital infrastructure.
- 4) **Governance (SI_G)** including (A) governance and monitoring of success of the urban strategy and its innovation component, (B) public sector Innovation and (C) Science diplomacy whether the city participates in global or bilateral initiatives for sustainable development goals.

5 Results – Urban strategy and EU-project activity

5.1 Urban strategy activity intensity including elements of circular economy

Urban strategy activity intensity for European cities was measured by counting total number of memberships, signatory profiles, and case studies from known web services focusing on urban strategies and/or circular economy. For more detailed description of the web services see Appendix 3. In Figure 1 the European cities having the Urban Strategy Activity Intensity score over 1 are presented. In Figure 1 the size of the blue circle is presenting the intensity level and varying between 2 to 44.

Urban Strategy Intensity by City name

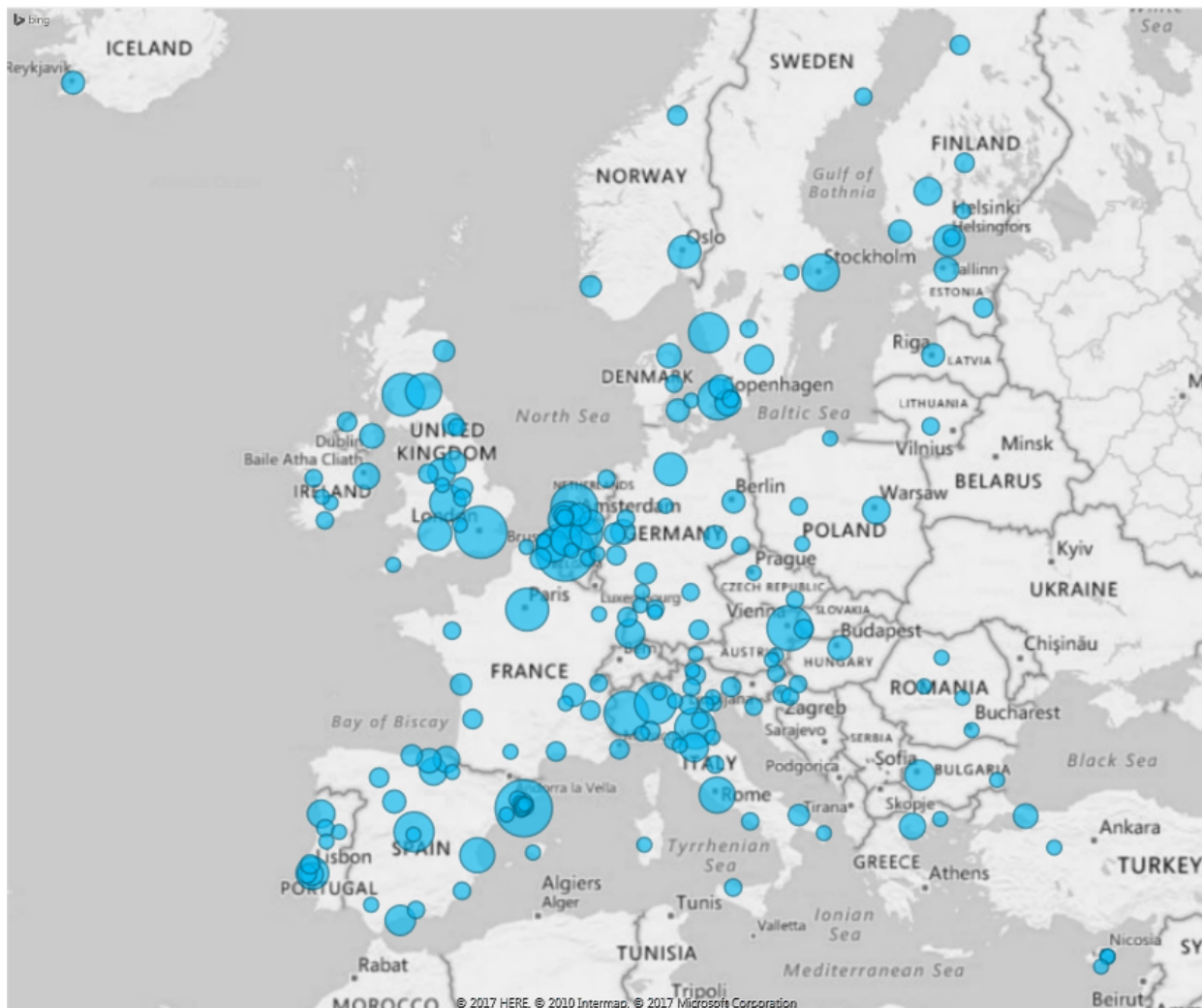


Figure 1: The Urban Strategy Activity Intensity including elements of circular economy > 1

As the Figure 1 indicates certain geographical areas in Europe appears to execute more intensive urban strategy. Among the leading cities are: Brussels (44 hits), Barcelona (42), London (35), Amsterdam (28), Vienna (26), Turin (25), Paris (23), Glasgow (23), Milan (22) Copenhagen (21), Bologna (21), Gothenburg (20), Madrid (20), Rotterdam (17), Stockholm (17), Birmingham (16), Edinburgh (16), Rome (16), Valencia (15), Bristol (14), Ghent (13), Oslo (13), Hamburg (13), Eindhoven (13), Lisbon (13), Helsinki (12), Antwerp (12), Sofia (11) and Malaga (11).

5.2 FP7 and H2020 funded projects including elements of Circular Economy

In order to evaluate in which cities FP7 and Horizon projects (later EU-projects) have been executed, the participants profiles, objective descriptions from Cordis⁴ database were analysed for 137 projects which were matching the initial search criteria on project focusing on Circular Economy (CE). Furthermore, when available⁵ project's websites (N=101) were searched for additional information. In a project, a city could have following different roles which was defined as a reference to a project: 1) beneficiary, 2) lighthouse city, 3) follower city, 4) benchmark city, 5) observer city, 6) demonstration city, 7) case study city or 8) pilot city. In Figure 2 the European cities having a reference to an EU-projects and elements of circular economy are presented. In Figure the size of the blue circle is presenting the amount of projects which varying between 1 to 11.

FP7/H2020 projects by City name



Figure 2: References to EU-projects including elements of circular economy at city level

⁴ http://cordis.europa.eu/home_en.html

⁵ the project websites were not existing anymore (N=3) or project website did not exist at all (N=33)

Over half of the EU-projects focusing on Circular Economy (N=77, 56.2 %) included a reference to a city, while for 43.8 percent of projects (N=60) a city reference could not be found. As a result, City of Barcelona (ES) by far was the most active city with 11 references. Furthermore, the first position of Barcelona's can be regarded even stronger since Sabadell (ES) with 3 references is only about 30 kilometers and Manresa (ES) with 2 references about 60 kilometers from Barcelona. The next best position was shared by following 8 cities: Amsterdam (NL), Berlin (DE), Helsinki (FI), London (UK), Madrid (ES), Manchester (UK), Milan (IT) and Turin (IT) which all had 6 projects. Third position was shared by Copenhagen (DK), Hamburg (DE), Ljubljana (SI) and Rome (IT) which all had 5 projects.

In Table 2 the most active cities (i.e. referred by 2 or more FP7/H2020 projects) are listed based on geographical location and size. Furthermore, the distribution of relative share of the cities in each geographical location and size category is presented in parenthesis below the each location and size category title.

Table 2: Size and geographical location of the most active cities

		Urban center population								
		<100 k	100 k -250 k	250 k-1 M	1 M-3 M	> 3 M				
Location		(28.3%)	(25.7%)	(30.1%)	(9.3%)	(6.6%)				
SOUTH (26.1 %)	Manresa	(2)	Brescia	(3)	Turin	(6)	Lisbon	(4)	Barcelona	(11)
	Santiago de Compostela	(2)	Santander	(3)	Naples	(3)			Madrid	(6)
			Sabadell	(3)	Porto	(3)			Milan	(6)
			Bolzano	(2)	Vitoria-Gasteiz	(3)			Rome	(5)
			Trento	(2)	Florence	(2)				
					Genova	(2)				
					Lecce	(2)				
					Malaga	(2)				
					Nicosia	(2)				
					Pisa	(2)				
	NORTH (14.2%)	Eskilstuna	(2)	Stavanger	(2)	Oslo	(4)	Helsinki	(6)	
					Gothenburg	(4)	Copenhagen	(5)		
					Malmö	(3)	Stockholm	(4)		
					Aarhus	(2)				
WEST (25.7%)	Corby	(2)	Aberdeen	(3)	Amsterdam	(6)	Manchester	(6)	London	(6)
	Mechelen	(2)	Arnhem	(2)	Antwerp	(4)	Brussels	(4)	Paris	(3)
			Eindhoven	(2)	Ghent	(4)	Dublin	(4)		
			Enschede	(2)	Glasgow	(3)	Birmingham	(3)		
			Utrecht	(2)	Leeds	(3)	Lyon	(2)		
					Rotterdam	(3)				
					Bristol	(2)				
					Edinburgh	(2)				
					Nice	(2)				
					Nottinham	(2)				
EAST (7.1%)	Tartu	(2)	Suceava	(2)	Riga	(2)	Sofia	(3)		
					Skopje	(2)	Warsaw	(2)		
CENTER (18.6%)	Pula	(2)	Heidelberg	(2)	Ljubljana	(5)	Hamburg	(5)	Berlin	(6)
			Rostock	(2)	Vienna	(4)	Budapest	(4)		
					Zagreb	(3)	Cologne	(3)		
					Graz	(3)	Belgrade	(2)		
					Frankfurt	(2)	Prague	(2)		
					Geneva	(2)				
					Grenoble	(2)				
				Skopje	(2)					

It appears that South and West European cities are competing head-to-head on the first position. South Europe is taking the first place with 59 cities and 26.1 percent share and West Europe takes the second place with 58 cities and 25.7 percent share. Central Europe takes the third place with 42 cities which results 18.6 percent share. North European countries are taking the fourth position with 32 cities and 14.2 percent share. Afterwards, there is a clear cap to East (N=16) and Non-European (19) countries, which both remain below 10 percent share.

When a city reference to a project were evaluated in terms of South, North, West, East, Center and Non-Europe countries it appeared that 21 projects (26.6 %) included only one region, 27 projects (34.2 %) two regions, 15 projects (19 %) three regions, 10 projects (12.7 %) four regions and 6 projects (7.6 %) five regions. None of the project included all six regions.

5.2.1 FP7/H2020 projects relation to Circular Economy themes

The keywords and themes related to each circular economy themes were iteratively derived by reading objectives descriptions from each project and then mapping these keywords to each project. The list of keywords for each Circular Economy dimension is presented in Appendix 4. In Table 3 the most active cites (i.e. referred by 4 or more projects, N=23) are classified based on the three main Circular Economy themes. Basically, this analysis reveals that great majority of the leading cities (N=18, 78.3 %) had covered all three circular economy dimensions.

Table 3: Thematic areas coverage in cites having more than three FP7/H2020-project references

Rank	City	CE RESOURCE MGMT	CE MOBILITY	CE ENVIRONMENT	BUILT	SUM	Different projects (N)
1	Barcelona (ES)	5	5	6		16	11
2	Amsterdam (NL)	3	2	1		6	6
	Berlin (DE)	3	3	3		9	6
	Helsinki (FI)	1	4	3		8	6
	London (UK)	3	4	1		8	6
	Madrid (ES)	1	4	1		6	6
	Manchester (UK)	3	4	3		10	6
	Milan (IT)	1	4	1		6	6
	Turin (IT)	3	3	1		7	6
3	Copenhagen (DK)	3	1	1		5	5
	Hamburg (DE)	3	2			5	5
	Ljubljana (SL)	4	1	2		7	5
	Rome (IT)	2	4	1		7	5
4	Antwerp (BE)		3	1		4	4
	Brussels (BE)	1	2	1		4	4
	Budapest (HR)	2	2	2		6	4
	Dublin (IE)	3	1	1		5	4
	Ghent (BE)	2	2			4	4
	Gothenburg (SE)	1	3			4	4
	Lisbon (PT)	3	1			4	4
	Oslo (NO)	1	2	1		4	4
	Stockholm (SE)	3	2	3		8	4
	Vienna (AT)	2	2	1		5	4

In all the projects which included a reference to a city were relatively evenly distributed between the three Circular Economy dimensions (see Table 4). Seven projects (8.9 %) covered all three circular economy themes and fourteen projects (17.7 %) covered two themes. As a result, about fourth of the all projects (26.6%) could be considered as a multi-thematic whereas remaining projects focused on a single Circular Economy theme.

Table 4: Number of projects in three Circular Economy dimensions

	CE RESOURCE MGMT	CE MOBILITY	CE BUILT ENVIRONMENT
All projects (N=137)	78	52	54
Projects including a reference to a city (N=79)	39	32	34

5.3 Interreg Europe funded projects for Circular Economy

In order to evaluate in which cities Interreg projects focusing on circular economy have been executed, the list of beneficiaries at city level (i.e. Local Public Authority) were derived from Interreg Europe website. The projects having Environmental Sustainability as a main focus (N=70) or positive influence (N=68) were interpreted to have circular economy focus.

In Figure 3 the European cities being an Interreg Europe beneficiary more than once are presented. In Figure the size of the blue circle is presenting the amount of projects which varying between 2 to 10.

Interreg beneficiary by City name



Figure 3: Interreg project beneficiaries at city level

As a result, City of Sofia (BG) was the most active city with 10 projects. City of Warszawa (PL) with 7 projects was ranked second. Eindhoven (NL) and Riga (LV) with 6 projects was ranked third while Tallin (EE) with 5 projects shared the fourth position with Torino (IT). The fifth position with 4 projects was shared by Bologna (IT), Helsinki (FI), London (UK) and Manchester (UK).

5.4 Living Labs in Europe focusing on Circular Economy

The list of **European Network of Living Labs (ENoLL)** members (N=59) which focused on “Smart cities & regions”, “Energy” or “Mobility” themes was used to identify the Living Lab locations and their maturity⁶. In Figure 4 these particular ENoLL members are presented while the size of the blue circle is presenting the maturity of Living Lab by years ranging from 1 to 10 years.

Living Lab maturity by City name

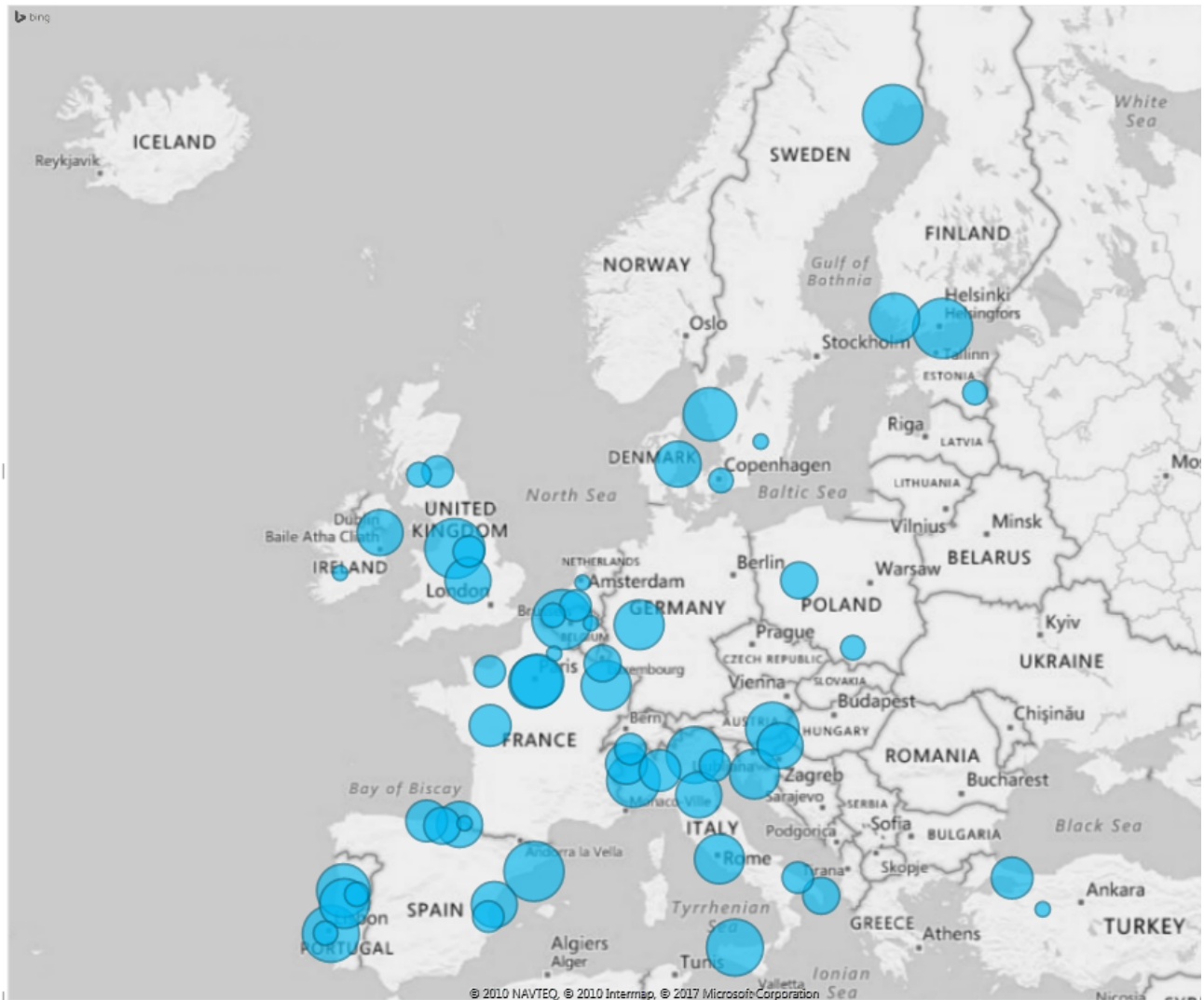


Figure 4: European Network of Living Labs (ENoLL) members focusing on “Smart cities & regions”, “Energy” or “Mobility” themes according maturity

The most mature Living Labs started in 2007 and are located in Ghent (BE), Barcelona (ES), Helsinki (FI), Luleå (SE), Manchester (UK) and Sophia Antipolis (FR). In year 2008 Palermo (IT), Trento (IT) and Lisbon (PT) followed. In year 2009 Paris (FR), Turin (IT), Issy-les-Moulineaux (FR), Águeda (PT) and Gothenburg (SE)

⁶ See Chapter 3 for detailed definition for each theme

In Table 5 the forerunner Living Lab cities are presented on the basis of 1) Living Lab maturity and coverage (i.e. number of all Living Labs and themes) and 2) participation in FP7/H2020 projects focusing on Living Labs and Circular Economy.

Table 5: Forerunner Living Lab cities

Rank	City	LL experience in years	LLs in urban center (N)	LL focusing on CE themes (N)	FP7/H2020 LL project (N)	Circular Economy FP7/H2020 projects	LL vs. ALL FP7/H2020 project ratio	ALL SUM
1	Barcelona	10	5	3	2	9	18 %	35
2	Paris	7	7	2	1	2	33 %	24
3	Helsinki	10	2	1	4	2	67 %	23
4	Ghent	10	2	2	3	1	75 %	22
	Manchester	10	2	2	3	3	50 %	22
5	Lisbon	9	2	2	2	2	50 %	21
6	Turin	8	1	1	3	3	50 %	20
7	Lecce	4	5	3		2		19
8	Milan	5	1	1	3	3	50 %	17
9	Luleå	10	1	1				16
	Donostia-San Sebastian	6	4	2		1		16
	Edinburgh	9	1		1	1	50 %	16
10	Montreal	7	2	2				15
	Gothenburg	8	1	1	3	1	75 %	15
	Graz	8	2	1	1	2	33 %	15
	Trento	9	1	1		2	0 %	15
11	Bari	3	2	1	1		100 %	14
	Bristol	8	1		1	1	50 %	14
	Birmingham	8	1		1	2	33 %	14
	Rome	7	1	1	1	4	20 %	14
12	Bilbao	6	2	1				13
	Penela	7	1	1				13
	Vantaa	9	1					13
	Vitoria	7	2	1				13
	Eindhoven	3	1	1	1	1	50 %	13
	Budapest	6	1		2	2	50 %	13
	Stockholm	7	1		1	3	25 %	13

As a result the clear winner in terms of Living Lab activities is Barcelona with total 35 points, which is among the most experienced Living and hosting multiple Living Labs which are covering various themes. Furthermore, Barcelona's FP7/H2020 are emphasizing more Circular Economy themes than project focusing more purely on Living Lab activities. After Barcelona, the close runner-ups are Paris (24 points), Helsinki (23), Ghent and Manchester (22), Lisbon (21) and Turin (20). Among the Living Lab forerunners, Helsinki and Ghent are more heavily applying Living Lab methods than their close rivals Living Lab cities. It is noteworthy to point out that Ghent is a relatively small city comparing to other Living Lab leaders since it has only around 250.000 inhabitants in urban center.

Thematically Living Lab projects have been mostly focusing on CE-MOBILITY (11 projects), secondly on CE-RESOURCE (8) and thirdly on CE_BUILT_ENVIRONMENT (4).

5.5 Urban strategy activities relation to FP7 and H2020 funded projects

The visual comparison between Urban strategy activity intensity (Figure 1), EU-projects (Figure 2 and Figure 3) and Living Lab activities (Figure 4) suggest that these activities are somewhat interrelated. In Table 6 the correlation analysis results between the following key measured are presented:

- **Urban Strategy Intensity (US Intensity)** = Total number of memberships, signatory profiles, and case studies
- **Urban Strategy diversity (US Diversity)** = Number of different databases where a city was presented
- **FP7/H2020 funding (FP-funding)** = Total number of projects references in a city
- **Interreg funding (IR funding)** = Total number of projects where city has been a beneficiary
- **Funding ALL** = Summary of FP and IR funding
- **Living Lab maturity (LL Maturity)** = The age of the first Living Lab in a city
- **Living Lab volume (LL Volume)** = The total number of Living Labs in a city
- **Living Lab themes (LL Themes)** = The total number of themes covered by Living Labs in a city
- **LL Summary** = Summary of LL Maturity, LL Volume and LL Themes

Table 6: City size classification based on Eurostat population categories (N=304)

	US Intensity	US Diversity	FP Funding	IR Funding	Funding ALL	LL Maturity	LL Volume	LL Themes
US Diversity	0.883**							
FP Funding	0.753**	0.716**						
IR Funding	0.420**	0.374**	0.389**					
Funding ALL	0.742**	0.694**	0.908**	0.740**				
LL maturity	0.226**	0.218**	0.230**		0.219**			
LL volume	0.332**	0.306**	0.290**	0.144*	0.278**	0.696**		
LL themes	0.328**	0.293**	0.287**	0.119*	0.264**	0.612**	0.877**	
LL SUMMARY	0.311**	0.288**	0.290**	0.132*	0.272**	0.903**	0.898**	0.889**

** . Correlation is significant at the 0.01 level (2-tailed); * . Correlation is significant at the 0.05 level (2-tailed).

Urban strategy Intensity (US Intensity) and Diversity (US Diversity) measures had very strongly correlation (0.833**), which indicates that cities being present in various Urban strategy web services have also more case studies available. The both of these measures – US Intensity (0.753**) and US Diversity (0.716**) – had also strong correlation with total number of FP7/H2020 projects measure (FP-Funding). US Intensity (0.420**) had also moderate correlation with IR Funding measure, while US Diversity correlation remained at weak level. (0.374**). The fact that all Interreg Europe projects were included in this measure, could partially explain the weaker linkage as well as the nature of Interreg Europe projects which stresses the sharing solutions between various regions. Therefore, also cities having less advanced Urban strategy as participating in Interreg Europe projects in order to learn from the lighthouse cities. Importantly, the data collection from urban strategy focused websites did not included in-depth content analysis. Therefore it might be also possible that these particular web forums were also used partially as a dissemination channel for EU-projects. If that would be the case, then the EU-funding would play even more significant role in implementing the circular economy strategies in cities. If not, then this result would reveal that the cities participating in EU-projects are also promoting circular economy with other public and private funding sources. This additional funding will then help building up the capabilities needed to gain highly competitive EU-projects where the success rate is often marginal. The underlying assumption is that the leading cities are moving forward in many urban strategy frontiers and the EU-funding such as FP7 and H2020 is helping them to increase the gap to other cities.

In the case of all Living Lab measures, only weak correlations between FP/H2020-funding and urban strategy measures were detected. In the case of Interreg Europe funding the correlation remained very weak. Basically this indicates that only handful of Living Lab location, have been able to gain EU-funding and those Interreg Europe beneficiary cities who have gained funding, rarely have ENoLL Living Lab members.

As a result it is argued that currently Living Labs seem to be an underutilized resource in urban strategy development or Living Lab activities (and other similar co-creation activities) are carried out by actors who have not been officially certified by ENoLL.

By responding to this shortcoming, the lack of public participation and citizen engagement could be better addressed in Large Scale EU projects.

5.6 Social Network Analysis of EU projects focusing on Circular Economy

When utilizing the social network analysis methodology there are various ways to measure the centrality of the actor nodes (i.e. cities) within a network determined by collaboration relationships within a FP7/H2020 project. To indicate the centrality of different cities, the degree centrality and betweenness centrality measures for each city were utilized. **Degree centrality** measure calculates how many direct connections each city has with other cities in a network. In practice this measure kind of indicates the possibilities to share a knowledge between different cities if assuming that the project partners are disseminating the projects related information between each other. A high degree centrality indicates that the city has had more possibilities to share and receive knowledge. **Betweenness centrality** measures the structural position of a city between clusters of cities in a network. The cities having a high betweenness centrality value are important actors in a network, since if they are deleted from this collaboration network, the network will disintegrate to separate parts. As a result these cities have powerful position in a network since they can exploit their gatekeeping role to share or not to share the knowledge between the separate parts of the network. In Figure 4 the cities are mapped based on their betweenness centrality measures while the size of the blue circle is presenting the betweenness centrality value ranging from 5 to 2801.

Betweenness centrality by City Name



Figure 5: Most important cities focusing on Circular Economy according to Social Network Analysis betweenness centrality measure

In Table 7 the distribution of number of connections (degree centrality) to other cities relating to FP7/H2020-projects are presented.

Table 7: Distribution of number of project partners

Number of connections	<= 5	6 – 9	10 – 17	18 – 39	40+
Number of cities	65	25	47	62	26
%-share of cities	28.9 %	11.1 %	20.9 %	27.6 %	11.6 %

In Table 8 the leading cities are ranked based on betweenness and degree centrality measure.

Table 8: The leading cities based on betweenness and degree centrality measures

City	Betweenness centrality	Name	Degree centrality
1. Turin (IT)	2 801	1. Manchester (UK)	88
2. Barcelona (ES)	1 700	2. Turin (IT)	75
3. Manchester (UK)	1 541	3. Milan (IT)	70
4. Lisbon (PT)	1 454	4. Madrid (ES)	67
5. Amsterdam (NL)	1 419	5. Ghent (BE)	63
6. London (UK)	1 353	6. Helsinki (FI)	58
7. Bolzano (IT)	1 212	7. Lisbon (PT) London (UK) Glasgow (UK) Utrecht (NL) Gothenburg (SE)	57
8. Milan (IT)	1 163	8. Dublin (IE)	53
9. Madrid (ES)	941	9. Rome (IT)	52
10. Budapest (HU)	929	10. Barcelona (ES)	47

As a result the most connected cities are Manchester [UK] (with 88 connections), Turin [IT] (75), Milan (70), Madrid [ES] (67) and Ghent [BE] (63). The most important cities based on betweenness centrality measures are Turin [IT] (Betweenness centrality = 2 801), Barcelona [ES] (1 700), Manchester [UK] (1 541), Lisbon [PT] (1 454) and Amsterdam [NL] (1 419).

A network component analysis was also conducted to evaluate the evolution of collaboration between cities. A component is a part of a network in which all cities are directly or indirectly connected by at least one connection. Thus, the component analysis will reveal those cities within the whole network which are internally connected, but separate from each other. "Component ratio" was also calculated, which get value 1 when every actor is an isolate and value 0 when all actors are connected and there is only one component. Cohesion measure "density" which is defined as number of links in the network expressed as a proportion of the number possible was also calculated. In Table 9 and Figure 5 the evolution of FP7/H2020-project network is presented.

Table 9: The leading cities based on betweenness and degree centrality measures

	2009	2009-2010	2009-2011	2009-2012	2009-2013	2009-2014	2009-2015	2009-2016
Avg Degree	20	14,80	11,74	11,48	10,54	10,61	19,63	17,82
Density	100 %	51 %	22 %	17 %	10 %	8 %	11 %	8 %
Components	1	3	6	6	11	9	8	9
Component Ratio	0	0,07	0,09	0,07	0,09	0,06	0,04	0,04
Cities (N) having connection	21	30	54	69	107	135	183	225

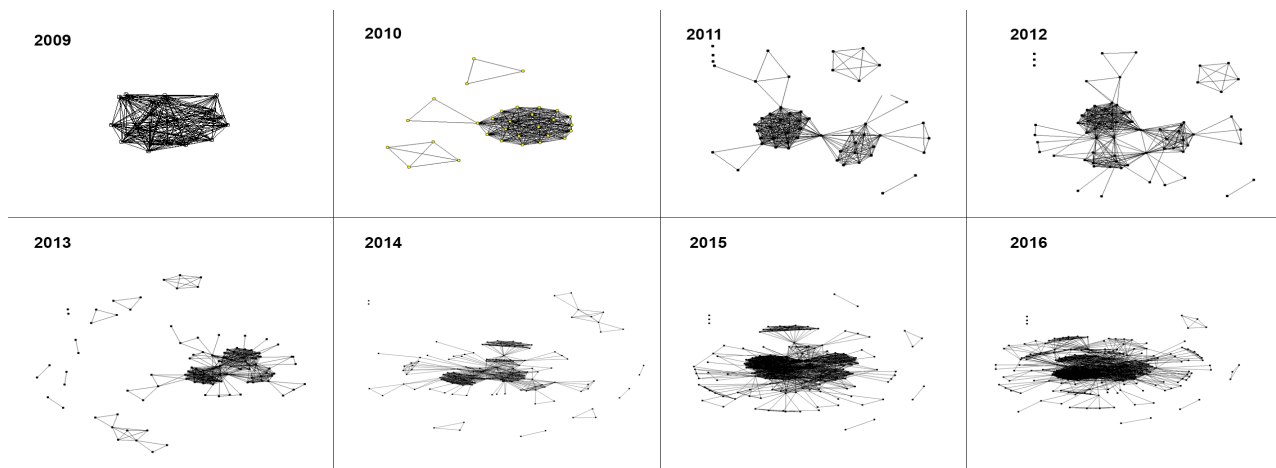


Figure 6: Evolution of FP7/H2020 project network collaboration

The average degree is ranging between 10,54 (years 2009-2013) to 20 (year 2009) while component ratio remains close to zero in all cumulative years. Basically this indicates that nearly all cities are connected with each other and on the average they have from 10 to 20 connections to other cities. However, when the number of cities having connections to other cities in a network is increasing, the network density is evening out to ca. 10% -level. This mean that only one tenth of possible connections are utilized and most of the connection between the cities are in-direct.

As a result FP7/H2020-project network relating Circular Economy and Living Labs can be considered as a decentralized, but not as distributed social network which are also known as federated social network. In the FP7/H2020-project collaboration network there are multiple cities which hold an important role due their participation project activities. These cities can be considered as knowledge and information hubs.

By the year 2013 the density within the network came down to 10 percent level and has remained there steadily afterwards. Basically this means that new projects are mainly grounded on the existing relationships and the new connection between actors not knowing each other are relatively rare. Furthermore when the new connections are occurring, they are typically adding only actors which do not have themselves an extensive prior connections to additional cities within this collaboration network.

This current collaboration structure might partially explain why knowledge dissemination across Europe is somewhat challenging. If the collaboration would be genuinely grounded on distributed networks where all cities would/could host the similar knowledge and multiple connections to other cities, the European wide capacity building relating Circular Economy would be more effective. This kind of structure would then implement the European Commission's vision for "Open innovation, open science, open to the world - a vision for Europe".

In order to identifying densely-connected core cities and sparsely-connected periphery cities, a core/periphery analysis was conducted. A core structure in a network is not only densely connected but also tends to have a role central in a network basically meaning that central cities are located at or very close to the center of the collaboration network while a peripheral city has opposite profile. As a result following cities are considered as core cities: Arnhem, Bath, Bremen, Bristol, Devon, Dublin, Eindhoven, Enschede, Eskilstuna, Eskisehir, Exeter, Funchal, Geneva, Ghent, Glasgow, Gothenburg, Heidelberg, Helmond, Helsinki, Kocaeli province, Leeds, Lille, Lisbon, London, Madrid, Manchester, Milan, Milton keynes, Muenster, Nantes, Nijmegen, Pisa, Porto, Reykjavik, San Francisco, Taormina, Trikala, Trondheim, Turin and Utrecht.

6 Case studies

6.1 Case selection

On the basis of previously presented Urban strategy and EU-project activity results, 15 European cities were asked to participate in a short survey in order to get a better overview of the Circular Economy strategies and projects within these cities. On the basis of the survey results, five cities were selected for in-depth case study to help identifying good and bad practices, the benefits and barriers of the EU funded R&I projects in order to make recommendations for developing future EU R&I funding instruments. The main aim behind the city selection was to collect case studies which represented a different social, legal, and cultural settings in order to reveal the possible differences between various innovation ecosystem settings. The selected cities size and geographical location profiles are presented and compared in Table 4.

Table 10: Case study cities

City	Inhabitants in Urban Center				Location					
	<100 k	100 k -250 k	250 k- 1 M	1 M- 3 M	> 3 M	South	North	West	Center	East
1 Helsinki				X			X			
2 Manresa	X					X				
3 Lisbon				X		X				
4 Eindhoven		X						X		
5 Riga			X							X

Below the main observations from case studies are compared and summarized while the in depth case study descriptions for each city are presented in Appendix 1: Helsinki (Appendix 1.1), Manresa (Appendix 1.2), Lisbon (Appendix 1.3), Eindhoven (Appendix 1.4) and Riga (Appendix 1.5).

6.2 The maturity of Circular Economy “labelled” strategies at city level are infancy

At the moment none of the case study cities have implemented a specific circular economy strategy: Nevertheless all cities have various other action plans or long term commitments which includes several references to different Circular Economy and/or sustainable development activities. Importantly, Lisbon and Eindhoven are currently working on a specific circular economy plan and Helsinki is developing a new city strategy which includes stronger emphasis on Circular Economy. These observations indicate that Circular Economy also as a term is starting to gain more attention among the cities. The case studies suggest that national and regional level strategies (or plans) are also influencing on cities’ attentions to formally move towards Circular Economy era. For example Finland has recently defined a **national circular economy road map** (2016) while Catalonia region has the **Strategy for Smart Specialization** (2014) which guarantees the promotion of circular economy. The Netherlands on the other hand benefitted from the **Interreg V-program** (2010-2014) by helping cross-border projects and motivating the regions to participate in the circular economy projects. Portugal has made “**Green Growth Commitment**” (2014) which incorporates circular economy policies and targets. Latvia has **National Sustainable Development Strategy** until 2030 (2010) which highlights eco-efficient economy as one of the strategic goals. As a result it is argued that a window of opportunity is currently open for influencing on cities to move towards circular economy while EU- and national funding instruments could be used to accelerate this process.

6.3 Comparing the perceptions of the systemic innovation dimensions importance

As a part of case study selection process, the cities also answered a survey which evaluated their perceptions relating the four systemic innovation dimensions including “Innovative solutions”, “Living Labs”, “Enablers” and “Governance”. For more detailed description of each systemic innovation dimensions see section 4.5 Construction of key measures. In Table 5 and Figure 7 the cities importance perceptions relating these four systemic Innovation dimensions are compared. Importantly, since the number of case studies was very limited, these results should be considered as descriptive. The assessment criterion was utilized as follows:

0. Irrelevant - 1. Slightly relevant - 2. Relevant - 3. Very relevant - 4. Crucial/Of the utmost importance

Table 11: Comparison of the systemic innovation dimensions importance perceptions

	Helsinki	Manresa	Riga	Lisbon	Eindhoven	Mean	Std. Dev
Innovative solutions	3.3	3.3	3	3.3	3	3.2	0.18
Technology-based solutions:	4	3	4	4	3	3.6	0.55
Research institutions, universities and innovative firms	3	3	3	3	3	3	0
New business models and industrial symbiosis	3	4	2	3	3	3	0.71
Living Labs	2.5	2.5	3.3	3.8	1.5	2.7	0.86
Citizen’s involvement and social innovation:	3	3	4	4	2	3.2	0.84
Public procurement of innovation:	2	3	2	3	1	2.2	0.84
Open innovation and value chains	3	2	3	4	2	2.8	0.84
Attractiveness	2	2	4	4	1	2.6	1.34
Enablers	3.8	3	2	3.5	1.8	2.8	0.89
Financing instruments:	4	4	4	4	1	3.4	1.34
Regulatory innovation:	3	3	0	4	2	2.4	1.52
Big Data and digitalisation:	4	2	3	3	2	2.8	0.84
Enabling physical and digital infrastructure:	4	3	1	3	2	2.6	1.14
Governance	3.3	3	3.3	3.7	1.7	3	0.78
Governance and monitoring of success	3	4	4	4	2	3.4	0.89
Public Sector Innovation:	4	3	3	3	2	3	0.71
Science diplomacy:	3	2	3	4	1	2.6	1.14
Total	3.21	2.93	2.86	3.57	1.93	2.9	0.61

The cities have different perceptions profiles. In order to compared the cities perceptions relating systematic innovation measures, the non-parametric Wilcoxon signed-rank tests was conducted due non normal distributed data. As a result Eindhoven perception profile is clearly different than all the other cities profile. Eindhoven appears to be more focused on the Innovative (technology) solutions, while other cities are more systemic in their approach having a balance between the four innovation dimensions. Therefore in the case of most measures, the other cities are giving higher importance for the different systemic innovation measures than Eindhoven. In addition Lisbon, which is having

the highest values is having different perception profile than Manresa and Riga. Otherwise the city profiles could be considered as similar.

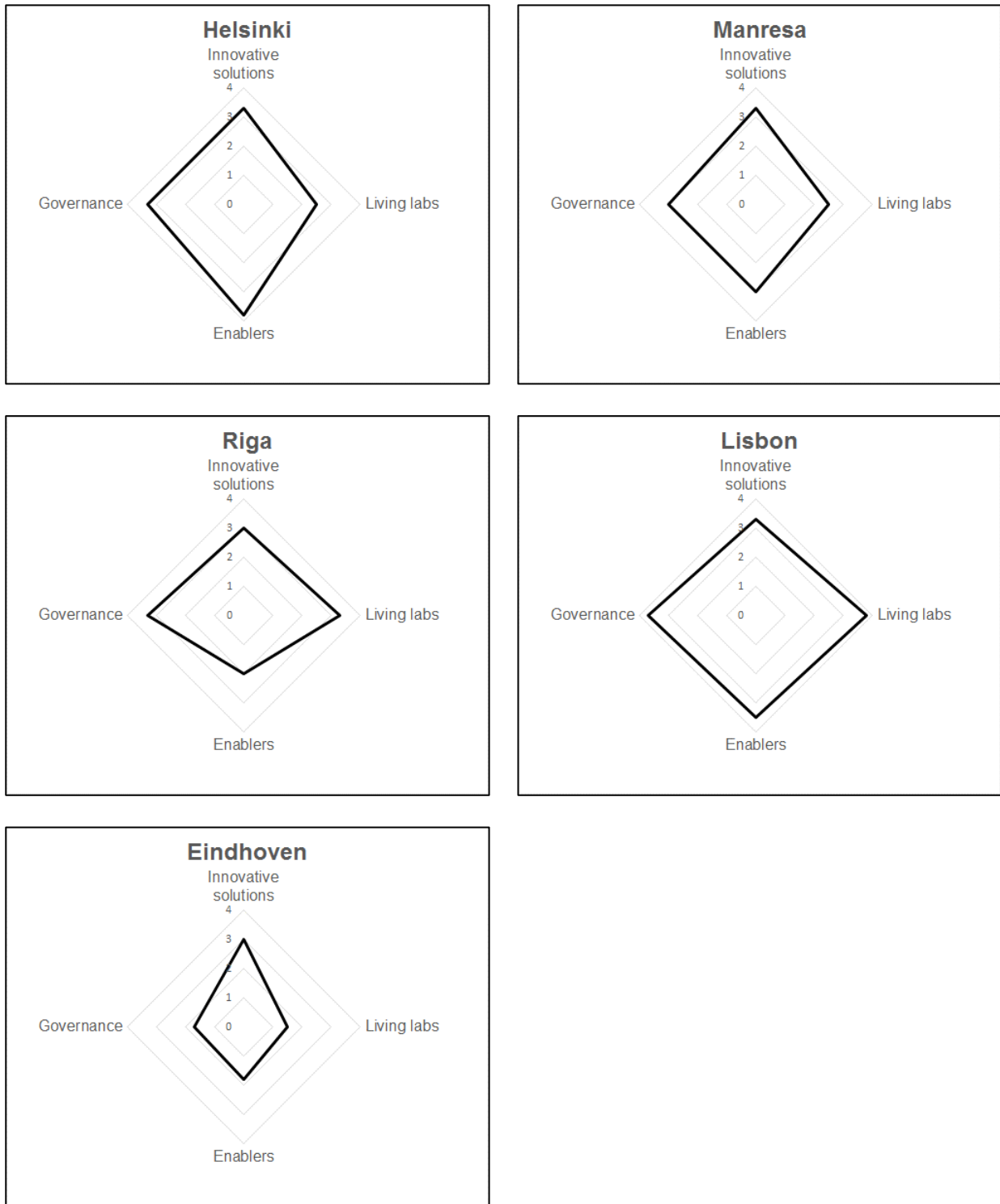


Figure 7: Comparison of the systemic innovation dimensions importance perceptions

The four innovation dimensions had somewhat equal importance. When the four system innovation dimensions were compared as combined measures, significant differences between them were not detected. Furthermore, when individual measures were compared, in most cases the Wilcoxon signed-rank test did not indicate any differences excluding following differences: A) “Governance and monitoring of success“ (mean =3.4) vs. “Public procurement of innovation” (mean = 2.2), B) “Open innovation and value chains” (mean = 2.8) vs. “Technology based solutions” (mean = 3.6) and C) “Big Data and digitalisation” (mean= 2.8) vs. Technology based solutions (mean = 3.6).

However, due the small sample size these results are not robust. By adding four additional cities which also responded to survey changed these results. The larger sample size suggest that “Science diplomacy” is less emphasized than “Technology based solutions”, “Citizen’s involvement and social innovation”, “Governance and monitoring of success” and “Public Sector Innovation”. Furthermore, also “Technology based solutions” had stronger emphasis than “Big Data and digitalisation” and “Regulatory innovation” when adding new cities. “Citizen’s involvement and social innovation” compered to “Open innovation and value chains” was also stressed more. Besides these significant differences, four other comparison remained barely below the 0.05 threshold highlighting even more the emphasis on “Technology based solutions” and “Citizen’s involvement and social innovation” measures.

As a result it is argued that cities associate the circular economy especially on “technological innovations” and “citizen’s involvement”, whereas science diplomacy (i.e. the city participating in global or bilateral initiatives) is less valued.

6.4 Circular Economy projects activities relation to systemic innovation dimensions

As a part of case study interviews, the past and ongoing research and innovation projects supporting the circular economy strategy were evaluated for each case city. As a result a great variety of projects covering multiple system innovation dimensions and funded by different kinds of funding instruments were identified. In the following few interesting examples for each systemic innovation dimensions is highlighted while in-depth case study descriptions for each city are presented in Appendix 1: Furthermore, few additional remarks are also made to FP7/H2020 projects (N=137) in order to reflect European level situation within the given innovation dimension.

INNOVATIVE SOLUTIONS

Cities associate the circular economy on “technological innovations”.

Case cites were running various large and small scale technical solutions such as: 1) **Combined District Heating and Cooling System in Helsinki** which is the world’s largest heating and cooling plant of its kind and has won various awards including Global District Energy Climate Award in year 2015. Importantly the idea of District Heating and Cooling System is not novel and has been running since 1953 (heating) and 1998 (cooling), although currently according to some sources more than 80 % of production is based on energy that otherwise would be wasted making it genuine circular economy solution and 2) Riga and Stopiņi Municipalities jointly manages **Getliņi ecological landfill**, which one of the most modern landfills in Europe. In Getliņi, biodegradable waste is used to produce biogas which is then converted into energy (electricity and heat) while useful materials and metal products are recycled. The heat is used to grow tomatoes and hanging flowers in greenhouses. As presented in prior section, it is important to highlight that the cities associate the circular economy especially on “technological innovations”. In all FP7/H2020 projects have applied in various settings

(e.g. district, different kind of vehicles, family-houses and commercial buildings) many different technological solutions such as wind power (including small wind turbines and Roof Wind Energy System), air/water heat pumps, marine energy, bio energy, hybrid solutions, solar systems (including solar tiles and photovoltaic), smart grids, distributed/ decentralized energy generation, hydrogen/fuel cell technology, lighting system, metering, phase change materials, bioreactor-wall, Li-ion batteries and insulation materials. It is argued that the projects in cities have covered many of the major technological solutions which are currently associated to circular economy.

Research institutions, universities and innovative firms have a central role in the process.

There are various examples where a case city has made commitments with other Triple Helix actors. Among these are collaboration agreement between city of **Eindhoven, Philips Lighting, Technical University of Eindhoven and Heijmans** which specializes in developing roads infrastructure, civil engineering and non-residential buildings. This consortium aims to turn Eindhoven as Living Lab for intelligent lighting by developing innovative lighting applications in public spaces. The collaboration is grounded on “**Vision and Roadmap Urban Lighting Eindhoven 2030**”, which development can be linked to FP7, H2020 and Interreg funding. This observation also emphasizes, the importance of EU-funding as circular economy enabler and highlights the need for long term funding and collaboration commitments. In Manresa, the success of the innovative projects relies on the sound collaboration of the city council with the local research institute and the different stakeholders within the industrial area of the city. When different actors participation to all FP7/H2020 projects was evaluated, it appeared that the public sector actors as beneficiaries are the smallest Triple Helix group. Public sector actors were included as beneficiaries in circa 40 percent of all projects, whereas in 81 percent of the projects included private sector actors and 84 percent educational or research institutes. About a third of the projects were considered as full Triple Helix projects which included education/research, public and private sector actors.

New business models and industrial symbiosis are existing.

In practice many of the already presented examples are covering various systemic innovation dimensions at the same time. Therefore the above Eindhoven Urban Lighting and Riga’s ecological landfill examples are also valid examples for this particular systemic innovation dimension. In addition JPI – Urban Europe funded “**Integrated Smart City Mobility and Energy Platform**” project in Lisbon is developing and verifying an urban market place that combines e-mobility-demand side management technology with smart meter automation options within an innovative business model. There are also large scale and long term industrial symbiosis such as **Östersundom’s bioeconomy node** in Helsinki which is going to co-create a circular economy industrial park that generates electricity, heat and bioproducts from the resulting side streams. Importantly this Helsinki case example is grounded on the shared vision which was built in a joint process together with municipal, state, academic and private organizations. The city of Manresa recently implemented an industrial symbiosis project in which a third party seek to bridge the needs of the different industries in a same territory. This action proved to be successful thanks to a long-lasting cooperation with the industries and therefore a certain trust to work together in a permanent way.

LIVING LABS

Citizen’s involvement and social innovations are essential part of development activities, but the intensity and role of the city administration varies in Living Lab activities. Especially Helsinki, Eindhoven and Lisbon are strong believers of Living Lab activities which are covering a great variety of thematic areas. It is argued that the City as a Living Lab’ is in the core of city policies especially for Helsinki and Eindhoven, which both follow kind of centralized Living Lab model. Lisbon on the other hand doesn’t seem to go towards a centralized Living Lab model, where one public actor supports and represents local Living Lab activities while connecting European actors to local ones.

Interestingly in Riga the TDF LatLab (Technology Development Forum) is no longer an active member of the ENoll network but the city is implementing the so-called 'Neighborhood Programme', where local NGOs that represent districts in Riga are involved in City development projects. In Manresa the local Living Lab is hosted by research institute which helps city administration to gain EU-project funding. However, only 17 FP7/H2020-projects (12 percent) had specifically mentioned Living Lab as a part of their project description.

Public procurement of innovation has strong focus on pre-commercial procurement.

Even if public procurement of innovation appeared to be less stressed by the case cities, the interviewed cities are participating in significant H2020 projects which have a focus on the public procurement. Riga is participating in H2020 funded **GreenS-project** (2015-2018) which aim of stimulating Green Purchasing for public administrations through the implementation of innovative and virtuous processes that protect environment and support green economy. Furthermore, Helsinki is participating in "**Select for cities**" project (H2020: 2015-2018) in order to boost wellbeing self-management and remote care of Diabetes patients at Smart homes and undertake a pre-commercial procurement (PCP) to procure the research and development of new innovative solutions. Even if in this project Helsinki's activities are not as directly linked to Circular Economy, the other project consortium cities – Antwerp and Copenhagen – are focusing on mobility (and air quality data) information in order to improve city traffic. As a part of Eindhoven's "**Vision and Roadmap Urban Lighting Eindhoven 2030**", the city council opened a European tender procedure for developing lighting in the public space.

Leading cities are applying systematic and long term strategies to attract firms to finance or test their innovations in the city which can also benefiting the other close-by cities in the region. City of Helsinki is presented as a good example of systemic international, national, regional and local efforts to attract innovative firms relating circular economy. At international level, Helsinki has participated in various FP7/H2020-projects, which have buildup an infrastructure especially for Living Lab activities as well as undertake a pre-commercial procurement (PCP) procure. On a national level, Finland has defined a national circular economy road map, which is motivating Finnish cities as well as other public sector actors to seek for a pioneering role in the various circular economy areas. Furthermore, there is the 6Aika project focusing on sustainable urban development in which the six largest cities in Finland are collaborating across the multiple regions while utilizing ERDF-funding. In addition Smart and clean foundation which involves multiple cities, private companies, research, education and government organizations aim to accelerate climate change mitigation and attract investments, create jobs and new low-carbon business. The previously presented Östersundom's industrial symbiosis example is developing a new neighborhood which however is at the early planning stage. This highlights the importance of long term planning in order to create proper operational conditions for circular economy. Finally there is ongoing The Smart Kalasatama Programme for Agile Piloting which accelerates Smart City innovation by procuring prototypes to real city environments to be co-created with citizens. This project is also acting as a testing ground for the 6Aika project. Importantly, Helsinki has long history relating Living Lab activities which have built city level capabilities to attract funding for past ten years. Among these are e.g. Helsinki Living Lab project (2006 to 2008) which included public funding by Tekes – the Finnish Funding Agency for Innovation –and private funding from participating companies. Relating to circular mobility theme, the Helsinki Living Lab project included testing of traffic information boards. Besides Helsinki – a capital city and a lighthouse city in Finland and the region – a city of Manresa which is located close-by of Barcelona is presented as an example of a city, which can benefit the lessons learnt in the region to finance innovative projects at the city level.

Cities capabilities to run open innovation activities varies and also private companies and research institutes can lead the transformation towards open innovation and value chains business models. Eindhoven is an excellent example for a private company lead transformation towards open innovation practices. In 2003, Phillips opened their High Tech Campus in Eindhoven to other technological companies and initiated an extensive growth of innovative companies. In 2012 the Campus was sold to Ramphastos Investments for further development. Importantly, the Campus itself is also applies sustainable and environmentally-friendly business practices and rules while many of the companies in the Campus are developing energy-efficient and environmentally-responsible products and production methods. In 2011 the Brainport region, in which the High Tech Campus Eindhoven is central, received also international recognition when it was selected as the **'Smartest region in the World'** by The Intelligent Community Forum. In all the Eindhoven Living Lab development seems to be tightly connected to Phillips even if there is also strong support from Brainport Development which is a government agency. However, the level of city engagement to open innovation activities varies especially in smaller cities. In Riga, the open innovation is mainly driven by and with university of Latvia, RTU and business sector cooperation whereas city of Riga is less active. Correspondingly in Manresa, the local Living Lab and open innovation activities are hosted by local research institute which has the better capabilities to run open innovation activities. Apparently, it is good if the city have dedicated resources to run open innovation activities such as Forum Virium in Helsinki which is an innovation unit within the Helsinki City Group.

ENABLERS

Cities are using a great mixture of funding instruments to promote circular economy.

Besides H2020 and FP7 funding instruments which were an object of interest of this study, many other EU related funding instruments such as ERDF, Interreg, LIFE, JPI Urban Europe and Cohesion Fund were also used by the case cities. Furthermore, various national, regional and municipal funding sources as well as public-private partnership cooperative agreements had been utilized (e.g. foundations). In some cases even crowdfunding where any person can create and publish a project in order to seek funding had been used. Cities have also founded incubator services in collaboration with other actors. For example in 2011 city of Lisbon founded Startup Lisboa with Bank Montepio and IAPMEI (Portuguese Agency for Competitiveness and Innovation, which acts under the authority of the Minister of Economy, Innovation and Development). Startup Lisboa is a private non-profitable association that provides entrepreneurs and companies office space as well as a support structure. Interestingly, **Startup Lisboa** was born from the will of citizens, by being one of the most voted ideas in the **Lisbon Participative Budget**, an initiative of the Municipality of Lisbon. These observations indicate that the active cities are not only relying on the EU-funding to promote circular economy, but are seeking all kinds of ways enable development activities in collaboration with private sector and people. In this process also national and municipal funding are playing an active role. These findings calls out careful coordination between different EU-funding instruments in order to prevent overlapping efforts and enable prolific cross-border and cross-country collaboration. Since our prior observations grounded on secondary data sources suggested that Urban strategy Intensity (US Intensity) and H2020/FP7-funding are strongly correlated, this stresses the importance of knowledge sharing from the lighthouse cities to fast followers but also to the cities which have not yet been activated to promote circular economy and/or Living Labs actions.

Regulatory innovation is not stressed in the projects.

When comparing to other systemic innovation dimensions, the projects related to regulatory innovation, were not emphasized within the case cities. A regulation can be a legal act of the European Union, member country or a city which sets geographical boundaries to regulatory driven innovations. Importantly regulation can stimulate innovation or can be a barrier. For example in city

of Oslo, all cars will be banned in downtown by 2019, which will be the first comprehensive and permanent prohibition in any major European city. Evidently, this kind of regulative action will have a major impact on the city level ecosystem. Also some studies exist which are evaluating the regulative barriers in context of circular economy⁷ It is argued that there is an opportunity for a novel projects which develops regulatory driven innovations. The very recent European Union roaming regulation which from 15 June 2017 ended roaming charges for most of the travelers⁸ in the EU is an excellent example which is expected to change consumer behavior when travelling. In all about every fifth project included specific terms relating regulation such as regulation, law, policy, policy measure, regulatory regime and legal restrictions.

Past few years cities have started to opening their big data in order to enable new digital services.

Open data refers to an information which has been made available for free for anyone to use. In year 2013 The Helsinki Region Infoshare service (HRI), was awarded a European Prize for Innovation in Public Administration and therefore can be considered among the European forerunners to utilize big open data. Currently there are 605 open datasets including also 60 environment and nature related datasets. Furthermore also the other case cities have applied the open data principle. **By definition, the Open innovation movement is a cross-cutting phenomenon, which engages public, private, education/research sectors as well as citizens.** Therefore it is not a surprise that there are also not-for-profit associations which are promoting Open Innovation agenda and especially the open data movement. Open Knowledge International (previously known as Open Knowledge International) is a global non-profit organisation focused on realising open data's value to society by helping civil society groups access and use data to take action on social problems. In Europe there are nine chapters in Austria, Belgium, Finland, Germany, Greece, Ireland, Spain, Sweden and Switzerland which are officially part of the wider Open Knowledge Network but operates as autonomously and independently. There are also established groups in Czech Republic, Denmark, France, Italy, Macedonia, Portugal that have been working actively in a location for at least 9 months. Big data and new digital services related terms such as big data, software, apps, application, cloud, ICT, software tools, cloud-based, cloud system, API, ICT technologies, ICT technology, ICT data hub, Information and Communication Technology (ICT), automated decision making process, large-scale Internet of Things (IoT), real-time IoT, Internet of Everything (IoE), semantic discovery, social data, Software as a service (SaaS), open city data, testbeds and smartphone were relative popular in project descriptions. In all 38 percent of the project were associated to these terms.

EU-funding has important role in developing physical and digital infrastructure.

Multiple H2020/FP7 projects were detected in which the case cities are participating to develop physical and digital infrastructures enabling various smart city services. Among the latest projects are for example 1) "Select for cities" (H2020: 2015-2018) which is developing an open, standardized, data-driven, service-oriented and user-centric platform that enables large-scale co-creation, testing and validation of urban Internet of Everything applications and services (Helsinki) and 2) Triangulum (H2020: 2015-2020) which is defining a reference-architecture for IT-based smart city services and technologies, and enabling future replication and standardised approaches of crosscutting solutions for urban energy, buildings and mobility technologies (Eindhoven). As a result it is argued that in next few years if these projects genuinely meet their goals, the standardized solutions which can be transferred and replicated across Europe should be available. Therefore the prior suggestion relating

⁷ Regulatory barriers for the Circular Economy – Lessons from ten case studies; A report by Technopolis Group in consortium with Fraunhofer ISI, Thinkstep and Wuppertal Institute for the European Commission. Published on: 10/11/2016, Last update: 17/11/2016.

⁸ e.g. the Finnish Communications Regulatory Authority, have granted four Finnish operators permission to charge roaming fees

the coordination between various funding instruments as well as regulation driven innovations are again stressed in order to make sure that public funding is generating technical ecosystems which are communicating beyond national and regional borders. Physical and digital infrastructure associated terms are partially overlapping with big data and digital services. The following terms were included about in every fourth project infra*, platform, smart-phone platform, design platform, services platform, ecosystem, smart data management platform, smart services, distributed intelligence, Experimentation as a Service” (EaaS).

GOVERNANCE

Governance and monitoring of success of the urban strategy and its innovation component is considered important.

In all about 36 percent of all FP7/H2020-projects included following terms which can be associated with governance and monitoring of success: governance, measure, policy, assessment, organisational model, strategic policy, technical policy, policy maker, decision support tool, metering architecture, metrics and metering system. Furthermore, also the governance and monitoring of success importance perceptions among the five case cities was high. There are also specific EU-projects which are developing the governance of circular economy and includes our case cities. **The URBAN WINS project** (H2020) is currently particularly working on improving the governance of waste management by setting up participatory instruments such as physical and virtual discussion groups – urban agoras – that will be created to engage urban stakeholders in the co-creation and the discussion of the new solutions. Actors with different roles in the waste value chain and in the waste prevention and management cycle are invited to join the UrbanWINS participatory instruments. The aim of the project is not only to raise awareness on urban environmental resilience, but also to elaborate strategic plans for waste prevention and management that are replicable, based on the experience led in the 8 pilot cities, among which one is Manresa.

The Living Lab methodology is an important public sector innovation which enable the foundation for bottom-up (public sector) innovations.

Helsinki, Eindhoven and Lisbon have clear commitments to Living Lab activities which have enabled a foundation for developing bottom-up instead of top-down public sector innovations. Therefore, especially the city driven Living Lab is suggested to be an important public sector innovation. Interestingly, in some cases even the establishment of Living Lab can be born from the will of citizens such as Startup Lisboa Living Lab. Besides Urban Living Labs, City Labs are quite common in the ENoLL network, which are usually supported by municipalities and thr topics, projetcs and main direction of the Lab is suggested by the citizens livign around the Living Lab constellation, enagbling the validation of services and infrastructural investment plans of the city.

Commitment to science diplomacy has strong correlation with participation to FP7/H2020-projects.

In this study science diplomacy was defined as whether the city participates in global or bilateral initiatives for sustainable development goals. In order to define the maturity of urban strategy (and commitment to science diplomacy) in a city, the memberships and case study descriptions in web services associated with science diplomacy were evaluated (for more details see Appendix 3). As already identified in previous sections (see section 5.5), there was strong correlation between urban strategy maturity and FP7/H2020-project activities. Thus, the leading circular economy cities including our case cities Helsinki, Eindhoven and Lisbon are actively taking part to various science diplomacy activities whereas Riga and Manresa partially due smaller resources fall behind of them but also show activity. Interestingly, the case study cities perceptions relating the importance of this

system innovation dimension suggest that “**Science diplomacy**” could be less emphasized than many other dimensions. Therefore the cities having FP7/H2020-projects are most likely using these web services also for dissemination purposes. Furthermore, participation (or presence) in some of the web sites required the ability to show concrete measures to meet the conditions global or bilateral initiative e.g. for award completion.

7 Policy recommendations

The following policy recommendations are lessons learnt from the questionnaires and case studies completed with the city administration. It was also completed with the testimony of experts from national associations of cities and regions working on circular economy during CEMR expert group meeting which took place on 27th June in Brussels – see the report at Appendix 5 and minutes at Appendix 6.

Innovation in Circular Economy requires a systemic approach. Cities must act as facilitators of a sustainable and **systemic approach** by stimulating co-creation, co-design and co-implementation with different actors and citizens at both the local and the international level. Evidence from this study has shown that the stakeholder composition, even at the one of Living Lab project level (micro, meso or macro), influences the typology of innovation that actors might undertake. Industrial ecosystems are very important in the innovation processes at urban level and for circular economy planning: see the case of Industrial Districts in the field of eco-design. Through careful **programme management**, backed up by **investments in shared resources** including urban observatories, datasets, models and Living Labs, the systemic approach will ensure that the whole is greater than the sum of its parts; that outcomes from research projects and the methods employed in realizing them are **mutually informative**. However, a successful transition to circular economy requires not only a top-down approach instigated by public authorities, but also to identify and apply **new ways of voluntary (formal and informal) cooperation** between public authorities and other local circular stakeholders such as citizens, businesses (commerce and industry), media, academia, educational institutions and organisations of civil society (NGOs). The large number of different stakeholders, and the individual interests and interactions between them makes the Circular Governance in a city quite complex: this calls for the **need to take a more systematic approach in identifying governance barriers, enablers and actions to promote the transition to circular economies at the city level.**

Need to promote new business models and alternative sources of funding at city level. In order to finance sustainable and innovative urban transition, conventional business models and centralised state provisions may be outmoded; alternative, more inclusive and more resilient models may be required. The new models may include **cooperatives, public-private partnerships, and crowd-funding**; furthermore, in case where significant public investments require compromises elsewhere, **new forms of public engagement and co-productive practices – social innovation** – may be required. Also, there is a common need of understanding under which circumstances municipalities and private enterprises can engage in close and effective collaborative practices and how these practices can be best encouraged and facilitated, and of the new viable forms of business model that include civil society (e.g., forms of crowd-funding in which civil society co-funds and co-creates urban development and infrastructures). Moreover, there is a need to understanding to what extent business models can be **vertically inclusive**, involving state (national and / or regional or city scale), private institutions and citizens, and to what extent **regulation and policy support** can incentivize these practices.

Importance of targeting transversal and holistic approaches in funding Programmes. From the city perspective, it is important to **reduce the fragmentation in funding,**

research and urban development programmes, as this is an obstacle to build critical mass to realize urban transitions, and can be a cause of the spreading of actors at urban Level and the absence of a systemic approach. In the majority of cases, Municipalities tend to combine EU funds with resources coming from the National, Regional (sometimes with ESIF funds) or the private level. The overarching principle of a new R&I Programme shall be therefore the alignment and coordination of regional, national and European research, technological development and innovation in the field of urban development. The findings of this study are in favor of supporting an ambitious **longitudinal research programme** that is focused on the development and application of methodologies supporting the definition and measurement of urban sustainability and the establishment of transition targets and strategies to achieve them.

Improved coordination across multiple levels of government. The idea of a circular economy is to generate a systemic change, rather than an incremental change of current practices. Cities and regions have experience in integrating different policy domains in their practices, e.g. by ensuring **collaboration between the different policy domains and actors**. In the course of this study we have seen that a strategic framework at regional level empowers the strategy at city level as well (case of Manresa, Catalunya). **Multilevel governance** is crucial also in facilitating innovative best practices able to activate the circular transition, as well as by encouraging a continuous alignment with national and institutional research programmes, to build European urban research, technology and innovation capacity, and European solutions to address global urban challenges (case of Lisbon and its strategic framework). But it is also crucial within the single Municipality, where there is often a fragmentation that causes ‘silos policy approach’. **Cities need to appoint specific coordinating structures** within the Municipality that shall be in charge of both coordinating the implementation of activities and processes, facilitating the dialogue with all the different stakeholders, and at the same time overseeing the respect of the circular principles adopted. In order to build strong partnership, the **concept of circular economy strategy needs to be defined and aligned** at all different levels of cooperation.

Circular regulation and a more structured framework of incentives. It is important to acknowledge that more empowered local authorities can best finance the delivery of their plans through regulation, taxation, levies, land readjustment policies and through planning gains. Regulation is an important driver for innovation: in order to promote innovation for circular economy options driven by legislations, careful implementation with dynamic goals that reflect the current state of the art is required. For example, a sound regulation must be put in place for the implementation of circular procurement, which is a powerful mean cities have to push the economy towards a more sustainable direction within their public schools, health care institutions, and city hall administration. The eligibility criteria, taking into account the whole life-cycle of the product must be transparent and objective. Thus, continuity and predictability in legislations is an important factor for the promotion of innovations.

Transnational co-creation of innovation, collaborative experimentation, and scaling up protocols need further development in order to scale up any innovation especially digitally. The collaborative nature of Living labs provides a solid context for this activity. Ideas turn into innovations through participatory service design methods through living lab activities, and are validated and tested with multi-stakeholder environment. Pilots are launched in local arenas and often require localization to some degree. Innovative pilots can be scaled up through multi-smart-city framework with the help of Living lab network. This in turn enables integration between different urban systems and co-creation between citizens, cities, regions, countries, and continents on Circular Economy topics.

Exploring the opportunity to co-create self-sustaining model through an open innovation driven, quadruple-helix style with service design approach to co-develop and support social innovations to overcome institutional barriers. Living Labs are resolute to build and strengthen the European Open Innovation ecosystem that enables the pan-European experimentation environment, supporting the realization of the European Digital Single Market. Through the experiment of collecting the case studies (see Annex) and compiling this report, our conclusion is that further investment and collaborative experiment will be necessary at European and International level to realise this.

Role of capacity building and knowledge sharing crucial at city level in fostering innovation processes. The study reveals that good practices exist in cities of various scales. The upscaling and the replicability of these projects needs to be strengthened, through peer-to-peer learning or similar exchanges at the city level. EU funding programs such as FP7 and Horizon2020 can particularly address this issue in the next programming period. Other financing instruments such as the cohesion policy would also be useful to enhance training and exchanges on the innovative circular economy strategies. At the same time, we noticed in the case of Manresa that a small-size city can benefit from the proximity of a capital city that is sharing knowledge and disseminating results. In order to replicate this at a larger scale, the question of the communication on the projects outcome at the EU level also needs to be tackled, taking into account the language capacities of the cities. In this perspective, we observed that **the creation of open data sources and digitalization also favors the inclusion of actors and enables co-creation processes and innovation**

Circular development monitoring and reporting in a formal framework of action. First of all, in the course of this study it has been discovered that, as Circular Economy is still an emerging theme, there is a need for a **common definition of that to be used and disseminated by Cities**. Secondly, there is a need, at city level, to support stakeholders in **translating specific strategies into actionable implementation plans and associated financing strategies**, in order to favor the transition of cities along the pathway from current to target states. This co-creative transdisciplinary process should also incorporate **plans to monitor the effectiveness of implemented transition strategies; socially, economically and environmentally**. A city-based initiative promoting a common governance and monitoring model – similar to the one implemented in the framework of the Global Covenant of Mayors for Climate and Energy – can provide cities with the knowledge and evidence needed for **taking informed decisions** on investments into key urban infrastructure as well as for policy-making, planning and land use management affecting the urban environment. **A key aspect to making the circular economy a reality will be building knowledge, monitoring progress and making sure policy makers have the understanding, data and information they need** to help guide the development of supportive and flexible policies.

Long Term perspective very important in innovative Urban Circular Economy planning. The case studies show that the impact of the Research and Innovation projects can be expected after the duration of the project. Long-term commitment is required for the transition towards innovative strategies at the local level. The political endorsement in the long term is also crucial for a comprehensive and continuous implementation of the strategy. Practically, it means that the objectives of the transition towards a circular economy in the cities need to be included in the political city strategy (such as Agenda 21) to trigger the long term cooperation of all stakeholders in the field.

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9 Appendix

9.1 Appendix 1: Case study profiles

HELSINKI



MANRESA



LISBON



EINDHOVEN



RIGA



HELSINKI



Country: Finland

Number of inhabitants: 639,591 (31.12.2016)

Website: <https://www.hel.fi/helsinki/en>

Presence of a Urban and Circular Economy Strategies

Presence of an Urban Strategy: Yes

http://www.hel.fi/hel2/ksv/julkaisut/yos_2013-23_en.pdf

Presence of a Circular Economy Strategy: No

The City of Helsinki has lined that it has only one City Strategy, which includes all the important targets and goals. However, the City of Helsinki also has circular economy targets in different programmes in different levels, (e.g. the Environmental Policy and the Baltic Sea Action Plan). At country level Finland has also a national circular economy road map, which are motivating the cities in Finland including Helsinki.

Importantly, the City of Helsinki had in its previous Strategy Programme (2013-2016) targets 1) to become an internationally known development and testbed for new products and services and 2) to create the area of Östersumdom into piloting area for energy efficient and renewable energy solutions as well as for cleantech companies (i.e. circular economy as a word was not used, but it's included to cleantech). In the new City Strategy (2017-2021), the circular economy will be in more central role. The Strategy will be executed during Autumn 2017.

Main features of the Circular Economy Strategy

- Finland has defined a national circular economy road map, which is motivating Finnish cities as well as other public sector actors to seek a pioneering role in the following focus areas: 1) a sustainable food system, 2) forest based loops, 3) technical loops, 4) transport and logistics, and 5) joint actions. The actions are divided into three levels: policy actions, key projects and pilots (i.e. starting fast with quick actions and concrete trials) in order to achieve a systemic change.
- According to the Helsinki City Council Strategy Programme 2013-2016 and the City environmental policies, Helsinki is profiled as a climate-friendly city and a forerunner in resource efficiency. The City actively prevents climate change and promotes the reduction of emissions, in both the production and consumption of energy (for latest status information see City of Helsinki Environmental Report 2016).
- HELSINKI CITY PLAN Vision 2050 defines seven themes and gives a goal-oriented future view of Helsinki in 2050 highlighting especially sustainable modes of transport by prioritised walking, cycling and public transport and offering “transport packages” similar to current mobile call/data packages. Furthermore, vision also includes transforming motorway-like areas into high street-like city boulevards and residential use.
- Helsinki Region Transport is a joint authority, which includes seven cities and municipals from Helsinki region. HLS strategy highlights increasing the use of public transport, intelligent technology, sustainable energy sources and low-emission vehicles.
- The Helsinki energy company Helsingin Energia (fully owned by the City of Helsinki) has prepared strategy and a development programme in order to achieve a climate-neutral energy system by year 2050. Importantly, in 2015 Helsinki won Global District Energy Climate Award in expansion category with its Combined District Heating and Cooling System. The Katri Vala heat and cool plant, produces an overall energy saving of 80% in which renewable sources include seawater for both heating and cooling, sewage and even the buildings themselves as effective solar collector. Helsinki is also listed as District Energy champion city in the United Nations Environment Program (UNEP) report “District Energy in Cities: Unlocking the Potential of Energy Efficiency and Renewable Energy“ which was published 2015.

PROJECTS

Projects implemented in the field of Circular Economy (or related area)

Number of projects: 14 in the survey, but e.g. Helsinki business hub has identified 48 development project

Funding instrument: H2020 (FP7), ERDF, Municipal, PPP-funding, national, private funding

Helsinki lighthouse projects

Smart Kalasatama is a living lab (a.k.a. a practical test and development laboratory and an experimental innovation platform) to co-create smart urban infrastructure and services in collaboration with residents, companies, city officials and other stakeholders (The Innovators' Club). It is Finland's first model district of smart energy systems and a part of The 6Aika Six City Strategy for sustainable urban development carried out by the six largest cities in Finland. Smart Kalasatama includes a great variety of project such as Agile Piloting program and Internet of Things – IoT.

Smart and clean foundation is turning the Helsinki capital region into a world-class test platform for clean and smart solution. Foundation partners includes cities, The Finnish Innovation Fund Sitra and a group of private businesses each allocating one third of the 7.5 million euros funding in the next five-years. The goal is to conclude 20 to 30 projects in the following key areas: transport and mobility, the built environment, energy, waste and water, and “consumer cleantech”, with digitisation and the circular economy as common denominators.

mySMARTLife project (H2020) aims to make cities more environmentally friendly by reducing CO2 emissions and increasing the use of renewable energy sources via new technological developments in connection with refurbishments of buildings, usage of renewable energies, clean transport and supporting ICT solutions such as leveraging IoT-enabled systems and open data. In the project Helsinki will e.g. 1) co-design a smart LED-based outdoor lighting system while 2) IOT-based sensor network will real-time monitor of real estate heating and energy consumption. Furthermore all collected data by the newly implemented sensors will be also in public use for the software developers and researchers as an open data.

Other H2020 Projects

1) **Select for cities** is developing an open, standardized, data-driven, service-oriented and user-centric platform that enables large-scale co-creation, testing and validation of urban Internet of Everything applications and services; 2) **The FINEST Twins** focus areas are Smart Environment, Smart Mobility and Smart Living and it is the first EU cross-border Smart City center of excellence and demo lab; 3) **The EMPOWER project (H2020)** aims at substantially reducing the use of conventionally fuelled vehicles (CFV) in cities by researching how positive incentives such as allowances in personal mobility accounts and promoting new transport modes can encourage citizens to reconsider their travel choices.

There are a lot of projects and action in different scales and levels in Helsinki but also in the Helsinki Metropolitan Area. However, not all of them necessarily use the term circular economy, even though the basic idea in them might be promoting the circular economy. **Smart'n'Clean Helsinki** by Helsinki Business Hub showcases currently 48 development projects covering following topics: “Built environment” (15 projects), “energy efficiency” (26), “material efficiency” (7), “water and air” (11), “energy systems” (27), “traffic and transport” (14), “waste and recycle” (10) and “sustainable consumer” (20). **The City of Helsinki Environment Centre** has had several EU funded projects aiming to develop and expand eco-support activity. As a result of these projects nowadays the eco-support activity is coordinated by a permanent employee in the City of Helsinki and more than 1 300 of the 38 000 employees of the City organisation have been trained as eco-supporters. Furthermore, **Eco-compass** is an environmental management system for SMEs, public events and the offices of the city administration which was developed with the help of European Regional Development Fund (ERDF). The system is currently in use or being implemented in 13/31 organizational departments in the City of Helsinki organization, in 60 companies in the Metropolitan area and in 30 events around Finland.

INNOVATION DIMENSIONS

Main innovation dimensions mainstreamed in the Circular Economy Strategy/Projects Innovative solutions

Innovative solutions

- Technology-based solutions: Suvilahti Battery Energy Storage System is megawatt -class electricity storage system based on lithium ion batteries. Combined District Heating and Cooling System.
- Research institutions, universities and innovative firm: Smart Kalasatama is developed flexibly and through piloting, in close co-operation with residents, companies, city officials and other stakeholders.
- New business models and industrial symbiosis: The eco-industrial centre Ekomo looks for new ways to utilize waste bound for landfills by providing a platform and premises for companies to develop industrial symbioses. Smart&Clean Östersundom is enabling green growth and add value from the sidestreams and wastes by industrial symbioses and co-creates a circular economy industrial park that generates electricity, heat and bioproducts from the resulting side streams. TRYOUT! provides the opportunity for experimenting with new business models in circular economy and cleantech, with cross-sectoral ways of action and forms of cooperation.

Enablers

- Financing Instruments: Smart and clean foundation to accelerate climate change mitigation and attract investments, create jobs and new low-carbon business. Helsinki is building Solar Power by leasing solar panels to consumers.
- Big Data and Digitalization: Helsinki region infoshare is a web service to access open data sources between the cities of Helsinki, Espoo, Vantaa and Kauniainen. SUPERHUB project develops an open source platform and mobile app able to plan customised urban routes, combining all mobility offers in real time.
- Enabling physical and digital infrastructure: Select for cities is developing an open, standardized, data-driven, service-oriented and user-centric platform that enables large-scale co-creation, testing and validation of urban Internet of Everything applications and services. The FINEST Twins Center of Excellence (CoE) is the first EU cross-border Smart City center of excellence and demo lab. Also Smart Kalasatama project has strong IoT focus.

Role of the Living Labs

- Citizen's involvement and social innovation: Smart Kalasatama is developed flexibly and through piloting, in close co-operation with residents, companies, city officials and other stakeholders via Agile Piloting program and The Innovators' Club. Climate Str. project is searching for new solutions to cut down greenhouse gas emissions and energy consumption levels. Living Lab Bus (LLB) project is developing, testing and demonstrating various services and technologies by using innovative electric buses as a concrete platform in a real use environment.
- Public procurement of Innovation: Select for cities is also undertaking a pre-commercial procurement (PCP) to procure the research and development of new innovative solutions. Clean Vallisaari was an Innovation Competition seeking for creative and viable technical solutions to enable the development of the historic island into an ecological destination for nature tourism and recreation. The Smart Kalasatama Programme for Agile Piloting accelerates Smart City innovation by procuring prototypes to real city environments to be co-created with citizens. TARVE-project (only in Finnish) that develops innovative energy-efficiency investment processes
- Attractiveness: Smart and clean foundation to accelerate climate change mitigation and attract investments, create jobs and new low-carbon business.

Governance features

- Governance and Monitoring of Success: "Future Circular Economy Hubs in Finland" project seeks solutions how to increase material flow in and facilitate business potential to emerge from circular economy hubs. The key activities cover and address improved knowledge of material flows (analysis and foresight), improvement of information and knowledge flow between all actors, business opportunity mapping, business models, value chain networks and R&D&I platform development.
- Public Sector Innovation: Forum Virium Living Lab which is an innovation unit within the Helsinki City Group
- Science diplomacy: Signatory in "Covenant of Mayors for Climate & Energy", commitments in "Market Place of the European Innovation Partnership on Smart Cities and Communities", EUROCITIES case studies, Open & Agile smart cities, Eltis, ICLEI - Local Governments for Sustainability.

LIVING LABS

Name of the Living Lab: Forum Virium Helsinki

<https://forumvirium.fi/en/>

also Laurea Living labs is located in Helsinki urban centre area, but is located in City of Espoo and City of Vantaa which are different administrative cities.

<https://www.laurea.fi/en/research-development-and-innovations/laurea-living-labs>

Thematic Areas of the Living Lab

Smart city & region which includes various subthemes such as smart mobility, smart district

Cooperation with city level

Forum Virium is an innovation unit within the Helsinki City Group, which comprises the City of Helsinki, about 70 subsidiaries and 11 affiliated foundations. Forum Virium develops new digital services and urban innovations in cooperation with companies, the City of Helsinki, other public sector organizations and citizens.



MANRESA



Country: Spain

Number of inhabitants: 639,630 (01.01.2016)

Website: <http://www.manresa.cat/>

Manresa is the capital of the Comarca of Bages, located nearby Barcelona, in the geographic centre of Catalonia, Spain, and crossed by the river Cardener. It is an industrial area with textile, metallurgical, and glass industries.

Circular Economy Strategy and activities

Presence of a Urban Strategy: Yes

- Agenda 21 (2011)

<http://www.manresa.cat/web/article/4169-agenda-21>

- Sustainable Energy Action Plan (2009)

http://mycovenant.eumayors.eu/seap-monitoring/index.php?page=iframe_graphs&process=download_documents&item_id=9561&report_id=7314

Presence of a National Circular Economy Strategy: No

However, there are several strategies related to circular economy at national level

- National Waste Plan (PEMAR) (2016-2022)

http://www.mapama.gob.es/es/calidad-y-evaluacion-ambiental/planes-y-estrategias/pemaraprobado6noviembrecondaae_tcm7-401704.pdf

- Waste Prevention Program (27.11.2013)

<http://www.mapama.gob.es/es/calidad-y-evaluacion-ambiental/planes-y-estrategias/planes-y-programas.aspx>

- Strategy «More food, less waste» (2013)

- Strategy for Energy Saving and Efficiency in Spain (2004-2012 / 2011-2020)

- Spanish Renewable Energies Plan (2011-2020)

- Smart Cities National Plan (2015 version)

<http://www.agendadigital.gob.es/planes-actuaciones/Paginas/plan-nacional-ciudades-inteligentes.aspx>

Presence of a Regional Circular Economy Strategy: Yes

The Strategy for Smart Specialization of Catalonia (RIS3CAT) was approved by the Government of Catalonia in February 2014. RIS3CAT guarantees the promotion of circular economy through four main lines of action:

a) the integration of circular economy into seven leading sectors, with specific initiatives driven by a private public steering committee that enables their efficient implementation, b) to support emerging activities related to circular economy, c) to develop opportunities arising from cross-cutting enabling technologies, d) to boost an innovation ecosystem that prioritises eco-innovation.

Circular Economy Strategy at Manresa City level: No

Though there is not a comprehensive Circular Economy Strategy, several actions led by the cities relates to the following sectors:

- Waste management
- Industrial Symbiosis
- Energy recovery
- CO2 reduction

PROJECTS

Projects implemented in the field of Circular Economy (or related area)

Number of projects: 2 ongoing

Funding instrument: H2020, Municipal / Regional co-funding

Most relevant ongoing projects

Urban Wins

<https://www.urbanwins.eu/>

Thematic Area: Innovative waste prevention and management

UrbanWINS is a European project funded by the Research and Innovation Program Horizon 2020 that will study how cities consume resources and products, and how they eliminate the waste produced, in order to develop and test innovative plans and solutions aimed at improving waste prevention and management.

Launched this June 2016, the project will analyse current strategies for waste prevention and management in a total of 24 cities and assess how they contribute towards resilience and resource efficiency. The project will follow the urban metabolism approach, in which cities are considered living organisms that use natural resources and create a flow of materials and energies. The results will be used to define objectives and indicators of the Strategic Plans for Waste Prevention and Management in the eight pilot cities.

Active participation from citizens, governments, organisations, suppliers, research institutes and educational centres is foreseen through physical and online urban agoras in the eight pilot cities, where participants will share opinions, discuss ideas and plan solutions.

The participatory approach is an added value of UrbanWINS, as the vision of all relevant players for waste production and management at urban level will be taken into account to co-develop new strategies and co-test innovative solutions. Recommendations and tools will be transferable to other urban contexts. The final outcome of the project will be a toolkit for participatory and science-based decision-making and planning for waste management that can be applied in any public authority across Europe.

This three-year project is co-ordinated by the Municipality of Cremona, in partnership with 26 partners.

Simbiosi

<http://www.bufalvent.org/simbiosi/>

Thematic Area: Industrial symbiosis

The purpose of the project is to create synergies and business opportunities within an industrial area in the city. In collaboration with Manresa Research Center and a third party, the platform Inex was created to analyze available resources and potential match with the needs of neighboring industries. Eventually the process would lead to decrease costs and increase the competitiveness of the region, while strengthening the industrial base in the area, encouraging innovation and creation of new companies and jobs

The project is co-financed by local and regional fundings.

INNOVATION DIMENSIONS

Main innovation dimensions mainstreamed in the Circular Economy Strategy/Projects Innovative solutions

Innovative solutions

- Technology based solutions
- Strong cooperation with local research institute, the Manresa Research Center

<http://www.ctm.com.es/en/centre-tecnologic-de-manresa.php>

- Industrial Symbiosis

Enablers

- Different sources of fundings
- Online synergy platform

Governance features

- Governance : Agoras to involve stakeholders and cooperative approach with industry actors
- Science Diplomacy : member of the Covenant of Mayors and Mayors Adapt



LIVING LABS

Name of the Living Lab: iCat Catalonia Digital Living Lab

the iCat Catalonia Living Lab dates back to the first wave of Living Lab members of the European Network of Living Labs in 2006. Focusing to promote research and innovation in advanced internet technologies, the non-profit organisation of i2CAT aims to make this information available to the society.

The i2CAT Foundation aims to convert Catalunya into a leader in research and innovation in Internet technology making it available to everybody and everywhere.

Numerous research projects have been carried out under the auspices of i2CAT. These include the creation of an experimental network platform; middleware services and generic applications that are among the most advanced in Europe; and a group of projects for specific sectors, called Clusters. The experimental platform comprises the following: - OptiCAT - MediaCAT - GigaCAT - MobiCAT – GridCAT

Name of the Living Lab: Barcelona Laboratori

The main objective of Barcelona Laboratori (BcnLab) is to encourage innovation through public and private collaboration between the arts, science and technology. Urban innovation ecosystems seem to be highlighted by these two features:

1. Cities are becoming open laboratories, committed to do research and innovate in a truly transformative way.
2. City-labs try to open the new innovation system to all citizens. Tend to transform the city into an open and universal creativity and innovation environment.

Based on the Quadruple Helix approach, BcnLab is able to cover the entire value chain from experimentation to idea to business model. Comprising culture to include science, technology and arts together, it promotes creativity and innovation in the city of Barcelona. Synergies between high-level research and innovation infrastructures (both scientific and technological) as well as the cultural and creative sectors and citizens, form the basis of the research.

Furthermore, for the first time, the City is adopting a peer to peer attitude towards civil society, supporting the innovation communities - a policy which opened up a new Directorate of Creativity and Innovation in the area of Culture: "Culture, Knowledge, Creativity and Innovation".

Name of the Living Lab: Library Living Lab – Barcelona

The Library Living Lab – Barcelona (L3), is an open, participatory, experimentation and co-creation space, situated in the public library "Miquel Batllori" at the Volpelleres neighbourhood of Sant Cugat del Vallès, Barcelona, Spain. This Living Lab is a genuine bottom-up implementation of a people/public/private scheme.

The laboratory was developed as a joint initiative between the Association of Neighbours of Volpelleres, the Municipality of Sant Cugat, the Provincial Council of Barcelona, the Universitat Autònoma de Barcelona, and the Computer Vision Centre, which is coordinating the Living Lab activities.

The lab's focus is on technology-based solutions and on how technological advances can be meaningfully exploited within the cultural context.

L3 is the result of a bottom up initiative from the very citizens of the local neighbourhood. It was born by the restless drive of the local population to improve their area and is a fruit of local awareness.

LISBON



Country: Portugal

Number of inhabitants: 504 471 (2015)

Website: <http://www.cm-lisboa.pt/en>

Main features of the innovation process at city level

Governance of the processes in the Circular Economy domain:

- Presence of a National Sustainable Development Strategy? No, but Portugal has made the so called 'Green Growth Commitment' executing the Strategic Partnership (2014-2020) with the EC
- At city level, presence of a 'Mission Team set up in 2012 to coordinate and facilitate the planning and implementation of projects in various transversal domains in line with the EU Strategic Framework 2020. The Mission Team planned and has been implementing now 21 projects funded by EU Programmes, of which around 10 by the R&I programmes (FP7 and H2020). The Mission Team is also working for the post 2020 Horizon. Other Coordinating bodies at the City level are: Urban Planning Department for the Municipal Master Plan, but then each Department governs its own area of expertise (Waste, Mobility, Energy, etc.)
- Citizens involved at the strategic level, and consulted when designing the European Strategic Charter of Lisboa 2010-2024; citizens are also quite active at the Living Lab level: Lisbon has been one of the cities whose Living Labs have strongly contributed to the birth of the European Living Lab movement.

Presence of an ecosystem involving all relevant stakeholders:

- Cooperation Municipality-Academia-Private Sector: very good, especially in the field of smart digital solutions, energy efficiency and sustainable urban planning.
- Cooperation with the private sector (and/or the Living Lab actors) relevant in terms of facilitating the creation of start-ups. Lisbon has been also awarded the European Entrepreneurial Region of the Year 2015.
- Multistakeholder dimension to foster innovation process: present and foreseen also at the formal political level with the City Stakeholder Committee that includes Majority and Opposition Politicians, Academy and Research, Citizenship and Private Sector representatives. Living Lab methodologies and projects have also helped a lot boost quadruple helix innovation.
- Integrated/holistic and systematic governance approaches: present

Main dynamics of the innovation processes:

- Innovation dynamics at city level were introduced by the 'new deal' of the Strategic Charter and the actions undertaken by the Mission Team in terms of project management and fund raising
- The city is quite willing to align its policy and future development with the European strategic framework, therefore a lot is ongoing – though, often not yet structured in a formal strategic or planning document – in the domains of smart and inclusive solutions, new mobility concept, energy efficiency and climate mitigation, climate adaptation and nature based solutions in urban planning (only to mention some of the many domains touched by the Circular Economy concept)
- Many innovation elements have also been introduced by the strategic objective of the city to become an entrepreneurial hub; moreover, the city is very active in terms of 'Science Diplomacy' and hosted in november 2016 the European Technology and Innovation WebSummit 2016

Circular Economy Strategy and activities

Circular Economy Strategy at Lisbon City level: No

The City of Lisbon declares that its activities are focused on the Reduce, Recycle and Reuse sectors and that the Municipality is currently developing a comprehensive strategy for Circular Economy.

Presence of other relevant plan: Yes

- Lisbon's Strategic Charter 2010/2024 (input for a Master Plan approved in 2012)

<http://www.cm-lisboa.pt/en/city-council/city-council/strategic-charter>

- Lisbon Energy and Environment Strategy adopted on 12.2008

<http://lisboaenova.org/pt/projetos/projetosestrategicos/estrategia-energetico-ambiental-lisboa>

- Lisbon Ecologic Purchasing Plan adopted on 2009

http://www.cm-lisboa.pt/publicacoes-digitais/todas-as-publicacoes?eID=dam_frontend_push&docID=30121

There are several elements regarding CE in all the different plans.

Lisbon's Strategic Charter covers the environmental dimension, with 10 directions (an Integrated Climate approach, an Ecological approach and a Urban Waste strategy) expressing a new paradigm and aiming at a sustainable, coherent and integrated Urban Strategy.

Lisbon's Energy and Environmental Strategy was prepared by the Municipal Energy and Environment Agency 'Lisboa E-Nova' and aims at identifying the development path until 2020. According to the document, the main areas of intervention are:

- The reduction of primary energy demand, increasing the efficiency and quality of energy services;
- The harmonization between energy supply and demand, through intelligent energy networks;
- The promotion of energy production decentralization and increase energy supply sources diversification (renewable energies, micro-generation e alternative fuels), increasing security of supply.

Three operational plans targeting respectively Energy (monitoring Lisbon's consumptions and emissions), Water (water consumption and management – see the interesting project 'Water remote Management' - as well as waste water collection and treatment) and Materials, plus the Covenant of Mayors 'Sustainable Energy Action Plan', define the operational direction and targets of the Energy and Environmental Strategy. In this respect, a number of projects in the Energy Efficiency field – among which several based on technology based solutions (e.g. INTEGRIDY, LOCATIONS described afterwards), some others on education and awareness raising – are funded in the frame of the PPEC - Consumption Efficiency Promotion Plan (Plano de Promoção da Eficiência no Consumo de Energia Elétrica) – which is the Portuguese tender mechanism to promote efficiency on electricity consumption, or were funded in the frame of the programme "Intelligent Energy Europe", such as the projects 'Urban Sol Plus - Solar Thermal in Major Renovations and Protected Urban Areas', or 'ProSTO - Best Practice Implementation of Solar Thermal Obligations'.

Another circular economy pillar in Lisbon's strategy is Sustainable Mobility and its network of 516 charging points for electric cars. In this context, Lisboa E Nova implements an electric mobility plan called MOBI-E. Electricity comes from different sources, mainly low-emission ones such as natural gas and zero-emission sources such as wind, solar and hydro. Besides this, the public transport network and the cycling network have been strengthened, and a bike sharing scheme will be in place during the next few months.

The city is also active in the field of sustainable urban waste with the projects FORCE, URBAN WASTE and PAYT, aiming to transform waste into value through the application of circular economy principles. In particular, the project URBAN WASTE - Urban Strategies for Waste Management in Tourist Cities the Municipality of Lisbon aims to help develop strategies to reduce the amount of municipal waste production as well as strategies to further develop re-use, recycling, collection and disposal of waste. In doing so URBAN-WASTE will adopt and apply the urban metabolism approach to support the switch to a circular model where waste is considered as resource and reintegrated in the urban flow. In parallel to this, the project PAYT exposes the city to innovative methods, technologies, and actions primarily targeting waste prevention, reuse, and separate collection, empowering them to pursue different practices and financing them.

Finally, the city addresses the themes of Circular Economy and Innovation through several projects in the Smart Cities domain such as the Sharing Cities initiative, which fosters international collaboration between industry and cities and seeks to develop affordable, integrated, commercial-scale smart city solutions with a high market potential. It is also worth mentioning the me2 project, developing an integrated perspective on urban mobility and electricity, whose expected results are an increased understanding and integration of e-mobility and electricity behavior, developing mechanisms to influence these behaviors using gamification elements based on smart algorithms, on an individual and community level; more balanced local grids and a lowered average energy costs for consumers, for instance as a result of enabling smarter, more economical energy usage patterns.

PROJECTS

Projects implemented in the field of Circular Economy (or related area)

Number of projects: More than 7 ongoing

Funding instrument: H2020 (11 projects), FP7 (among which also IEE - Intelligent Energy Europe, INTERREG (ERDF), LIFE, JPI (Joint Programming Initiative) – Urban Europe, National co-funding (PPEC), Municipal co-funding

Most relevant ongoing projects

H2020 / FORCE: Cities Cooperating for Circular Economy

Starting date: 01.09.2016 Ending date: 31.08.2020

Total Value: € 11 308 117,50 EC Contribution: € 9 724 969,13 City of Lisbon's share: € 1 648 125

Link: <http://www.ce-force.eu/>

Project Summary: The FORCE project aims to transform waste into value through the application of circular economy principles. The four cities involved in the project, Copenhagen, Hamburg, Lisbon and Genoa, will develop four pilot projects focused on four different products and waste chains. Each city will also build-up a pilot project for the other products and waste chains for a total of four projects for each city. FORCE goal is to turn a source of pollution and a cost into an opportunity and value. FORCE is part of a biggest process promoting sustainable and green development of Europe and the entire world, in a strategic vision to create smart and green cities.

H2020 / URBAN WASTE: Urban Strategies for Waste Management in Tourist Cities

Starting date: 01.06.2016 Ending date: 31.05.2019

Total Value: € 4,248,782.5 EC Contribution: € 4,248,782.5 City of Lisbon's share: € 124,277

Link: <http://www.urban-waste.eu/>

Project Summary: The URBAN WASTE project aims to help develop strategies aimed at reducing the amount of municipal waste production as well as strategies to further develop re-use, recycling, collection and disposal of waste. In doing so URBAN-WASTE will adopt and apply the urban metabolism approach to support the switch to a circular model where waste is considered as resource and reintegrated in the urban flow. The project will develop eco-innovative and gender-sensitive waste prevention and management strategies in cities with high levels of tourism in order to reduce the urban waste production and improve municipal waste management. These strategies will facilitate the reintroduction of waste as a resource into the urban metabolism flows and address waste management, risk prevention and land-use as an integral part of urban development.

LIFE+ / PAYT: Pay As You Throw

Starting date: 01.10.2016 Ending date: 31.12.2019

Total Value: € 2,517,571.00 EC Contribution: € 1,351,945.00

Link: <http://www.life-payt.eu/en/>

Project Summary: The project LIFE PAYT – Tool to Reduce Waste in South Europe aims to change strategies, tackling present obstacles and contribute to transform decision makers (elected officials; tech. staff) mind-set and eliminate misconceptions regarding PAYT (Pay-As-You-Throw). Local authorities will be exposed to innovative (in this part of Europe) methods, technologies, and actions primarily targeting waste prevention, reuse, and separate collection, empowering them to pursue different practices and financing them. LIFE PAYT has four main objectives:

- Reduce residual waste from household and commerce
- Increase separate collection rates for packaging materials
- Demonstrate that PAYT is feasible, changing local decision makers, tech. staff mind-set, in Southern European Municipalities, resulting in benefits and contributing to the implementation of EU environmental strategies and targets.
- Promote the replication of the concept to wider regions with the same problems.

H2020 / SHAR-LLM: Sharing Cities

Starting date: 01.01.2016 Ending date: 31.12.2020

Total Value: € 28 068 093,92 EC Contribution: € 24 753 944,98 City of Lisbon's share: € 611 884

Link: <http://www.sharingcities.eu/>

Project Summary: The Sharing Cities 'lighthouse' programme is a proving ground for a better, common approach to making smart cities a reality. By fostering international collaboration between industry and cities, the project seeks to develop affordable, integrated, commercial-scale smart city solutions with a high market potential. The project partners work in close cooperation with the European Innovation Partnership on Smart Cities and Communities and with other 'lighthouse' consortia. Sharing Cities offers a framework for citizen engagement and collaboration at local level, thereby strengthening trust between cities and citizens. The project aims to trigger €500 million in investment and to engage over 100 municipalities across Europe.

JPI - Urban / me2: Integrated Smart City Mobility and Energy Platform

Starting date: 01.06.2016 Ending date: 30.06.2018

Total Value: € 1,119,024 EC Contribution: € 862,880

Link: <http://me2-project.eu/>

Project Summary: The project me² represents an integrated perspective on urban mobility and electricity with the following overall objective:

"Develop and verify an urban market place that combines e-mobility-demand side management technology with smart meter automation options within an innovative business model. The project includes operational methods to encourage usage, to optimize resources, to balance both the fluctuating renewable electricity generation and the urban local grid. It further sets these operational measures within the larger regulatory contexts to derive effective policy implications".

The expected results are: a tested, validated and operational Smart City Aggregator platform; pilots in two different settings, i.e. in a city with high degree of EV adoption (Amsterdam) and in a city with a lower degree of EV adoption (Lisbon), using an open-community (in Amsterdam) and closed-community (in Lisbon); increased understanding and integration of e-mobility and electricity behavior; lowered average energy costs for consumers, defined as 10% lower household energy costs.

H2020 / INTEGRIDY: Integrated Smart GRID Cross-Functional Solutions for Optimized Synergetic Energy Distribution, Utilization & Storage Technologies

Starting date: 01.01.2017 Ending date: 31.12.2020

Total Value: € 15,839,775.63 EC Contribution: € 12,329,013.63 City of Lisbon's share: € 335 275

Link: <http://www.integrity.eu/>

Project Summary: inteGRIDy aims to integrate cutting-edge technologies, solutions and mechanisms in a scalable Cross-Functional Platform connecting energy networks with diverse stakeholders, facilitating optimal and dynamic operation of the Distribution Grid (DG), fostering the stability and coordination of distributed energy resources and enabling collaborative storage schemes within an increasing share of renewables.

INTERREG Med (ERDF) / LOCATIONS: Low Carbon Transport in Cruise Destination Cities

Starting date: 01.11.2016 Ending date: 30.10.2019

Total Value: € 3,012,605.75 EC Contribution: € 2,560,714.89

Link: <http://lisboaenova.org/en/projects/sustainablemobility/locations>

Project Summary: LOCATIONS' (Low Carbon Transport in Cruise Destination Cities) overall objective is to support local public administrations in drafting Low-Carbon Transport and mobility Plans (LCTPs) with measures dedicated to cruise-related passengers and freight flows, contributing to decongest the city traffic and to lower the production of greenhouse gases. A methodology will be tested to respond to specific mobility-related issues in the countries involved. The definition of modular packages will pave the way for transferability in new MED area countries by means of international capacity building actions and mutual learning activities for new sustainable mobility concepts. New LCTPs will be produced and capitalization actions will grant the involvement of a broader number of cruise destinations to adopt the LOCATIONS approach by means of bankable projects. Involvement of citizenship and cruise passengers is foreseen through raising-awareness campaign, encouraging participation and responsibility in enhancing cities' quality of life.

INNOVATION DIMENSIONS

Main innovation dimensions mainstreamed in the Circular Economy Strategy/Projects Innovative solutions

Innovative solutions

- Technology-based solutions: many, mainly in the fields of Energy Efficiency, Building and Urban Renovations, ICT Solutions, Urban Waste solutions, electric mobility solutions
- Research institutions, universities and innovative firms: involved, both at local and international level
- New business models and industrial symbiosis: present

Enablers

- Financing Instruments: Platform of crowd-funding 'Boa Boa', which funds a collaborative way to raise funds for ideas and projects in the sector of i) Entrepreneurship; ii) Social Entrepreneurship and innovation; iii) Science and R&D; iv) Culture, Citizenship and Participation. Boa Boa provides an online platform for any entrepreneur to find support from a large community, in a simple and transparent way.
- Big Data and Digitalization: open data principle applied
- Enabling Physical and Digital infrastructure: FIREBALL Project

Role of the Living Labs

- Citizen's involvement and social innovation: citizens consulted before approval of strategic plans. Local Living Labs collaborating with the citizenry on projects
- Public procurement of Innovation: present
- Open Innovation and Value Chains: massive work for entrepreneurship creation and start up development

Governance features

- Governance and Monitoring of Success: present, and continuous effort to coordinate with the National and European government level
- Public Sector Innovation: present
- Science Diplomacy: European Entrepreneurial Region of the Year 2015; Lisbon is hosting many Technology and Innovation European events, such as, in November 2016, the WebSummit 2016



LIVING LABS

Lisbon has been at the core of Living Lab activities since the start of the ENoLL Living Lab movement in Europe in 2006. The Portuguese, Lisbon-based laboratory Lighting Living Lab has been part of the ENoLL Council Board for years through one of his delegates, who then has also become President of the ENoLL Network afterwards. This allowed Lisbon Living Lab community being involved in key activities, workshops and events, fostering diffusion of Living Lab mindset in the local open innovation ecosystem. Such effort brought to the inception of new Living Labs in the city territory, some of which also focus on circular economy themes (a list of some of the key Living Lab actors in circular economy is provided below). Unlike e.g. Eindhoven, Lisbon doesn't seem to go towards a centralized Living Lab model where one public actor supports and represents local Living Lab activities while connecting European actors to local ones.

Name of the Living Lab: RENER Living Lab

RENER Living Lab is a space for development, testing and experimentation of smart urban solutions in real world context, under the concepts of open innovation and co-creation with the involvement of end users. It is also a space for sharing best practices and innovative experiences capable of replication, as well as for the incubation of local solutions with potential for internationalization. The living lab was created under the Portuguese Electric Mobility Programme, as a pilot network for the introduction of the electric vehicle in the country. Its activities then were extended to other areas of interest, always keeping a quadruple helix approach to innovation. The organizational structure of the network includes a Strategic Committee, a Technical Committee and a Technical Manager, which is INTELI, an urban innovation centre located in Lisbon, Portugal.

Thematic Areas of the Living Lab: Already since 2013, RENER extended its intervention to other solutions for urban sustainability in different areas: energy, sustainable buildings, governance, social innovation, etc. operating as a Smart Cities Network in Portugal. Several joint projects are emerging in these domains due to the work of the municipalities in thematic groups: Governance; Energy and Environment; Mobility; Society and Quality of Life; Economy and Innovation.

Cooperation with city level: RENER Living Lab develops two types of projects; intelligence projects, and structural projects. In the context of intelligence projects, the Living Lab generates information and knowledge to support policy-making processes. One of the tools used in these projects is the Smart City Index 2020. To strategically position cities in terms of urban intelligence is the main objective of this index that intends to create a database of municipal information and knowledge to support decision-making by public authorities and economic and social actors. The methodology is composed of 5 dimensions of analysis - innovation, sustainability, social inclusion, governance and connectivity, 21 sub-dimensions and a set of around 100 indicators.

Name of the Living Lab: Startup Lisboa Tech

Founded in 2011 by the Lisbon Municipality, Bank Montepio and IAPMEI – Portuguese Agency for Competitiveness and Innovation IP, it's a private non-profitable association that provides entrepreneurs and companies office space as well as a support structure. Mentoring, link to strategic partners, access to investment, help with business basics, networking activities, communication.

Thematic Areas of the Living Lab: Startup Lisboa supports the development and growth of the incubated startups, helping them to attract customers and investors, to scale up and become global. Its incubation model includes the assignment of workspaces with a cost below market value. Also, Startup Lisboa establishes a link to mentors (founders, CEO, specialists) to help entrepreneurs develop their business; provides access to partners that offer or make available at a lower price specialized services; connects entrepreneurs to business angels, venture capital investors and other top financing sources; promotes the knowledge sharing between the entrepreneurs, and networking events, like workshops and mentoring sessions.

Cooperation with city level: The cooperation with the Living Lab started with the involvement of the City of Lisbon with some Universities and some companies, which started to mention the possibility to have Living Labs

EINDHOVEN



Country: Netherlands

Number of inhabitants: 221.402 (02.2017)

Website: <https://www.eindhoven.nl/en.htm>

Sectors of activity in the Circular Economy loop: “Recycling (domestic) waste”, “energy-efficiency actions in buildings”

Presence of an Urban Strategy: Yes (i.e. city plan level)

- EINDHOVEN CITY PLAN Vision 2050 | Urban plan - the new Eindhoven city plan

Presence of a Circular Economy Strategy

The city of Eindhoven is currently working on a circular economy plan, which should be developed from this year.

The program is focused on recycling (domestic) waste, and making improvements in construction work, renovating buildings by using circular economy principals. One of the primary goals is to be an energy-neutral city by 2045.

The circular economy strategy is strongly and primarily based on three innovation axes: technology-based solutions, research institutions involvement, and new business models in private and corporate sectors. Secondly, the city focuses on the digitalisation of public and private data to improve the implementation and monitoring of the urban strategy for a circular economy in the city. Long-term funding for these solutions is still under assessment.

At national level, Netherlands benefited from the Interreg V-program for 2014-2010, helping cross-border projects and motivating the regions to participate in the circular economy projects. Today the Interreg Flanders – Netherlands programme guarantees € 152 million from the European Regional Development Fund (ERDF) to invest between 2014 and 2020 in valuable cross-border projects.

Main features of the Circular Economy Strategy included in the urban strategies mentioned above:

- The city of Eindhoven highlights the use of innovative technology for sustainable domestic waste management.
- Creation of innovative solutions to reduce land contamination.
- Promote innovative alternatives to re-use water.
- Development low cost- efficient options to support healthy leaving.
- Gather information for sustainable alternatives for materials in construction.
- Support for energy efficiency and renewable sources of energy.

PROJECTS

Projects implemented in the field of Circular Economy (or related area)

Number of projects: 14

Funding instrument: Municipal, EU-funding

Research and Innovation projects

REnescience: “Value from Waste,” Eindhoven city is currently working on the realization of REnescience, an innovative factory to recycle waste. REnescience develops a new clean technology turning mixed municipal solid waste (MSW) into “bioliquid” and other valuable products. REnescience offers significantly higher capture rates of the biodegradable materials (more than 90% ends in the bioliquid), higher recycling rates of waste and more sustainable waste management than traditional practices.

Materialslab: With two big housing companies, Eindhoven city is working on gathering information on the most eco-friendly alternatives for construction materials and sustainable procurement.

hilips Innovation Labs: In October 2016 Eindhoven city offered the New Material Award during the Dutch Design Week. A carefully selected group of material makers demonstrated unique and inventive approaches to the development of innovative materials for energy production.

‘Roadmap Urban Lighting Eindhoven 2030’: Innovative solutions for smarter urban lighting infrastructure. Together with the City of Eindhoven and specialists from engineering departments, this initiative engages citizens to jointly develop LED street lighting and lighting applications in Eindhoven’s public spaces. The plan also includes the development of smart sensors of LEDs.

Intelligent Lighting Institute: The Eindhoven University of Technology’s Intelligent Lighting Institute investigates novel creative lighting solutions based on large-scale introduction of LED technology, with a particular emphasis on how these new solutions might affect people’s life. ILI researchers are developing new concepts for interactive lighting solutions, as well as the necessary technology, working on programs like: ‘brilliant streets,’ ‘sound lighting,’ ‘no switches allowed,’ ‘lighting optics & rendering,’ and ‘open light.’

Roadmap for Urban Lighting: Eindhoven, ‘the City of Light,’ will be developing its urban lighting system into an integrated ‘Smart Light Grid,’ and will be promoting the development of services based on this grid. During the next 10+ years and until 2030 ‘new lighting’ solutions will be developed with other city partners.

Smart Mobility: As one of the leading partners, the Eindhoven University of Technology participates in developing technology that provides automated communication between vehicles, and between vehicles and their surrounding infrastructure: Cooperative-Intelligent Transport System (C-ITS). To carry out this project, an international consortium of 37 partners received a grant of 12.5 million from the European subsidy program Horizon 2020.

AiREAS project: Eindhoven city decided to install a network of sensors to measure air quality in real time. The project involves doctors, engineers, researchers, politicians and citizens within a single open and cooperative programme.

SCiA company, 2009, has installed in Eindhoven a noise-reducing barrier designed to reduce the noise of traffic.

EU funding program

Interreg V Flanders: 2014-2020, including five Flemish provinces and three southern provinces of Netherlands, the program helps cross-border projects, focused on the following points:

- Innovation: Strengthening research, technological development, and innovation.
- Sustainable energy: Support for energy efficiency and renewable energy.
- Environment and resources: Protecting the environment and promoting resource efficiency.
- Labor: Promoting employment and supporting labor mobility.

SPEA project: 2013-2016, Eindhoven focuses strongly on exploring opportunities for renovating its building stock. SPEA project focuses on entice all actors to cooperate towards achieving the energy neutrality ambitions. The city is aware of the need to set a positive example to other stakeholders and citizens.

Brainport 2020 Strategy: A triple helix strategy involving public actors, research and private sector, which sets out the economic and innovation policy direction for Eindhoven region towards 2020.

Triangulum Project: In Eindhoven, two districts will be transformed into sustainable living environments during the project. An innovative concept to clean up contaminated land will double as a means of producing energy. A district-wide ICT solution will allow residents to access different kinds of infrastructure, such as booking electric vehicles from a district car sharing scheme or using smart parking concepts. In this way, the IT-based tool will help residents to develop sustainable patterns of energy and mobility behaviour.

Strijp_s Project: The revitalisation of the Philips Company's industrial and business complex is transforming the area into a new public/urban domain to live, work and play.

"The smart way towards sustainable municipal buildings" project: H2020, In 2012 the Municipality of Eindhoven joined the European project 'Smart Procurement European Alliance.' A web-based call for tenders was launched on 16th July 2014, where the city received about 200 proposals to innovate city buildings, aiming to make them more energy-efficient. This tender stimulates the cooperation between the interested parties.

R4E (Roadmaps for Energy): ambitions for 2050. The full R4E scenario is detailed here. With the objective of creating a safe living environment that is resilient to the changing climate through the smart use of solutions on the appropriate scale; a healthy living environment with extensive 'green and blue' areas that support social activities and healthy lifestyles; a circular water system that provides sustainable re-use of water, materials and energy.

INNOVATION DIMENSIONS

Main innovation dimensions mainstreamed in the Circular Economy Strategy/Projects Innovative solutions

Innovative solutions

- Technology-based solutions: 'Roadmap Urban Lighting Eindhoven 2030': smart technology delivered through the lighting infrastructure. Residents can reduce their consumption of energy with the appropriation of smart sensors with LEDs.
- Development of sustainable solutions for construction materials, renovation of city buildings, renovation of city districts.
- Research institutions, universities and innovative firm: Eindhoven University of Technology, develops technology that provides automated communication between vehicles, and between vehicles and their surrounding infrastructure. Technical University of Eindhoven (TU/e): It has formed a partnership with the city of Eindhoven, Philips Lighting and Heijmans and the private sector to develop innovations in urban lighting infrastructure.
- New business models and industrial symbiosis: Brainport 2020 strategy, a triple helix collaboration involving public actors, research and private sector

Enablers

- Financing Instruments: EC H2020 funding. Brainport 2020 Strategy: Involves public and private sector to set out the economic and policy direction for the city of Eindhoven.
- Regulatory innovation:
- Big Data and Digitalization:
- Enabling physical and digital infrastructure: Triangulum Project: it will allow residents to access different kinds of infrastructure, such as booking electric vehicles from a district car sharing scheme or using smart parking concepts. Citizens will be able to develop sustainable patterns of energy and mobility behaviour. Strijp_s Project: it transforms public/urban domains to live, work and play. R4E (Roadmaps for Energy): It promotes the development and support of "green and blue." It reinforces not only healthy lifestyles but also sustainable re-use of materials, water, and energy.

Role of the Living Labs

- Citizen's involvement and social innovation: "The smart way towards sustainable municipal buildings" project: it stimulates the cooperation among the interested parties towards energy-efficiency. AiREAS project: it invites doctors, engineers, researchers, politicians, and citizens to try a network of sensors to measure air quality.
- Public Procurement of Innovation:
- Attractiveness: SPEA project: it attracts people and private sector to cooperate towards achieving the energy neutrality ambitions.

Governance features

- Governance and Monitoring of Success:
- Public Sector Innovation: Strong collaboration with local ecosystem towards a quadruple helix model of innovation. Collaborative projects on-going with academia, private companies and citizens. Active role in the European Living Lab movement.
- Science diplomacy:

LIVING LABS

Name of Living Lab: Eindhoven Living Lab

Eindhoven Living Lab, located at the center of the Brainport Eindhoven region, in the City of Eindhoven. The lab has a strong commitment towards its citizens to enhance the quality of life, by mobilizing the creative power of triple helix parties and citizens/end users all together. It is also opening up the city itself as a real-life testing ground for products and services with an added value that meet the needs of the end users.

Thematic Areas of the Living Lab

Smart city & region Which includes subthemes such as: Improve urban lighting infrastructure, Energy efficiency, renewable resources, high technology systems, support “green and blue” areas, Internet of Things, the transformation of biodegradable waste management

Cooperation with city level

Eindhoven is a strong believer in quadruple helix model of innovation and active collaboration between different partners of local innovation ecosystem. Moreover, an extra layer was added to the well-functioning multiple helix model by incorporating ‘The City as a Living Lab’ into the core of its policy: “The City of Eindhoven is not only the breeding room for innovation, nor is it only its production facility, it also wants to be the living lab of these inventions. We want the city and its citizens to benefit from our companies’ developments. (...) Eindhoven is the city where smart products and services are being developed and implemented, in close cooperation with the end users in real-life settings”.

Bringing together partners on the one hand and creating/contributing to structures in which partners can meet on the other hand are the two main points that are to characterise ‘Eindhoven Living Lab’ : over the last few years, the City of Eindhoven and its partners have developed quite a large number of successful Living Lab projects. ‘Eindhoven Living Lab’ is the ‘umbrella approach’ to incorporate these LLs and future ones into one, more integrated and integral approach. ‘Eindhoven Living Lab’ is about:

- LLs in which the City of Eindhoven is taking an active lead role
- LLs in which the City of Eindhoven is taking a minor role as a partner, or which are merely

facilitated by the City by providing the necessary infrastructure and the access to it; in this case the LL can extend beyond the territory of the city



RIGA



Country: Latvia

Number of inhabitants: 639,630 (01.01.2016)

Website: <http://www.rdpad.lv/en/>

Main features of the innovation process at city level

Governance of the processes in the Circular Economy domain:

- Presence of a National Sustainable Development Strategy of Latvia until 2030 and of a National Development Plan of Latvia for 2014-202
- Presence of a strategic coordination body such as the City Development Department and involvement of several city departments such as the Environmental Department, Financial Department, Riga Energy Agency;
- Cooperation Municipality-Academia shown by several interesting projects in the field of sustainable urban planning and energy efficiency;
- Citizens involved to some extent in the urban planning processes through the 'Neighbourhood Programmes'

Presence of an ecosystem involving all relevant stakeholders:

- As Latvia has experienced a difficult transition to a liberal economy and a re-orientation toward Western Europe, many processes at city level are resistant to the introduction of new practices;
- Strong bi-lateral cooperations with the Academic and Research sector;
- Not so strong cooperation with the private sector (and/or the Living Lab actors), and therefore weak or absent co-creation dimension;
- Multistakeholder dimension to foster innovation process still under development;
- Industrial Symbiosis: not very present, but in the case of the new ecological landfill 'Getlini Eko'.

Main dynamics of the innovation processes:

- Innovation dynamics at city level are mainly decided by the priorities of the City Development Department and by actions undertaken by other departments (such as the Riga Energy Agency), for instance when applying for international funding;
- A fair amount of innovation elements is also introduced in the city via the action of other stakeholders – such as the Living Lab "Technology Development Forum" – that can work with their own stakeholders network, for instance in the domains of digitalization and the creation of open data sources;
- The city is quite active in applying for EU funding mainly in the field of the INTERREG Central Baltic Programme, thus the priorities of the Programme are somehow reflected in the innovation practices at city level.

Circular Economy Strategy and activities

Presence of an Urban Strategy: Yes

- Sustainable Development Strategy of Riga until 2030
- Action Programme 2014-2020
- Riga City Sustainable Energy Action Plan for Smart Cities 2014-2020 (SEAP).
- The European Capital of Culture 2014 has quite an articulated Urban Development Strategy that addresses the need of urban regeneration, while having to preserve the UNESCO heritage status and fighting against the urban sprawl outside the borders of the City.

The Urban Environment is one of the three strategic pillars of the Development Strategy, stressing the Municipal objective of living in a convenient, safe, and healthy environment.

Circular Economy Strategy at Riga City level: No

Though there is not a comprehensive Circular Economy Strategy, in both Riga's Sustainable Development Strategy until 2030, and in Riga's SEAP 2014-2020 there are several 'Action Directions' touching on the following sectors:

- Reduce: CO2 Emissions reduction
- Recycle: Resource Efficiency
- Reuse: Raw materials conservation
- Re-manufacture: Ecological and Technological innovation.

According to what stated in the SEAP, Riga's long-term development strategy concentrates on:

- Energy efficiency – optimise and promote of multimodal transport
- Technological innovation – vehicles energy efficiency improvement
- Alternative fuel – introduction of alternative fuels infrastructure

Going through the Sustainable Development Strategy, the following "Action Direction" priorities are set for the 2030 timeframe:

'Action Direction" PAD 11: Well-balanced traffic infrastructure and organisation

- Implementation of a new mobility concept which foresees the implementation of a multimodal/dynamic traffic model, based on the mobility principle that, within the core of the city, it is more convenient and faster to walk or combine walking with public transport, or cycling rather than using one's private car transport. Also, project of renovation of the Central Station according to a multi-modal principle.
- Car sharing is starting now, but as a private investment; municipality investments on electric or hybrid cars are done only for the use of the local authority.
- According to Riga's SEAP, the sustained growth of electrical and hybrid vehicles in the city since 2009 has facilitated development of a publicly accessible infrastructure for charging these new vehicles. The slow charging system has been established by the public sector ("Zero emission mobility support society") and the private sector in collaboration with the municipal energy company JSC "Latvenergo".
- Around 76 million euros from the Cohesion Fund will be allocated to fund low grid tram lines. As for railways, there is no Rail System yet, but the big infrastructure project shall start in 2019 thanks to the Rail Baltic project.

'Action Direction' AD 13: Broad-scale implementation of energy efficiency

- Promote the rational use of heat energy and electric energy by introducing innovative technologies, equipment, and solutions
- Ensure the renovation of buildings of municipal authorities, introduce energy-effective lights in public buildings and apartment houses and encourage the use of renewable resources: Riga's SEAP foresees the renovation for 6,000 residential buildings for a total of 12 million m². Since the beginning of 2013, 30 residential buildings - incl. 2 social housing units - have been renovated via national and EU Structural Funds. Additional 18 buildings were insulated using various other funds, including private ones. The average energy savings are 50% as regards heat consumption.

Riga's City Council decided to support the setting up and operation of energy service companies (ESCOs) in Latvia. They notably ensure that funds are available for ESCOs' operations. The overall objective is to provide loans to associations of owners and to other authorised persons for up to 20 years with low and fixed interest rates (up to 3 %, which is necessary to ensure operation of the fund) amongst other measures.

'Action Direction' AD 15: Good environmental quality

- Among the key principles to implement this action direction there is the introduction of new and environment-friendly technologies to maintain green areas, improve the air quality and reduce the CO₂ emissions; the purification of the polluted sites; the performance of anti-flood measures and rainwater management actions, and the developing engineering constructions, to integrate them in the urban environment (and implement several climate adaptation measures)
- The City is implementing a Green Corridors Strategy
- A focus is also in the revitalization of neighbourhoods and parks (spatial planning and quality of living), of brownfield areas (project Baltic Urban Labs) and the regeneration of the waterfront of river Daugava (construction of bicycle and pedestrian routes) and the renovation of landfill sites, such as the modern landfill Getlini Eko and the one in Augusta Deglava Street (2013-2015).

PROJECTS

Projects implemented in the field of Circular Economy (or related area)

Number of projects: More than 3 ongoing

Funding instrument: H2020, FP7, IEE, ERDF (INTERREG Central Baltic), Cohesion Fund, LIFE, Municipal co-funding

Most relevant ongoing projects

H2020 / GreenS: Green public procurement supporters for innovative and sustainable institutional change

Starting date: 01.06.2015 Ending date: 31.05.2018

Total Value: 1 489 540,33 € EC Contribution: 1 489 540,33 € City of Riga's share: € 123 062,50

Link: <http://greensproject.eu/en/>

Project Summary: Implemented by a consortium of 14 partners from 8 EU countries seven Energy Agencies, and 7 institutional bodies, developed with the aim of stimulating Green Purchasing for public administrations through the implementation of innovative and virtuous processes that protect environment and support green economy.

The realization of the project comprehends technical assistance on GPP (Green Public Procurement), as well as multilevel cooperation among a variety of key-actors in the GPP policies (Ministry, Region, ANCI, associations, companies) at national, regional and local level. Improving public entities' capacity of energy saving, reducing CO2 emissions and energetic relative costs, through application of innovative solutions in GPP is the fundamental objective of the GreenS project.

INTERREG Central Baltic (ERDF) / Baltic Urban Lab: Integrated Planning and Partnership Model for Brownfield Regeneration

Starting date: 01.10.2015 Ending date: 31.12.2018

Total Value: € 2 200 242 EC Contribution: €1 697 128 City of Riga's share: € 490.675

City of Riga's share: € 368.006

Link: <https://www.balticurbanlab.eu/>

Project Summary: The Baltic Urban Lab project improves urban planning by developing and testing new integrated planning and Public-Private-People partnership models for the regeneration of four brownfield sites in Norrköping, Tallinn, Turku and Riga. The project identifies and promotes already existing good practices on brownfield regeneration and facilitates learning and exchange of experiences between planners and experts in the Central Baltic region.

The main research and Innovation elements are the implementation of new Public-Private-People partnership models utilizing advanced digital technologies (Mobile apps, 3D visualization tool etc.).

H2020 / SMR: Smart Mature Resilience

Starting date: 01.06.2015 Ending date: 31.05.2018

Total Value: € 4 641 233,25 EC Contribution: € 4 641 233,25 City of Riga's share: € 107 960

City of Riga's share: € 107 960

Link: <http://www.smr-project.eu/home/>

Project Summary: Supporting and building on the nexus of key resilient cities across Europe can create a strong backbone for all of Europe's cities to support one another in overcoming the challenges arising from risks ahead. Smart Mature Resilience cities work closely together with research partners to develop and validate tools through pilot activities encompassing critical infrastructure security, climate change and social dynamics. The tools developed will form a new Resilience Management Guideline. In particular, the tools are: Resilience Maturity Model, Risk System city, Questionnaire, Portfolio of Resilience Building Policies, System Dynamics Model, Resilience Engagement and Communication Tool, European Resilience Management Guideline.

INNOVATION DIMENSIONS

Main innovation dimensions mainstreamed in the Circular Economy Strategy/Projects Innovative solutions

Technology-based solutions: besides the new mobility concept mentioned prior and the first private car sharing business started in May 2017, the Municipality owns and runs a modern, technological and environmentally friendly landfill of household waste that produces electricity, heat and ecological tomatoes called 'Getlini eko'.

Research institutions, universities and innovative firms: The City Development Department continuously involve and work with students and researchers from University of Latvia, Riga Technical University (RTU) and University of Business, Arts and Technology (RISEBA) in city development projects.

New business models and industrial symbiosis: In the frame of the Baltic Urban Lab project a new Public-Private-People partnership models is being implemented utilizing advanced digital technologies (Mobile apps, 3D visualization tool etc.) in brownfield regeneration.

Enablers

Financing Instruments: The city is implementing an integrated municipal territory investment plan (public-state-private financing model) and has allocated neighborhood funds designed for local NGO projects such as "Atspēriens" (idea grant for new businesses, funded by the municipality targeting start-ups - maximal amount Eur 3000).

Big Data and Digitalization: open data principle is applied in the working processes of the Municipality. Municipality provides data and research about the city that is available for the public on site.

Enabling Physical and Digital infrastructure: a future action direction for Riga City Council are digital innovations for more efficient society involvement in planning, cloud computing as a basis for the implementation of e-Riga and the universal workplace mentioned in Riga's SEAP and part of the strategy of integration of ICT into the energy system.

Role of the Living Labs

Citizen's involvement and social innovation: the city is implementing the so-called 'Neighborhood Programme', where local NGOs that represent districts in Riga are involved in City development projects.

Public procurement of Innovation: through the projects GreenS and Baltic Urban Lab the city is implementing innovative procurement in the sustainability domain.

Open Innovation and Value Chains: mainly with university of Latvia, RTU and business sector cooperation (science, technologies and innovative business, environmental tech start-ups, patents etc.).

Attractiveness: strategy supports science and innovation in the Action Direction 16 "Favorable business environment and high economic growth". Science and entrepreneurship cooperation has been marked as prioritized development area, together with the development of infrastructures to launch business and attract substantial private investment.

Governance features

Governance and Monitoring of Success: strategic supervision system provides annual overview; active citizens informing about various scale projects and developments (district NGOs are key in the cooperation).

Public Sector Innovation: part of Riga City Municipality services can be provided online via e-service (the goal is to have at least 50% of services online by 2020). Riga City Council tries to apply an open data principle.

Science Diplomacy: again, ensure the 'recognition of Riga as a business place to a local and international audience of entrepreneurs' is one of the strategic objectives of the Development Plan.

LIVING LABS

Name of Living Lab: Technology Development Forum” - TDF (“Tehnoloģiju attīstības forums”)

Thematic Areas of the Living Lab

Different applied and fundamental research fields, such as farming, pollution reduction, water based solutions, e.g.: development of on-line learning software tools for dissemination of knowledge; design of wireless sensors systems and processing of satellite data and satellite images for GIS applications; GIS developments towards SDI in the areas of tourism, e-governance, rural development and environment protection working for different projects in a variety of organizations in Latvia.

Member of the Technology Space Cluster.

High impact projects implemented

Plan4all: ERDF, e-Content+ (2009-2011)

Plan4all was focused on large scale spatial planning data harmonisation in Europe and provided draft INSPIRE data specifications for five spatial data themes including land use and land cover. Plan4business developed an open data platform for aggregation, management and analysis of spatial planning information. Plan4all is now an operational non-profit association sustaining and further enhancing the results of multiple research and innovation projects.

BALLAD project: ERDF, Interreg Central Baltic (2007-2013)

The Ballad project created processes and models to support internationalization of digital services from SMEs in the Central Baltic region.

FOODIE – Farm Oriented Open Data in Europe: EU CIP (2014-2017)

The key point of FOODIE project is creating a platform hub on the cloud where spatial and non-spatial data related to agricultural sector are available for agri-food stakeholders groups and interoperable. The project offers an infrastructure integrating the existing open datasets related to agriculture providing specific and high-value applications and services for the support of planning and decision-making processes.

Cooperation with city level

Yes, but at present with cities other than Riga.



9.2 Appendix 2: The geographical location of the cities in the sample according to Central, Western, Eastern, Southern and Northern Europe classification

EU28	Country code	South	Nordic	West	East	Center	Non-Europe
Austria	AT					1	
Belgium	BE			1			
Bulgaria	BG				1		
Croatia	HR					1	
Cyprus	CY	1					
Czech Republic	CZ					1	
Denmark	DK		1				
Estonia	EE				1		
Finland	FI		1				
France	FR			1			
Germany	DE					1	
Greece	EL	1					
Hungary	HU					1	
Ireland	IE			1			
Italy	IT	1					
Latvia	LV				1		
Lithuania	LT				1		
Luxembourg	LU			1			
Malta	MT	1					
Netherlands	NL			1			
Poland	PL					1	
Portugal	PT	1					
Romania	RO				1		
Slovakia	SK					1	
Slovenia	SI					1	
Spain	ES	1					
Sweden	SE		1				
United Kingdom	UK			1			
Horizon 2020 associated countries found in the dataset (1.1.2017)							
Iceland			1				
Israel							1
Norway			1				
Serbia						1	
Switzerland						1	
the former Yugoslav Republic of Macedonia					1		
Turkey							1
Ukraine							1

9.3 Appendix 3: Description of web services focusing on urban strategies used for data collection

- **Covenant of Mayors for Climate and Energy** (<http://www.covenantofmayors.eu>) have been progressively integrated from the Covenant of Mayors and Mayors Adapt initiatives, which are involving local and regional authorities who are voluntarily commit to increasing energy efficiency and the use of renewable energy sources on their territories. The initiative started in 2008 with the support of the European Commission and has now 7.200 signatories.
- **Sustainable Cities Platform** (<http://www.sustainablecities.eu/>) was launched in 2016 and it focuses on the uptake of The Basque Declaration. The platform provides city examples of Transformative Actions which are in line with The Basque Declaration and our size classification. Furthermore there is Sustainable Cities Platform which have are part of Aalborg 2004 signatories and our target group.
- **Urban Innovative Actions (UIA)** (<http://www.uia-initiative.eu/>) is an Initiative of the European Commission that provides urban areas throughout Europe with resources to test new and unproven solutions to address urban challenges. Currently there are 17 cities which are listed as UIA city.
- **The European Green Capital Award** is an initiative to promote and reward local authorities to improve the environment and to spur cities to commit to further action, and to showcase and encourage exchange of best practice among European cities. Our city list includes winning cities, previous finalists and 2019 applicants.
- **The European Green Leaf** is a competition aimed at cities and towns across Europe, with between 20,000 and 100,000 inhabitants that recognises commitment to better environmental outcomes, with a particular accent on efforts that generate green growth and new jobs. Since this study uses urban center for inhabitant definition, there are cities which could apply Green Leaf competition. Our city list includes wining cities and shortlisted cities.
- **European Innovation Partnership on Smart Cities and Communities Market Place** (<https://eu-smartcities.eu/>) aims to boost the development of smart technologies in cities – by pooling research resources from energy, transport and ICT and concentrating them on a small number of demonstration projects which will be implemented in partnership with cities. Initiative was launched in 2011 by European Commission. The work is structured into six action clusters (and eleven priority areas) which are an assembly of partners committing to work on specific issues related to smart cities, by sharing the knowledge and expertise with their peers, giving added-value to their national and local experience and identifying gaps that need to be fulfilled at European level. Topically action clusters covers following areas: 1) Business Models, Finance and Procurement, 2) Citizen Focus, 3) Integrated Infrastructures & Processes (including Open Data), 4) Policy & Regulations / Integrated Planning, 5) Sustainable Districts and Built Environment and 6) Sustainable Urban Mobility. The smartcities website is listing EU-projects and commitments.
- **The Circular Europe Network** (<http://www.circular-europe-network.eu/>) is a specific initiative on circular economy planning which was launched by Association of Cities and Regions for sustainable Resource management (ACR+) to support and help local and regional authorities adopt aspiring circular economy strategies. ACR+ is an international network of members who share the common aim of promoting smart resource consumption and waste management through prevention at the source, reuse and recycling. The Circular Europe Network includes also factsheet listing.
- **The Reference Framework for Sustainable Cities (RFSC)** (<http://rfsc.eu/>) is a web tool which helps key city actors to develop and implement plans and strategies for attractive and sustainable cities.
- **The European Capital of Innovation Award (iCapital)** (http://ec.europa.eu/research/innovation-union/index_en.cfm?section=icapital) is award for cities

which are willing to experiment with new and innovative citizen-driven initiatives, proving itself as a 'test-bed' for potential solutions to relevant societal challenges. List included 2016 finalist and 2014 finalist.

- **The Open & Agile Smart Cities initiative (OASC)** (<http://www.oascities.org/>) is a city-driven, non-profit organisation which overall objective is to create a Smart City market by the use of a shared set of methods to develop systems and make them interoperable across a single city as well as between multiple cities. There is a list of cities available who have officially joined the Open & Agile Smart Cities initiative.
- **The Ellen MacArthur Foundation** (<https://www.ellenmacarthurfoundation.org/>). The Circular Cities Network offers a knowledge exchange platform for pioneering cities which are embedding circular economy into their urban operations Participation is by invitation only, based on a peer-referral scheme.
- **ICLEI - Local Governments for Sustainability** (<http://www.iclei.org/>) is the leading global network of more than 1,500 cities, towns and regions committed to building a sustainable future. ICLEI members, case stories and case studies were collected.
- **Eltis** facilitates the exchange of information, knowledge and experiences in the field of sustainable urban mobility in Europe. It is aimed at individuals working in transport as well as in related disciplines, including urban and regional development, health, energy and environmental sciences. Eltis is now Europe's main observatory on urban mobility. Eltis city database provides the names of cities involved in ongoing and completed EU-supported SUMP projects and initiatives and provides a web-links to cities urban mobility and transport plan matching our size classification. There are also 1474 case studies but these were not included into analysis.
- **C40 Cities Climate Leadership Group** (<http://www.c40.org/>) is a network of the world's megacities committed to addressing climate change. C40 brings together a unique set of assets and creates a shared sense of purpose. C40 offers cities an effective forum where they can collaborate, share knowledge and drive meaningful, measurable and sustainable action on climate change. The C40 Cities Awards are granted in 10 categories and provide global recognition for cities that are demonstrating climate action leadership. Award winners from 2013 to 2016 and finalist from 2014 to 2016 were identified resulting. C40 cities are also publishing case studies but at these were not included into analysed.
- **EUROCITIES** (<http://www.eurocities.eu/>) is the network of major European cities where members are the elected local and municipal governments of major European cities. Through the following six thematic areas, a wide range of working groups, projects, activities and events, EURO CITIES offer members a platform for sharing knowledge and exchanging ideas: culture, economy, environment, knowledge society, mobility, social affairs and cooperation.
- **European Network of Living Labs (ENoLL)** (<http://openlivinglabs.eu/>) is the international federation of benchmarked Living Labs in Europe and worldwide. The list of ENoLL's effective members, associated members and adherent Members were used identify Living Lab locations and their thematic areas. The Living Lab age in years, the number of different Living Labs and different thematic areas were used as indicators.

9.4 Appendix 4: Keywords for Circular Economy dimensions

Sustainable use of resources, natural and cultural capital (CE_RESOURCE_MGMT)

Search words: Natural risks, flooding, landslides, water quality, air quality, carbon emission, carbon footprint, biosphere, atmosphere, agriculture, crop monitoring, crop identification, yield assessment, water resource, water service, water management, environmental monitoring, Earth observation, urbanization management, sustainability science, environmental management, energy optimisation, energy supply, grid management, biodiversity, carbon footprint, system-level optimisation, energy performance, environmental performance, metering architecture, material flows, energy demand, energy balance, urban metabolism, organic matter, metabolic analysis, urban metabolism, flow analysis, material flow, energy flow, footprint, circular economy, linear economy, material flow, forest monitoring, metabolic circulation, waste management, waste water, solid waste, biowaste, wood waste, waste management cycle, wheat straw, energy waste, plastic waste, metals, cellulose nanofibers, waste treatment, bulky waste, recycled component, recycled paper, waste as a resource, recycled product, energy strategy, energy planning, post-carbon cities, Sustainable Energy Action Plan, waste prevention, wastewater treatment plants, circular value chain, urban decision making, distributed energy generation, smart grids, smart grid development, distributed energy resource, decentralized renewable energy, distribution system operator, distributed electricity generation, energy efficiency, energy reduction, carbon emissions reduction, urban ecological footprint, energy trading, electrical power systems, Wind Turbine, wind power, heat pump, WindTree, distributed solar photovoltaic, environment energy, marine energy, renewable energy, energy-efficient solution, renewable energy production, hybrid, future energy, bio energy, non-renewable energy, cultural landscape

Circular mobility (CE_MOBILITY)

Search words: driver behaviour, movements of passengers, cycling; biking, bike, head protection, bicycle, hydrogen fuel cell car, electric vehicles; electromobility, electrical vehicles, Electric L-category Vehicles, ICE car, motor vehicle, car-pooling, green vehicle, Electric Vehicle Mobility, fuel cell vehicle, hybrid fuel cell (for bus), Solar Photovoltaic; bus roof, city bus, direct-drive in-wheel electric powertrain system, heavy duty vehicles, new mobility concept, vehicle concept, dynamic traffic model, multimodal traffic, mobility service, sustainable mobility, affordable mobility, personal mobility, vehicle concept, spatial information, Urban Mobility Plans, transport research, accessibility, route planning, transport, E-mobility, mobility market, logistics market, multi-modal, fleet management system, traffic control, public transport systems, intelligent mobility, mobility system, multi-modal hub, road transport system, traffic flow, urban commutes, public transport, Hydrogen cell technology, fuel cell technology, solar photovoltaic, on-road charging, logistics, city logistics, port logistics, port city, port cities, fluvial transport, maritime transport, roman port, airline

Resource efficient buildings and urban spaces (CE_BUILT_ENVIRONMENT)

Search words: buildings; Urban Security; facility management; land-use; refurbishment, deep renovation, building performance; temperature fluctuation, techno-economical, multi-family house, commercial building; green spaces, hazard designation, public housing, private housing, residential building, building stock, zero energy, urban canyons, prefabricated module, windows, insulation material, industrial building, in-house; furniture, green roofs, roof coverage, building concentrator, households, heat pump, air pump, heating, ventilation, lighting, cooling, air conditioning, store heat, release heat, hot water, lighting system, MV/LV, smart plug equipment, city district, industrial parks, district refurbishment, district renovations, sustainability of district, zero/low energy district, zero/low energy house, integrated infrastructure, district energy efficient, district heating, low energy district, district scale, innovative district, solar photovoltaic; phase change materials, Integrated Roof Wind Energy System, solar panel, hybrid photovoltaic, solar panels, modular bioreactor-wall, a solar tile system, Li-ion batteries, Data Centre

9.5 Appendix 5: meeting of CEMR extraordinary expert group on circular economy final report



Council of European Municipalities and Regions
European Section of United Cities and Local Governments
AG / 20170616

Meeting of CEMR extraordinary expert group on circular economy

Tuesday 27th June, 14:00-17:00, CEMR, Square de Meeûs 1, Brussels

Registration [here](#)

Contact person: Axelle Griffon, Axelle.griffon@ccre-cemr.org, 0032.2.500.05.38

GUIDANCE DOCUMENT

Aim of the meeting

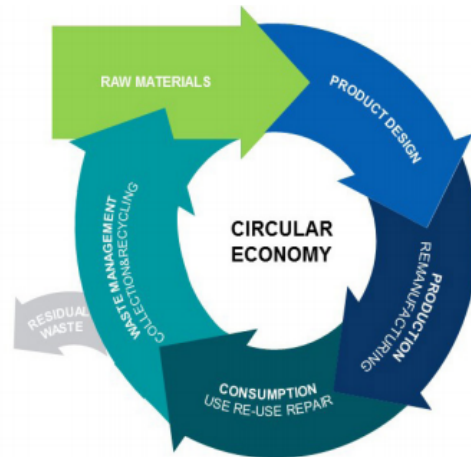
The purpose of this meeting is to further address the issue of the transition towards a circular economy at the local level and share expertise and knowledge and expertise in the field. It requires that we come to the meeting prepared, with good practices/challenges experienced in your country and that you contribute to the break-out sessions aiming at drafting policy recommendations.

Local governments and Circular economy: what is our contribution?

As discussed during our previous work on the circular economy package, the transition towards a circular economy is challenging, since the process involves players from different sectors, such as; the private sector which is the main actor for the design and production of materials; everyday consumers; and cities and regions as consumers and brokers of sustainable local economic models. It is also crucial to consider the collaboration with research and innovation center and existing Living Labs, in experimenting innovation processes such as new business models (ex: service and function based models). The **governance model** therefore needs to be designed accordingly, relying on innovative process for a wide consultation and cooperation with the relevant stakeholders

The diagram illustrates the key steps of the product lifecycle that need to be taken into account when designing new models towards a circular economy: (1) product design and production processes, (2) consumption, and (3) waste management.

- *During the expert group meeting, we will hear about successful examples in each of these steps and whether innovative solutions were adopted. We will then discuss within 3 break-out sessions the challenges met for the implementation and policy recommendations. Please prepare some relevant information to share your national experience.*



Group 1 : Product design and production

- Promote eco-design
- Cooperate with external stakeholders
- Encourage innovation
- Industrial symbiosis
- Building sustainable buildings

When it comes to the **product design stage**, local and regional authorities can lead by example in purchasing products and solutions that are resource-efficient and durable, can be easily repaired or upgraded and finally recycled or reused. This encourages the market to develop such solutions and makes them not only more accessible, but also more affordable for other actors. Looking further at the **production stage**, cities and regions can work with other stakeholders to promote sustainable sourcing of raw materials and different modes of resource circulation, such as industrial symbiosis, chemical leasing or remanufacturing.

Group 2 : Consumption

- Circular public procurement
- Encourage reuse and repair
- Waste prevention
- Sustainable food (reduce food waste, encourage urban farming...)

Local and regional authorities are also well positioned to actively influence **consumption patterns** of households, businesses and organisations. This might include education and awareness campaigns, promoting sharing economy approaches, as well as encouraging reuse and repair. Strategies aiming at local food consumption are also part of this process. But as consumers, local and regional authorities can also lead by the example by including circular economy considerations in their purchasing decisions by using green public procurement criteria and mechanisms such as pre-commercial procurement. In practice, this means assessing all costs related to the entire lifecycle of the product, including criteria related to maintenance, recycling and sustainable sourcing of raw materials.

Group 3 : Waste as a resource

- Value material flows (EPR, high quality recycling, biological treatment, energy recovery)
- Water reuse
- Urban resource efficiency

Finally, **waste collection and recycling** are two of the responsibilities most often associated with the municipal level. Improved waste collection can be a first step towards a circular economy but many cities and regions are also looking into extended producer responsibility or high-quality recycling and biological treatment of waste (e.g. bio-refining, composting or anaerobic digestion).

- *In each group you will :*
 - *Nominate a rapporteur*
 - *Discuss good practices from your country*
 - *Identify challenges in the implementation*
 - *Prepare 3 policy recommendations*
 - *Report in plenary*

How to finance the transition towards a circular economy at the local level?

The table below is a synthesis of the current funding instruments currently available for local authorities. However, as discussed in our previous expert group meeting, we pointed out in our position paper the need for adequate access to EU funds (and the importance of synergies among them) for all local governments to be able to finance the implementation of a circular economy.

Fund / Programme	Description of instrument
HORIZON 2020	<p>Cross-cutting call: 'Industry 2020 and the circular economy' EUR 650 million initiative supporting increasing resource efficiency through a systemic approach towards eco-innovation and the setting up of a circular economy.</p> <p>InnovFin (Upcoming) Previously only available to innovative industrial and technology enterprises, this instrument could also be used to support the transition to a more circular economy.</p>
LIFE	<p>The Multiannual work programme 2014-2017 focuses in part on supporting resource efficiency and green and circular economy by:</p> <ul style="list-style-type: none"> • Implementing the circular economy concept through actions spanning the value chain or ensuring the use of secondary resources/scrapped materials/wastes in other industries or value chains. • Promoting the take-up of circular business models and showcasing their benefits for SMEs.
COSME	<p>COSME helps address the competitiveness and sustainability of EU enterprises, promote entrepreneurship and improve access to finance and markets.</p>
European Structural and Investment Funds	<p>The European Regional Development Fund finances various programmes supporting EU regions' development:</p> <ul style="list-style-type: none"> • National/Regional Operational Programmes may support circular economy initiatives depending on the selected thematic objectives. • European Territorial Cooperation programmes support cross-border (Interreg A), transnational (Interreg B) and interregional cooperation (Interreg Europe) projects on the circular economy as well as Targeted Analyses projects (ESPON) and networking, sharing and capacity-building opportunities for cities (URBACT). URBACT will launch a call for good practices in December 2016 which will be followed by a call for transfer networks in mid-2017. ESPON has open invitations to submit proposals for Targeted Analyses throughout the year with bi-annual cut-off dates. Interreg Europe launches regular calls for project proposals. • Urban Innovative Actions is an Initiative of the European Commission promoting pilot projects in the field of sustainable urban development. The circular economy is one of the topics targeted by the 2nd call for proposals to be launched in November 2016.
European Investment Bank (EIB)	<p>The EIB is a major partner for circular economy investments in the EU. During the last 10 years EIB co-financed projects worth EUR 15 billion.</p> <p>The Natural Capital Financing Facility (NCFF) is an instrument that will support green investments, among others. A test phase is planned to last 3 to 4 years, starting in 2014.</p>

- *During the expert group, we would like to hear how your municipalities finance the transition towards circular economy (EU fundings, but also other sources like national, regional or local fundings)*

9.6 Appendix 6: meeting of CEMR extraordinary expert group on circular economy expert group findings



Council of European Municipalities and Regions
European Section of United Cities and Local Governments
AG / 20170614

Meeting of CEMR extraordinary expert group on circular economy

Tuesday 27th June

House of Municipalities and Regions

Square de Meeûs 1, Brussels

Contact person: Axelle Griffon, Axelle.griffon@ccre-cemr.org, 0032.2.500.05.38

MINUTES

1. Introduction

This expert group aimed at gathering good practices from the member associations in the field of circular economy and at discussing policy recommendations. The outcome of the meeting will feed the discussions on two ongoing actions at CEMR:

- Study “Cities as Living Labs”: this six-month study focuses on the way R&I funding and innovative solutions are combined with demand side instruments in “Living Labs” at city level analysing how cities act the transition to a circular economy.
- [Urban Agenda, thematic partnership on circular economy](#). This joint initiative of EC, Member States, cities and city networks to address urban challenges aims at achieving better knowledge, better regulation, better funding. There are 12 thematic partnerships, 1 is dedicated to circular economy. The selected themes are governance, urban resource management, circular business enablers and drivers, circular consumption. The coordinator of the circular economy partnership is Oslo, Norway. CEMR actively contributes to this 3 years work.

2. Maximise the benefits of circular economy, Jenny Koutsomarkou, URBACT

The [Policy brief](#) produced by ESPON, INTERACT, INTERREG EUROPE, URBACT (2016) shows how local & regional authorities can position themselves in the entire circle to maximise the benefits of circular economy.

It recommends:

- ✓ Local & regional authorities to act as initiators & facilitators of circular economy:
- ✓ Using clauses in public procurement
- ✓ Bringing together companies and engage them in circular economy
- ✓ Providing incentives (grants, tax relief) to companies willing to set up circular economy schemes
- ✓ Setting up ICT to make connections between companies, and between companies/products and consumers

3. The different stages of a local circular model introduced by the experts in plenary – introduction presentations with good practices.

- Product design and Production, Mrs Veerle Labeeuw, OVAM, Flanders
- Consumption and Circular Procurement, the exemple of Green Public Procurement of NAMRB
- Waste management, Alfred Krenn, city of Leoben, AT (energy recovery)

4. Break-out sessions on the policy recommendations

During the breakout sessions, the experts commented and discussed policy recommendations, based on the preliminary findings of the study Cities as Living Labs.

Innovation in Circular Economy requires a systemic approach. Cities must act as facilitators of a sustainable and **systemic approach** by stimulating co-creation, co-design and co-implementation with different actors and citizens at both the local and the international level. Evidence from this study has shown that the stakeholder composition, even at the simple Living Lab level, influences the typology of innovation that actors might undertake. Industrial ecosystems are very important in the innovation processes at urban level and for circular economy planning: see the case of Industrial Districts in the field of eco-design. Through careful **programme management**, backed up by **investments in shared resources** including urban observatories, datasets, models and living labs, the systemic approach will ensure that the whole is greater than the sum of its parts; that outcomes from research projects and the methods employed in realizing them are **mutually informative**. However, a successful transition to circular economy requires not only a top-down approach instigated by public authorities, but also to identify and apply **new ways of voluntary (formal and informal) cooperation** between public authorities and other local circular stakeholders such as citizens, businesses (commerce and industry), media, academia, educational institutions and organisations of civil society (NGOs). The large number of different stakeholders, and the individual interests and interactions between them makes the Circular Governance in a city quite complex: this calls for the **need to take a more systematic approach in identifying governance barriers, enablers and actions to promote the transition to circular economies at the city level.**

Need to promote new business models and alternative sources of funding at city level. In order to finance sustainable and innovative urban transition, conventional business models and centralised state provisions may be outmoded; alternative, more inclusive and more resilient models may be required. The new models may include **cooperatives, public-private partnerships, and crowd-funding**; furthermore, in case where significant public investments require compromises

elsewhere, **new forms of public engagement** and **co-productive practices – social innovation** – may be required. Also, there is a common need of understanding under which circumstances municipalities and private enterprises can engage in close and effective collaborative practices and how these practices can be best encouraged and facilitated, and of the new viable forms of business model that include civil society (e.g., forms of crowd-funding in which civil society co-funds and co-creates urban development and infrastructures). Moreover, there is a need to understanding to what extent business models can be **vertically inclusive**, involving state (national and / or regional or city scale), private institutions and citizens, and to what extent **regulation** and **policy support** can incentivize these practices.

Importance of targeting transversal and holistic approaches in funding Programmes. From the city perspective, it is important to **reduce the fragmentation in funding, research and urban development programmes**, as this is an obstacle to build critical mass to realize urban transitions, and can be a cause of the spreading of actors at urban Level and the absence of a systemic approach. In the majority of cases, Municipalities tend to combine EU funds with resources coming from the National, Regional (sometimes with ESIF funds) or the private level. The overarching principle of a new R&I Programme shall be therefore the alignment and coordination of regional, national and European research, technological development and innovation in the field of urban development. The findings of this study are in favor of supporting an ambitious **longitudinal research programme** that is focused on the development and application of methodologies supporting the definition and measurement of urban sustainability and the establishment of transition targets and strategies to achieve them.

Improved coordination across multiple levels of government. The idea of a circular economy is to generate a systemic change, rather than an incremental change of current practices. Cities and regions have experience in integrating different policy domains in their practices, e.g. by ensuring **collaboration between the different policy domains and actors**. In the course of this study we have seen that a strategic framework at regional level empowers the strategy at city level as well (case of Manresa, Catalunya). **Multilevel governance** is crucial also in facilitating innovative best practices able to activate the circular transition, as well as by encouraging a continuous alignment with national and institutional research programmes, to build European urban research, technology and innovation capacity, and European solutions to address global urban challenges (case of Lisbon and its strategic framework). But it is also crucial within the single Municipality, where there is often a fragmentation that causes ‘silos policy approach’. **Cities need to appoint specific coordinating structures** within the Municipality that shall be in charge of both coordinating the implementation of activities and processes, facilitating the dialogue with all the different stakeholders, and at the same time overseeing the respect of the circular principles adopted. In order to build strong partnership, the **concept of circular economy strategy needs to be defined and aligned** at all different levels of cooperation.

Circular regulation and a more structured framework of incentives. It is important to acknowledge that more empowered local authorities can best finance the delivery of their plans through regulation, taxation, levies, land readjustment policies and through planning gains. Regulation is an important driver for innovation: in order to promote innovation for circular economy options driven by legislations, careful implementation with dynamic goals that reflect the current state of the art is required. For example, a sound regulation must be put in place for the implementation of circular procurement, which is a powerful mean for cities have to push the economy towards a more sustainable direction within their public schools, health care institutions, and city hall administration. The eligibility criteria, taking into account the whole life-cycle of the product must be transparent and objective. Thus, continuity and predictability in legislations is an important factor for the promotion of innovations.

Role of capacity building and knowledge sharing crucial at city level in fostering innovation processes. The study reveals that good practices exist in cities of various scales. The upscaling and the replicability of these projects needs to be strengthened, through peer-to-peer learning or similar exchanges at the city level. EU funding programs such as FP7 and Horizon2020 can particularly address this issue in the next programming period. Other financing instruments such as the cohesion policy would also be useful to enhance training and exchanges on the innovative circular economy strategies. At the same time, we noticed in the case of Manresa that a small-size city can benefit from the proximity of a capital city that is sharing knowledge and disseminating results. In order to replicate this at a larger scale, the question of the communication on the projects outcome at the EU level also needs to be tackled, taking into account the language capacities of the cities. In this perspective, we observed that **the creation of open data sources and digitalization also favors the inclusion of actors and enables co-creation processes and innovation**

Circular development monitoring and reporting in a formal framework of action. First of all, in the course of this study it has been discovered that, as Circular Economy is still an emerging theme, there is a need for a **common definition of that to be used and disseminated by Cities**. Secondly, there is a need, at city level, to support stakeholders in **translating specific strategies into actionable implementation plans and associated financing strategies**, in order to favor the transition of cities along the pathway from current to target states. This co-creative transdisciplinary process should also incorporate **plans to monitor the effectiveness of implemented transition strategies; socially, economically and environmentally**. An city-based initiative promoting a common governance and monitoring model – similar to the one implemented in the framework of the Global Covenant of Mayors for Climate and Energy – can provide cities with the knowledge and evidence needed for **taking informed decisions** on investments into key urban infrastructure as well as for policy-making, planning and land use management affecting the urban environment. **A key aspect to making the circular economy a reality will be building knowledge, monitoring progress and making sure policy makers have the understanding, data and information they need** to help guide the development of supportive and flexible policies.

Long Term perspective very important in innovative Urban Circular Economy planning. The case studies show that the impact of the Research and Innovation projects can be expected after the duration of the project. Long-term commitment is required for the transition towards innovative strategies at the local level. The political endorsement in the long term is also crucial for a comprehensive and continuous implementation of the strategy. Practically, it means that the objectives of the transition towards a circular economy in the cities need to be included in the political city strategy (such as Agenda 21) to trigger the long term cooperation of all stakeholders in the field.

9.7 Appendix 7: The list of ENoLL members focusing on “Smart cities & regions”, “Energy” or “Mobility” themes

Country	City	Living Lab name	Year of joining ENoLL	Smart cities & Regions	Energy	Mobility
AT	Graz	CityLAB Graz	2015	1		
BE	Ghent	iLaB.o	2007	1	1	
BE	Ghent	Ghent Living Lab ONLINE buurten / ONLINE	2011	1	1	1
BE	Bruges	neighbourhoods Living Lab De	2015	1		
BE	Hasselt	Andere Markt (DAM)	2016	1		
HR	Rijeka	Rijeka iLivingLab Digital Urban Living Lab (DULL)	2010	1	1	1
DK	Aarhus	DOLL - Danish Outdoor Lighting Lab	2011	1	1	
DK	Copenhagen	ENERGY & WATER – Greater Copenhagen Living Lab	2015	1	1	1
DK	Copenhagen	Smart City Lab	2016	1		
EE	Tartu	Helsinki Living Lab - Forum Virium	2015	1	1	
FI	Helsinki	Helsinki Living Lab for Well- being and ICT (TWICT)	2007	1		
FI	Turku Sophia		2010	1		
FR	Antipolis	LL ICT Usage Lab	2007	1		
FR	Paris	3D Living Innovation Issy-les-Moulineaux	2009	1		1
FR	Moulineaux	Medialand Lorraine Smart Cities	2009	1		
FR	Nancy	Living Lab	2010	1		
FR	Doue	Brie'Nov	2012	1		
FR	Paris	Smart City Living Lab Silver Normandie	2012	1		
FR	Colombelles	Hub	2014	1		
FR	Saint Quentin	Faubourg Numérique	2016	1		
FR	Urrugne	OCEAN LIVING LAB PRAXLABS: Creating innovative technologies in practice	2016	1		
DE	Siegen		2010		1	

IE	Dundalk	CASALA Living Lab	2011	1	1	
IE	Limerick	Adaptive Governance Lab (AGL)	2016	1		1
IT	Palermo	TLL - Territorial Living Lab for the Sicilian Region	2008	1		
IT	Trento	Trentino as a Lab	2008	1		
IT	Turin	Living Piemonte Research Innovation Centre	2009	1	1	
IT	Roma	ICT Laboratory for the Public Administration (LabICT-PA)	2010	1		
IT	Bologna		2011	1		
IT	Aosta	ValléeLab City of the Future	2012	1	1	
IT	Milan	Living Lab	2012	1	1	
IT	Lecce	Puglia Smart Lab	2013	1		
IT	Treviso	Green Schools Apulian ICT Living Lab	2014		1	
IT	Bari		2015		1	1
IT	Lecce	Formedil Lab Apulian Living Lab on "Healthy, Active & Assisted Living" (INNOVAALab)	2015	1	1	
IT	Lecce		2015	1		
LU	Esch sur Alzette	Technoport Living Lab Luxembourg	2013	1		
NL	Eindhoven	Eindhoven Living Lab Care Innovation	2014	1	1	1
NL	Roosendaal	Center West-Brabant Urban Management - Fieldlabs	2014	1		1
NL	Amsterdam		2016		1	
PL	Poznan	Poznan Living Lab KRAKOW LIVING LAB	2013	1		
PL	Krakow		2015	1		
PT	Lisbon	RENER Living Lab	2008		1	
PT	Águeda	Lighting Living Lab Smart Rural Living Lab	2009		1	
PT	Penela		2010	1		
PT	Lisbon	Network of creative Living Lab s (Crealab)	2015	1		
PT	Seia	SMoLL - Smart Seia Mountains Living Lab	2015	1		
SL	Ptuj	E-zavod Living Lab i2Cat Catalonia	2011		1	
ES	Barcelona	Digital Lab	2007	1		1

ES	Donostia-San Sebastian	Mobility for sustainable territories – Mobility Lab	2011		1	1
ES	Bilbao	Comercios Innovadores de Bilbao (Bilbao Innovative Retailers)	2011	1		
ES	Castellon de la Plana	espaitec Living Lab (eLiving Lab)	2011	1		
ES	Donostia-San Sebastian	Bird Living Lab	2011		1	
ES	Santander	IoT Smart Santander Living Lab	2012	1		
ES	Barcelona	Barcelona Laboratori UAB Smart and Sustainable Campus	2013	1		
ES	Barcelona	Living Lab	2014	1	1	1
ES	Valencia	EVOMOBILE	2014	1		1
ES	Jaén	Living Lab Social in real environment	2015	1		
SE	Luleå	Botnia Living Lab	2007	1	1	
SE	Gothenburg	The Swedish Living Lab on Vehicle and Transport ICT	2009	1		
SE	Växjö	Småland Living Lab	2016	1	1	1
CH	Sierre	Energy Living Lab	2014		1	
TR	Basaksehir	Basaksehir Living Lab	2012	1	1	
TR	Eskişehir	Eliminating Barriers Living Lab (EBLL) Manchester Living Lab	2016	1	1	
UK	Manchester	Lab	2007	1		
UK	Coventry	City Lab Coventry	2011	1	1	1
UK	Manchester	Manchester Digital Innovation Living Lab	2014	1		
UK	Sheffield	Lab4Living	2014	1		
UK	Glasgow	City Observatory	2015	1	1	

9.8 Appendix 8: FP7, H2020 and Interreg projects on Circular Economy

FP7 projects on Circular Economy

1) ARTS, 2) BEAMS, 3) BUPESA, 4) CAP4ACCESS, 5) CI-ENERGY, 6) CitInES, 7) CITYFIED, 8) CLIMATENIGHT2012, 9) DC4Cities, 10) DoF, 11) eCOMPASS, 12) EE-HIGHRISE, 13) ELMO`S, 14) FABRIC, 15) FASUDIR, 16) FUTRA2013, 17) FUTURE-CITIES, 18) GEYSER, 19) GREEN SURGE, 20) H2MOVES SCANDINAVIA, 21) HIGH V.LO-CITY, 22) IDE4L, 23) MECHANICITY, 24) Mobility2.0, 25) MODUM, 26) MOVESMART, 27) MoveUs, 28) NEXT-BUILDINGS, 29) OPERAS, 30) PATHWAYS, 31) PITAGORAS, 32) POCACITO, 33) REDUCTION, 34) SINFONIA, 35) STEP-UP, 36) SUNSET, 37) SUPERHUB, 38) SWIP, 39) TURAS, 40) FIREBALL, 41) CityPulse, 42) EURO-URHIS 2, 43) ROMP, 44) SmartSantander, 45) URBAN CRIMINOLOGY

H2020 projects on Circular Economy

1) BERTIM, 2) CEPPI 2, 3) CHESS-SETUP, 4) CIPTEC, 5) CITYLAB, 6) DOMINO, 7) ELINKKER, 8) EMPOWER, 9) FESTIVAL, 10) FLEXMETER, 11) FORCE, 12) Ground Truth 2.0, 13) GrowSmarter, 14) IRWES, 15) iSCAPE, 16) OptEEemAL, 17) PORTIS, 18) REPAiR, 19) SmartEnCity, 20) SMARTER TOGETHER, 21) SMART-Plant, 22) SocialCar, 23) Triangulum, 24) URBAN LEARNING, 25) Urban_Wins, 26) URBANREC, 27) UrBAN-WASTE, 28) Waste4Think, 29) SELECT for Cities, 30) BigClouT, 31) FINEST TWINS, 32) PULSE

Interreg projects on Circular Economy

Environmental Sustainability as a main focus

1) Periurban Parks - Improving Environmental Conditions in Suburban Areas, 2) Regional Strategies for Disaster Prevention, 3) Regional administration of lake restoration initiatives, 4) TRansferring Actions iN Sustainable mobility For European Regions, 5) Forms for: Adapting to Climate Change through Territorial Strategies!, 6) HISTorical assets and related landsCAPE, 7) External Costs of Transport and Land Equalisation, 8) Sustainable Urban Mobility, 9) Green and Blue Space Adaptation for Urban Areas and Eco Towns, 10) Multi-modal Innovation for Sustainable Maritime & Hinterland Transport Structures, 11) Culture and Heritage Added value to Regional policies for Tourism Sustainability, 12) Network of STRAits, 13) Regions using ECO-Management for eco-innovation Development, 14) Integrated Measures for an Energy Efficiency Approach, 15) Sustainable Urban Goods logistics Achieved by Regional and local policies, 16) Regional cooperation towards adaptation to climate change, 17) Mitigating Spatial Relevant Risks in European Regions and Towns, 18) Cooperating 2 Foster Renewables and Energy Efficiency, 19) Regional Strategies for Energy Conscious Communities, 20) MORE4NRG, 21) Regions for Climate Protection: toward Governance, from Knowledge to Action, 22) Proactive Human Response to Wildfires Outbreak: Measure and Prepare for it, 23) European Forest Fire Monitoring using Information Systems, 24) ECOREGIONS, 25) Green Infrastructure Network, 26) Surpassing Energy Targets through Efficient Public Buildings, 27) Public Lighting Strategies for Sustainable Urban Spaces, 28) Sustainable use of former and abandoned landfills network for you, 29) Brownfield Policy Improvement Task Force, 30) Corporate Social and Environmental Responsibility through Public Policy, 31) IMAGINE Low Energy Cities, 32)

Developing Sustainable Regions through Responsible SMEs, 33) Decarbonated Airport Regions, 34) Assessing sustainability and strengthening operational policy, 35) From detached Lisbon and Gothenburg Strategies to a regionalised indigenous EU 2020, 36) Improve the effectiveness of waste prevention policies in EU territories, 37) Regions for Recycling, 38) Cooperative approaches to transport challenges in Metropolitan Regions, 39) Mobility Management oVer Europe: Changing Mobility Patterns, 40) Waste to Energy, 41) Green IT Network Europe, 42) REgional exchanges and policy making for protecting and valorising biodiVERSity in Europe, 43) Geothermal energy to address energy performance strategies in residential and industrial buildings, 44) Waterways Forward, 45) Policy and Public-Private Partnerships for Offshore Wind EneRgy, 46) Cleantech Incubation Europe, 47) Sustainable InteGral Management Approaches for Water areas, 48) Zero-Impact Cultural Heritage Event Network, 49) Regions for ITS solutions Network, 50) Network of European Delta Regions - Sustainable Delta Governance, 51) European cities for integrating cycling within sustainable mobility management schemes, 52) Sustainable Use of Regional Funds for Nature, 53) Green management plans for European urban and peri-urban Landscapes, 54) Cradle to Cradle Network, 55) Sustainable flood management strategies for cross border river basins, 56) Apply participatory forest planning for sustainability: Robinwood Plus, 57) Capitalising on Partner Initiatives in Mobility Management Services, 58) MOVE ON GREEN, 59) Common Information to European Air, 60) Improving Communities' Sustainable Energy Policy Tools, 61) Innovative sustainable development policies and strategies for the effective safeguarding and innovative enhancement of European "UNESCO World heritage" wine growing landscapes, 62) Water scarcity and droughts; coordinated actions in European regions, 63) Common Land for sustainable management, 64) Regional policy instruments and approaches for improving access to finance and speeding up investments in sustainable energy., 65) Climate Neutral Urban Districts in Europe, 66) Renewable Energies Transfer System, 67) Involving the private sector in Mobility Management, 68) POWER, 69) Renewable Energy Regions Network, 70) Regions for Sustainable Change.

Environmental Sustainability positive projects

1) "COMPLEX CHALLENGES, INNOVATIVE CITIES", 2) Flexible Transport Services and ICT platform for Eco-Mobility in urban and rural European areas, 3) European model for Public Transport Authority as a key factor leading to transport sustainability., 4) Peer Reviews for Sustainable Eco-Regions via Europe, 5) ORGANZA - Network of Medium Sized Creative Cities, 6) IMPLEMENTING MODI, 7) CREATIVE REGIONS, 8) Entrepreneurial Diversity, 9) Human capital and innovation: employment policies in local and regional innovation networks for talent attraction and better job opportunities, 10) Fire Risk Prevention and Improvement of the Fire Extinction Systems of the Historic Town Centers of Cities named Word Heritage, 11) Public Policies and Instruments in Support of Creative Industries, 12) Atelier European Fortresses - Powering Local Sustainable Development, 13) INNOvating entrepreneurship policies in the CRAFTS sector, 14) Promoting Innovation and the Knowledge Economy, 15) DIGITAL CITIES: A network for rapid and sustainable ICT regional adoption, 16) Disseminating Innovative STRategles for Capitalization of Targeted Good Practices, 17) Regional Policy Improvement for Financially Sustainable Creative Incubator Units, 18) Deploying the added value of water in local and regional development, 19) Public policies And Social Enterprises, 20) Information Society Policies for Sustainable

European Economic Development, 21) Capital regions integrating collective transport for increased energy efficiency, 22) Clusters & Cities Network, 23) Creative Industries in Traditional Intercultural Spaces, 24) Hybrid Parks: Combining abilities, creating synergies and enhancing the performance of parks for sustainable local and regional development policies, 25) REgional policies towards GREEN buildings, 26) Regional Policies for Information Society & ICT development in the audiovisual sector, 27) Nanotechnology for Market, 28) Effective Technology Transfer in Biotechnology, 29) Sharing Interregional knowledge to define Supporting Programmes for Young SMEs, 30) Policy Learning in Information Technologies for Public Transport Enhancement, 31) Geomatics Rural Information Society Initiative PLUS, 32) Improvement the effectiveness of regional development policies in eco-INNOvation for smart hOme and independent liVing to increase the quality of life of Aging people, 33) European Cultural Routes - Transfer Experiences, Share Solutions, 34) Developing Senior Tourism in Remote Regions, 35) Interregional cooperation for competitive and sustainable regional food industries, 36) WOMEN IN NET 8, 37) Policy Learning to Unlock Skills in the TEXtile sector, 38) Consortium for Assistive Solutions Adoption, 39) European River Corridor Improvement Plans, 40) Innovation Policy in University City Regions, 41) OBSERVATORY ON STATE AID IMPACT, 42) The role and involvement of local authorities in employment rate increase, 43) To promote and support entrepreneurship to create new SMEs, 44) Transfer Of Knowledge - Transfer Of Human Capital, 45) Clusters for European Innovation Cross-Linking, 46) Boosting European Games Industry, 47) Promotion of Open Specifications and Standards in Europe, 48) Innovative Concept of Eco-accommodation approach in rural Regions: Public support policies for eco-investors, 49) Gender4Growth, 50) Business to Nature - Interregional Approach to SMEs and Entrepreneurship Policies in Natural Areas, 51) Regions for Better Broadband connection, 52) Measuring INnovation among EURopean Subregions, 53) Enhancing 'Next Generation Access' Growth in Europe, 54) Observatory Network to Enhance ICT Structural Funds Absorption, 55) Smart Work Centres in Non-Metropolitan areas, 56) Producer Services for European Sustainability and Competitiveness, 57) Interregional Partnership Platform, 58) Knowledge Network Management in Technology Parks, 59) University Collaboration in Regional Development Spaces, 60) Mechanism for Enhancement of Synergy and Sustainability among Enterprises, 61) Funding Policies to bring Innovation to Finance/market/people, 62) Policies Against Depopulation in Mountain Areas, 63) INNOVATION FOR SOCIETAL CHANGE, 64) Digital Agenda for New Tourism Approach in European Rural and Mountain Areas, 65) Regional Telemedicine Forum, 66) Common methodology for the implementation of Digital Local Agenda and its impact on regional digital policies, 67) EUROPEAN SCREEN DESTINATIONS, 68) RURALAND: RURAL DEVELOPMENT PLAYERS.

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Summary

Aim of the study. From innovation system and policy development point of view, it is vital to understand the impact and added value of EU-funded projects especially in context of the complex societal challenges such as circular economy in cities. By definition Circular Economy (CE) promotes resource minimisation and the adoption of cleaner technologies while maintaining the value of products, materials and resources in the economy for as long as possible and minimizing waste generation. Living Lab (LL) is an open innovation ecosystem based on a systematic user co-creation approach that integrates public and private, research and innovation activities in communities, placing citizens at the centre of innovation with the help of various approaches, instruments, methods, and tools.

By using publically available data sources and case studies the aim of this study is:

- A) to evaluate how cities have elaborated and implemented urban strategies in context of following three circular economy (CE) dimensions: 1) sustainable use of resources, natural and cultural capital, 2) circular mobility and 3) resource efficient buildings and urban spaces and
- B) to describe if and how the cities mobilise and interact with the various system innovation (SI) dimension including the Living Labs and
- C) relating to A and B get a better understanding of the impact of EU funding especially from Horizon 2020 and the 7th Framework Programme projects focusing on circular economy at city-level in context of Living Labs.

