Strumenti innovativi di politica locale per l'innovazione sostenibile: benchmarking delle best practices globali

di Massimiliano Mazzanti[*], Arianna Pegoraro[†], Carlos Tapia[‡]

Sommario

Per affrontare le minacce derivanti dal cambiamento climatico, i leader politici hanno sviluppato un'agenda per lo sviluppo sostenibile e incentivano la diffusione di innovazioni ambientali. Questo lavoro studia come strumenti di politica e approcci innovativi per lo sviluppo sostenibile sono implementati con successo a livello locale. I risultati indicano che il principale fattore abilitante è la collaborazione tra diversi stakeholder. Altri fattori sono la presenza di formazione iniziale e continua, lo sviluppo di campagne pubblicitarie, l'impegno dei governi e un approccio aperto nei confronti delle pratiche innovative sostenibili.

Parole chiave: innovazione ambientale, sviluppo sostenibile, policy

Innovative local policy instruments enabling sustainable innovation: benchmarking worldwide best practices

Abstract

In order to tackle climate change related threats, international policy leaders developed an agenda for sustainable development and try to boost the dissemination of eco-innovations. This work investigates how innovative policy instruments and approaches enabling innovation for sustainable development are successfully implemented at the local level. Results show that the main enabler is strong collaboration among the different stakeholders. Other enabling factors are the presence of initial and ongoing training, the development of an advertising campaign and the government's commitment and open approach towards innovative sustainable practices.

Keywords: Eco-innovation, Sustainable development, Policy instrument

[*] Università di Ferrara; SEEDS, Italia. E-mail: massimiliano.mazzanti@unife.it

[†] Università di Ferrara, Italia. E-mail: arianna.pegoraro@student.unife.it

[‡] Tecnalia, Bilbao, Spagna; Nordregio, Stoccolma, Svezia. E-mail: carlos.tapia@nordregio.org

1. Introduction

It is evident nowadays that environmental problems such as water, air and soil pollution, resource depletion, biodiversity loss and climate change call for a global shift towards sustainability. This is a broad concept that includes not only the environmental sphere, but also the social and economic perspectives. These three aspects are considered the three pillars of sustainability, also referred to as the triple bottom line: 'planet, people and profit'. These three concepts are systematically interlinked: they affect and reinforce each other through mutual causality and positive feedbacks (Geissdoerfer, Savaget, Bocken, & Hultink, 2017).

Sustainability challenges materialize in different ways across the various geographical scales. In a globalized and increasingly urbanized world, cities can be considered 'hotspots of sustainability'. Even if cities cover just 3% of the planet's surface, they shelter more than half of world's population, generate more than 80% of global GDP, accounting for 60-80% of energy consumption and 75% of the planet's carbon emissions (United Nations, 2019). Cities themselves are confronted to a range of environmental, social and health issues, such as pollution, traffic congestion, as well as various forms of social, cultural, political, spatial and environmental segregation stemming from unsustainable development pathways (United Nations, 2015). These trends are not expected to change in the mid-term. Virtually all the population growth expected in the XXI century will in fact take place in urban and peri-urban areas (United Nations, 2018b).

Hence, as drivers of global change, cities and local communities have a tremendous responsibility to tackle major sustainability challenges. As outlined by Sustainable Development Goal (SDG) 11, local decision makers shall strive for the adoption of policies and strategies that can contribute to reconcile socio-economic development and economic resilience with environmental sustainability. This calls for the promotion of various forms of eco-innovation. According to the European Commission, an innovation can be defined as eco-innovation if it "makes progress towards the goal of sustainable development by reducing impacts on the environment, increasing resilience to environmental pressures or using natural resources more efficiently and responsibly" (European Commission, 2018b).

Still, the specific mechanisms and tools by which local authorities can promote the spread of eco-innovations at the local level are far from being

established. Previous studies have stressed the need for additional research on how local policies can contribute to design effective instruments for the adoption of eco-innovations in all its forms and expressions (see e.g. Jang et al. 2015; Von Malmbor, 2007). This work takes up this challenge by focusing on the implementation of policy instruments enabling innovation for sustainable development at the local level. Our main research question is how innovative sustainable policy instruments need to be applied in practice to succeed in delivering on sustainability priorities. To answer this question, we reflect upon the enabling conditions, challenges and implementation barriers that local policy instruments enabling sustainable innovation face in practice.

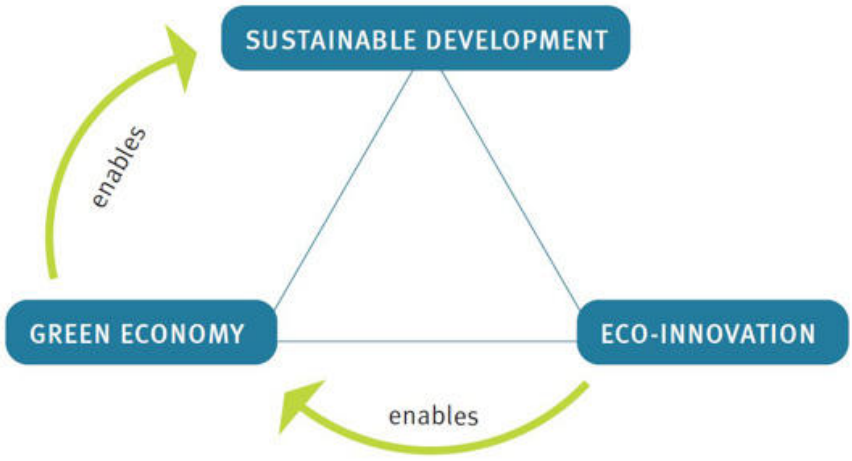
2. Innovation for sustainable development: conceptualization and international agenda

The most spread definition of sustainable development, which was proposed by the Brundtland Commission in 1987, presents it as a type of development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 43). Hence, in order to achieve sustainable development, the economy needs to operate within the absorption capacity of ecological systems. This requires deep transformations in the way in which the economy operates or, better said, innovations that allow producing the same amount of services at lower environmental and social costs. Hence, the concept of sustainable development can be naturally connected to the notions of green economy and eco-innovation. Eco-innovation can be considered an enabler for a greener economy to the same extent that a green economy is an enabler of sustainable development (Inno4sd.net, 2018).

It could be claimed that without eco-innovation sustainable development could not be materialized. In fact, eco-innovations are regarded as a "driving force within sustainable development" (Kanda, Hjelm, & Bienkowska, 2014, p. 1) or as a "fundamental lever towards sustainable transition" (EEA, 2012). For this reason, policy makers have focused on promoting eco-innovations considered "as very real economic multipliers" (Montalvo, López, & Brandes, 2011). In fact, they can contribute to reducing environmental threats such as climate change and resource scarcity and at the same time to boost economic development (Montalvo et al., 2011). In other words, environmental innovations can lead to a 'win-win' situation resulting in both economic and environmental

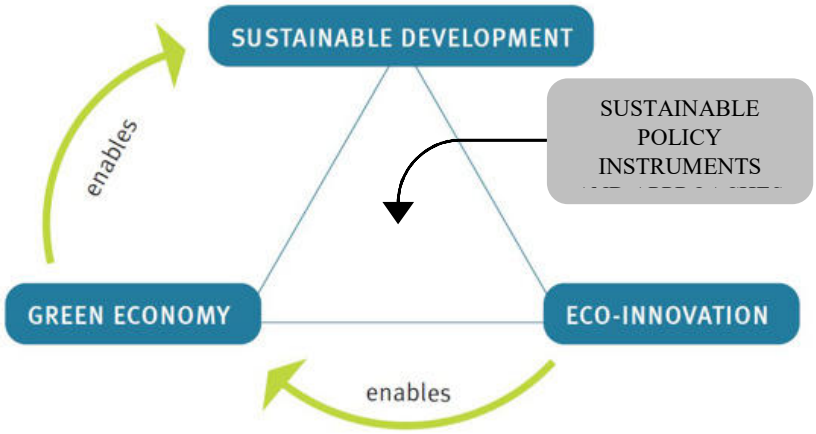
gains due to the positive spillovers associated with the internalization of negative environmental effects (Horbach, 2008, p. 163).

Fig. 1: The triangle between eco-innovation, green economy and sustainable development. Source: Inno4sd.net, 2018



In the innovation and diffusion phase, eco-innovations are hindered by market failures as businesses developing eco-innovations have to bear the related costs while the environmental gains are society wide. In this context, external actors such as governmental institutions have the important role of supporting businesses in tackling these challenges and enabling the dissemination of eco-innovations (Montalvo et al., 2011). Studies show that the enablers of eco-innovations can be both internal to the business including for example training activities and external such as policy levers and cooperation with other actors (Antonioli, Borghesi, & Mazzanti, 2016). Taking into consideration these thoughts, the triangle shown in Figure 1 can be revised considering also the policy sphere enabling eco-innovations (Figure 2).
In the following sections, the terms “innovation for sustainable development” or “sustainable innovation” have been often preferred to “eco-innovation” for their wider scope.

Fig. 2: The revised triangle enabling sustainable development. Source: Inno4sd.net, 2018.



2.1. An overview of international agendas for sustainable development

In Europe, the formalization of eco-innovation as a building block contributing to the sustainability agenda was set by the European Commission in 2011 with the adoption of the Eco-innovation Action Plan (EcoAp). The EcoAp was designed to boost the adoption and diffusion of eco-innovations in in Europe's economy. The Plan included actions on policy and legislation, as well as research and financial instruments, promoting a partnering and cooperative approach between stakeholders (European Commission, 2011). Moreover, in order to monitor eco-innovation performance across the different EU countries, the European Commission developed the Eco-innovation Scoreboard and the Eco-Innovation Index, which base on 16 performance indicators (European Commission, 2018b).

Building on the outcomes from the EcoAp, in the 2016-2020 period the EU Europe adopted the 2020 Strategy that focused on smart, sustainable and inclusive growth. The strategy was mostly designed as a way to overcome the structural weaknesses in Europe's economy, improve its competitiveness and productivity and underpin a sustainable social market economy (European Commission, 2018a). The agenda set specific targets belonging to different

areas: employment, research and development, climate change and energy, education, poverty and social exclusion. One of its pillars was the Circular Economy Strategy of 2016, which put the emphasis on the material efficiency of Europe's economy through various forms of production and consumption eco-innovations (European Commission, 2015).

More recently, in December 2019, the EU announced a new strategy, a European Green Deal, with the overarching purpose of making Europe climate neutral by 2050. This new plan aims to be a response to the new climate and environmental-related challenges that are threatening the entire world. It comprises numerous actions in every sector in order to build a new growth strategy leading to a carbon neutral and resource-efficient economy (European Commission, 2019a).

Fig. 3: Sustainable Development Goals (SDGs). Source: United Nations, 2018.

At the global level, the sustainability agenda is driven by the Sustainable Development Goals (SDGs). These goals came officially into force on 1st January 2016 as part of the 2030 Agenda for Sustainable development(United Nations, 2018a). The idea was to set a common universal action to pursue global sustainable development through "win-win" cooperation among all countries in the world. The SDGs aim at ending poverty, protecting the planet and ensuring prosperity for all. The SDGs are, in fact, universal and they apply to developed and developing countries alike (United Nations, 2018a). Each goal is associated with specific integrated and indivisible targets to be achieved by 2030. In order to monitor the success in achieving these goals and the related 169 targets at the global level, a set of indicators was established. Each target is covered by 1 to 4 indicators that are used to measure the level of achievement of the goals in numerical terms. The figure below depicts the 17 Sustainable Development Goals (SDGs). They require the implementation of different actions addressing economic growth, social issues like education, health, social protection and job opportunities simultaneously with environmental protection, climate change mitigation and adaptation.

This work takes the SDGs as the basis of the research and in particular, it focuses on the sustainable goal 11: "Make cities inclusive, safe, resilient and sustainable" as it will be explained later.

3. Policy instruments and approaches for sustainability transition implemented at the local level

A policy instrument can be defined as a tool to concretely reach policy objectives, traditionally developed by a governing authority (Rogge & Reichardt, 2016). Different policy instruments usually have specific goals which are in line with the long-term targets of the policy strategy and can be descripted in terms of several dimensions such as the governance level, geography, policy field and time (Rogge & Reichardt, 2016). The governance can be expressed on a vertical or horizontal level. The former refers to the links between higher levels of government such as the international level and lower such as the local one (Rogge & Reichardt, 2016). The latter refers to the links between governments at the same vertical level but working on different policy fields (Rogge & Reichardt, 2016). Consider now the vertical level of governance in relation to policies for sustainability transition. National policies related to this sphere

usually follow the guidelines of international principles. Starting from the guidelines established by international authorities, each country creates national policies consistent with the international agreements but modified accordingly to the national context. These policies adapted to the national context require concrete actions at sub-national administrative levels worldwide (Tapia & Menger, 2015). These levels are represented by different entities depending on the country and they can refer to provinces, regions along with local governments as municipalities (Tapia & Menger, 2015). The importance of local policy actors is indisputable. According to United Nations, the local authority represents "an essential actor of development". It is "the closest sphere of government to attend to people's primary needs" as it provides basic urban services such as water and sanitation (UN-Habitat, 2018). Since they are the nearest authority to the territory, local policy actors can understand "nature and urge" of local problems (Dallara & Rizzi, 2012) and find a way to solve them, improving the welfare of citizens and sustainable development of the area (VVSG, 2016). This proximity represents a "huge asset" as local policy makers are the actors which can implement concrete solutions in the path towards sustainable development: "local governments certainly do not have all the levers at hand, but their great advantage is they can experiment more locally and test certain pilot projects" (VVSG, 2016). In order to reach sustainable development goals globally, local changes are necessary (Legambiente, 2010). This idea follows the principle "think globally, act locally" (Legambiente, 2010) that fits well in the context of SDGs' implementation: even if SDGs are studied on a global scale, the path towards their fulfilment involves concrete actions on a local level. In this context, it is meaningful to say that local governments have the role of localising sustainable development goals, working with citizens and other stakeholders to contribute to the transition towards sustainable development (VVSG, 2016). In conclusion, even if the legal frameworks are established by the national or international policy makers, "the choices of sustainability can be more effective if worked out at the urban or local level" (Dallara & Rizzi, 2012, p. 323). In the seven cases collected in this work, the main policy actor is the city's government. The specific city and the local environment constitute the geographical dimension of each best practice and therefore, "the space from which the policy mix originates" (Rogge & Reichardt, 2016, p. 1628). The geographical aspect is object of increasing attention in recent research (Rogge & Reichardt, 2016) where it is considered as a relevant factor

in the adoption and diffusion of environmental innovations (Antonioli et al., 2016).

3.1 The policy field: some key areas for local policy action

The policy field refers to the "policy domain", the policy area representing the framework in which a policy mix is developed. In the case of a policy mix including different policy fields, the consistency between the different policy areas is very important otherwise the entire policy mix could be ineffective (Rogge & Reichardt, 2016). Thus, it is essential to deeply analyze the policy mix concerning different fields in order to identify "internal and external inconsistencies and incoherencies within and across policy fields" (Rogge & Reichardt, 2016, p. 1627). The following are some key policy areas consistent with the classifications of many studies and particularly relevant for sustainable policy mix at the local level:

- Water and sanitation
- Energy and electricity
- Local economic promotion and community development
- Climate change risk management
- Area zoning and building codes
- Transport planning
- Waste management

The 2030 Agenda for Sustainable Development includes actions in all these policy areas for the transition to sustainability. Each SDG asks for concrete action in a specific policy domain that should be undertaken by national and sub-national governments.

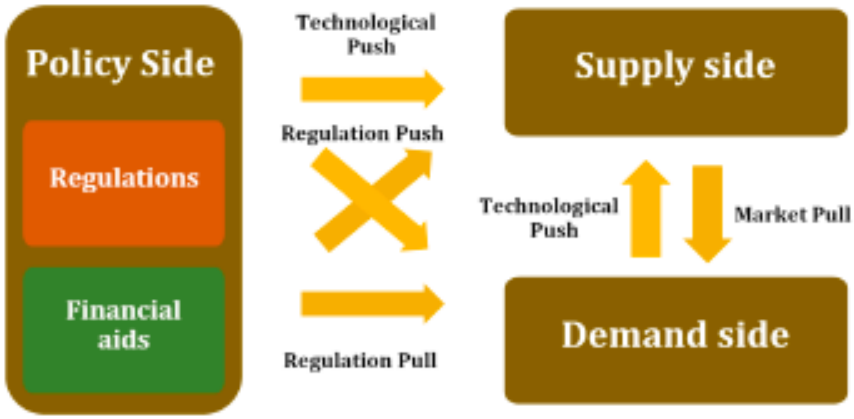
3.2 Key enablers and challenges for innovation for sustainable development at the local level

In order to reach a country's sustainable development goal, the government has a relevant role. The public policies implemented by the authority either at the national or at the local level can be structured in order to enable eco-innovation, considered the driving force within sustainable development (Kanda et al., 2014). For example, the government can induce the production of eco-

friendly goods and services through different instruments or approaches (Jang, Park, Roh, & Han, 2015). In other words, government policies and regulations play a vital role in creating the enabling framework for reaching sustainable development and a greener economy. In fact, they can encourage all society stakeholders to develop and adopt eco-innovations in the path towards sustainable development. The enabling framework consists in creating policy levers or incentives or addressing barriers to change. These policy drivers should be "strong enough for businesses to pursue this change on their own" and to citizens themselves to be aware of the shift and take a first step forward (Vancouver Economic Commission, 2015).

When the competent authorities are implementing a specific policy mix at the local level, local policy needs are a key element to be considered. Only starting from specific local policy needs, the government can create a policy mix "appropriate for the local context" (Vancouver Economic Commission, 2015) that can become successful. When a specific instrument meets with success locally, it might be applied also at upper levels, regionally or nationally becoming a nation-wide demonstration project as in the case of some best practices studied.

Fig. 4: Interactions among the determinants. Source Jang et al.,2015



In this research, policy instruments are considered for their role of enablers for innovation for sustainable development. In recent years, academic literature has focused on innovation for sustainable development with attention to its

determinants and barriers from a firm-level perspective. Three groups of factors have been found to be the principal determinants of environmental innovation in the literature. They refer to the supply side, demand side and institutional and political influences (Horbach, 2008). Great attention has been given to the definition of these concepts, however here it is interesting to focus on the interactions among them. As Jang et al. (2015) stated, "environmental policies stimulate and support the two other determinants: supply and demand". This is emphasized in the following figure.

From the policy side, firstly, regulations can influence the supply side with technology push, forcing technological improvements to meet environmental standards. Secondly, financial aids can help to develop eco-technologies and contribute to supporting eco-innovation markets. Moreover, beyond environmental policy instruments and regulations, governments can implement "soft instruments, such as voluntary commitments, eco-audits, and eco-labels" or "programs for environmental procurement and consumer awareness" that can support the formation of environmental innovation markets and stimulate innovative behavior in companies. In addition, the supply side stimulates markets through technological progress and markets influences technological improvements (Jang et al., 2015, p. 12590). In this context, different public policy instruments can be identified as providing the enabling framework for innovation for sustainable development to develop. In particular, four groups of instruments, suggested by the authors Tapia and Menger (2015), are considered relevant for this research as they can support innovation for sustainable development through different mechanisms at the local level:

- Economic and market-based instruments
- Planning and regulatory instruments
- Research, training and skills
- Awareness, engagement and participation.

The first group comprises all the fiscal and economic tools that have the aim of making households and firms incorporating environmental costs into their budget, thereby undertaking sustainable production and consumption (Jang et al., 2015). They include financing mechanisms such as taxes and market-based instruments, user fees and user taxes, limited exemptions and relaxation of standards and rules, financial support schemes for end consumers. At the local level, governments can also undertake actions to limit expenses in areas that exploit natural resources, to foster green public procurement or to provide a sustainable and fair access to resources (Tapia & Menger, 2015). The second

category includes the set of policies and regulations that "level the playing field for green innovation and the deployment of green technologies and respond to specific market failures" (Tapia & Menger, 2015). These instruments might address directly green entrepreneurs, by for example protecting the intellectual property, or aim at stimulating local green growth, by for example adopting urban plans in the context of local spatial planning (Tapia & Menger, 2015). Innovative eco-design is a noteworthy issue in the realm of spatial planning. The last two categories can be considered as informational instruments in so far as they are "political intervention methods that formally influence social and economic action through information", thanks to knowledge transfer, persuasion, advice and so on (Jang et al., 2015).

The group "research, training and skills" refers to programs, schemes or approaches aimed at developing green skills, knowledge sharing and transfer, building an education and capacity building system. These aspects related to the transferability and sharing of knowledge are very important for the development of an education system, which can be considered an enabler of green growth, but also for the reduction of poverty and inequalities (Tapia & Menger, 2015). The last category includes all the programs or approaches "to engage, encourage, and enable citizens, businesses, non-profits, and other community members to work together, promote behavioral change and adopt new habits towards sustainability" (Tapia & Menger, 2015).

Therefore, the implementation of policy instruments in the context of sustainability transition is essential for enabling the adoption and diffusion of sustainable innovations and thus, for addressing the barriers occurring in the initial phase. In fact, these innovations "are impeded by market failures both in their innovation and diffusion phase" (Kanda et al., 2014). This is due to the fact that the firms' return on R&D is lower than the social return coming from that innovation (Oltra, 2008). This is related to the double externality problem. It relates to the two positive externalities driven by environmental innovation: the knowledge created in the research and innovation stages and the positive effects in environmental quality (Oltra, 2008). This results in a situation where businesses are not likely to develop environmental innovations as they would improve the quality of the environment at their own costs bringing society wide benefits (Kanda et al., 2014). When markets fail, governments have a crucial role as they can "bridge the gap between research and industry" (OECD, 2011) with the implementation of specific policy instruments and approaches.

The literature offers different categorization of the main challenges occurring

in the development and market introduction stages of innovations for sustainable development. They can be classified in the same broad categories highlighted above for the enablers. Firstly, economic and financial barriers often represent a huge obstacle for the actors implementing an innovation for sustainable development. They refer for example to high market entry barriers or little market demand by final consumers, but also to lack of funding opportunities.

The second category refers to both "a lack of law enforcement and incentives, as well as to the persistence of harmful regulations" (Tapia & Menger, 2015).

The third category comprises the lack of expertise, technical knowledge, skilled workforce and misconception about green economy that are not leading to a structured education system (Tapia & Menger, 2015). The lack of technical expertise is often an obstacle for entrepreneurs adopting eco-innovations, together with a lack of time and human resources (Kanda et al., 2014).

The last category includes the cultural and behavioral barriers. This sphere is associated with the mentality that are generally reluctant to change and innovation, to policy traditions and lack of confidence on sustainability instruments for transition towards a greener economy (Tapia & Menger, 2015).

According to the Ellen MacArthur Foundation, in starting a circular economy transition project, it is very important that all the stakeholders are engaged in the project. "It is crucial to involve businesses through the project" as they can provide knowledge about opportunities, benefits and barriers in each focus sector. Other society actors need also to be involved in the project such as "citizens, consumers, labor and environmental organizations, researchers and academics" who can provide an overall picture of the context. Finally, it is relevant to engage a broader group of policy makers coming also from different departments (e.g. finance, environment, agriculture), beyond the ones driving the project, to transfer knowledge and information (The Ellen MacArthur Foundation, 2015). These aspects are emphasized also by OECD which underlines the importance of co-ordination between research and industry in the form of public-private partnerships for knowledge transfer and to "contribute to effective governance in support of eco-innovation" (OECD, 2011).

4. Research methodology

The first part of this work, comprising the sections completed so far, represents the background study for conducting the analysis. This section bases on a review of relevant documents (including peer-reviewed and grey literature) addressing the theme of innovation for sustainable development at the local level and its enablers. The second part aims at finding evidence of the theory with existing cases. In order to achieve this goal, seven best practices will be identified and interpreted in the next section.

According to UN-Habitat, best practices are considered successful initiatives which present the following characteristics:

- "Have a demonstrable and tangible impact on improving people's quality of life;
- Are the result of effective partnerships between the public, private and civil society sectors;
- Are socially, economically and environmentally sustainable" (You & Kitio, 2005).

For the purpose of this research, it is necessary that all the best practices studied respect the mentioned criteria and also another important characteristic that can be summarized as:

- Are implemented by the local public authority

The presence of this criterion is meaningful as the main goal of the research is to study how innovative policy instruments for innovation for sustainable development are applied at the local level. In other words, the initiatives considered have to be the result of an action taken by the local authority, providing effects mostly at the local level.

Once found cases respecting the criteria of "local best practices", some aspects were taken into consideration during the selection process:

- Geographical diversity;
- Policy area diversity;
- Data availability.

After the best practices were identified, collection of both qualitative and quantitative data was carried out. The research is based mainly of secondary data, but some primary sources were also used. The first consists of qualitative data taken from databases information, official city websites, academic and grey literature such as projects or conference reports, that were used for the description of the cases and quantitative sources which consist mainly of results

collected in databases and official statistics. The second comprises insights from web presentations and blogs. The main platforms and databases used have been: Un-habitat best practices database (UN-Habitat, 2011), The Global Opportunity explorer (Global Opportunity Explorer, 2018), the Transformative Actions Program (TAP), managed by ICLEI-Local Governments for sustainability (The Transformative Actions Program (TAP), 2018) and the European Climate Adaptation Platform (Climate-ADAPT) (European Commission & European Environment Agency, 2018).

It should be noted that the selection and interpretation of best practices based on publicly available sources written in English, French, Spanish and Italian. Therefore, potentially relevant cases documented in local languages other than the previously listed ones were not considered. Moreover, given that interventions implemented by local authorities are generally documented upon project completion, our case studies reflect best practices that have been developed a few years ago.

5. Benchmarking worldwide best practices at the local level

In order to provide an overall picture of how innovative policy instruments enabling sustainable innovation are successfully implemented at the local level, we analyzed seven case studies were these instruments were successfully applied. The following table summarises the best practices studied, focusing on the location, policy area and instrument implemented. Case studies were selected to illustrate the widest possible range of innovative policy instruments. They cover a vast range of policy instruments, including economic and market-based instruments, planning and regulatory measures, research, training, skills and awareness tools, as well as engagement and participation mechanisms. Each case study represents an innovation in itself and at the same time it has the objective to help companies, citizens and other public administrations to undertake sustainability improvements.

Drawing on these examples, the following paragraphs describe how sustainable innovations can be promoted and implemented through the implementation of innovative policy instruments at the local level. We focus in particular on (1) the context, motivations and key actors involved in the initiatives, (2) the benefits of the proposed solutions and their contribution to

innovation for sustainable development, (3) the key enablers and success factors and (4) the challenges and implementation barriers.

Tab 1: Innovative policy instruments and approaches enabling innovation for sustainable development: Seven Best practices

	Asia		***Europe***	***Africa***	***America***		
	Shijiuyang ecological wetland	*The Eco-Mileage System*	*Copenhagen's climate resilient neighbourhood*	*Tshwane Food and Energy centre*	*Move BRT and Mobicentro project*	*Buenos Aires' recycling centre*	*Zero emissions building plan*
Location	Jiaxing (China)	Seoul (South Korea)	Copenhagen (Denmark)	Tshwane (South Africa)	Belo Horizonte (Brazil)	Buenos Aires (Argentina)	Vancouver (Canada)
Policy area	Water and Sanitation	Energy and electricity	Climate change risk management	Community development	Transport planning	Waste management	Building codes
Instrument/ approach implemented	Artificial ecological wetland	Energy saving program	Sustainable urban planning	Sustainable agropolitan village	Sustainable urban mobility plan	Environmental park with education and recycling centre	Sustainable building plan and efficient construction standards

5.1 Context, motivation and key actors

The seven case studies are located in different cities around the world. This implies that the context is diverse for each case, from the size of the municipality to socio-economic and physical aspects. This diversity is meaningful as the territory plays a crucial role in the development process, "including the historical, cultural and social factors that are the basis of the continuous interaction among the economic and social actors" (Dallara & Rizzi, 2012). Each policy instrument implemented by the local governments originates from the local territory and "must be appropriate for the local context" (Vancouver Economic Commission, 2015). Therefore, this appropriateness and the context itself can drive the success or the failure of a specific policy.

Another important issue regards the key-actors involved in each project. Certainly, the main character is always the local authority as this was a criterion required for the analysis, but what can be observed is that each story presents

also other actors which participate in different ways and are determinant for the project's success. Local authorities participate in each project in different way. Most of the cities have a special commitment to sustainable development and have specific policy documents in place and specific administrative departments have been designated to deal with it. For instance, the Tshwane Food and Energy Centre, in 2013, the city of Tshwane created a Sustainability Unit, which two years later became the department in charge of the Tshwane Food and Energy Centre project. The commitment to sustainability was also formalized with the City of Tshwane's Vision 2055, a plan of sustainable economic growth, "one in which economic growth is decoupled from natural resource use and negative impacts" (Glcn (Global Lead City Network on Sustainable Procurement), 2018). Vision 2055 clarifies six outcomes for the coming years such as "outcome 1: a resilient and resource efficient city", "outcome 2: a growing economy that is inclusive, diversified and competitive" and "outcome 4: an equitable City that supports happiness, social cohesion, safety and healthy citizens" (Tshwane Economic Development Agency, 2014).

In general, local authorities play a leading role in most cases. They allocate resources and implementing key actions to solve a problem or address a specific challenge in that specific area. Most cities have a specific administrative or policy unit in charge of sustainable development. A change in the government's approach is determinant for the development of a sustainable solution. As claimed by Malmborg (2007), "[…] sustainable development requires technical, organizational and institutional change and innovation to become reality". This requires collaboration among different actors (Malmborg, 2007). In sum, the role of local authorities is key to create the enabling framework for sustainable development and green economy to prosper. In particular, local policy makers should spur all the actors in the society to initiate an environmentally driven change.

However, in some case studies, such as in the case of the Eco-Mileage System, civic groups have a particular role in encouraging the government to take the first step and then, in contributing to its implementation. Agreements with enterprises are also decisive for putting into practice the proposal. In some cases, though, the lead on sustainability is taken by the citizens who feel the need to do something for solving a problem of their own city. Regardless of formal leadership, in all case studies citizens are the key-actors in the sustainable development projects. Sometimes they promote and press for the adoption of the

initiative before they are approved, and in all cases citizens participate in the implementation and functioning of innovative projects geared at sustainability.

5.2 The innovative instrument, its benefits and contribution to innovation for sustainable development

The path towards sustainable development requires the adoption of development of eco-innovation. They are considered "key enablers for securing a knowledge-based, resource efficient, greener, and competitive European economy" (Montalvo, Lopez & Brandes, 2011). According to the most recent findings, "businesses and environmental protection enter a win-win situation" with eco-innovation. Evidence shows that policy and regulation have the potential to foster eco-innovation. In particular, the study by Montalvo et al. (2011) shows that firms having introduced more innovations where also the ones subjected to higher regulatory pressure. This is because "policy instruments can motivate business and industry to attempt to implement eco-innovation as a policy goal" (Jang et al., 2015). The policy instruments and approaches considered in this research are innovative in themselves and pursue the general goal of motivating eco-innovations. In other words, they can be considered eco-innovation multipliers. In fact, local policies may stimulate innovation and catalyse voluntary actions by society stakeholders, creating the enabling framework for the public and businesses to embrace eco-innovations in a specific sector.

The policy goals differ across policies and case studies, as they are very specific and related to the local problems they try to solve. Each city has different conditions and every policy instrument studied addresses a particular challenge related to a key area such as water and sanitation in that territory. Even if the best practices have specific goals related to a local policy area, at the same time, they all result in measurable improvements in economic, social and environmental conditions.

For instance, the principal benefits of the Shijiuyang ecological wetland are related to water quality improvement and safety, but more generally, it addresses different challenges such as the conservation of the ecosystem services, the control of erosion and the protection from floods, making Jiaxing an healthier and more livable city (EPA, 2018). Another example can be the "Zero emissions building plan" in the city of Vancouver. It has the clear purpose to achieve zero

emissions new buildings by creating the enabling framework for the public and businesses to embrace eco-innovations in the building sector. In particular, the government decided to innovate the building code by setting new standards and approaches that will encourage private industries and citizens to make buildings more resilient to climate change related events and energy prices. This will not only result in a reduction of GHG emissions, but in other co-benefits such as healthier and more comfortable buildings and local economic development. Moreover, in Tshwane, the project's concept enables not only benefits related to food and energy but also to the economic and social sphere. In fact, it creates new job opportunities addressing the problem of local unemployment, it enables the participating entrepreneurial farmers to become independent and self-sustaining, improving also their capacity building "in new ways of farming and business management" and contributing to local economic promotion (C40 Cities, 2018). These examples emphasise how the goals focusing on sustainability targets are highly adaptable to the local context and still share a common motivation (VVSG, 2016). In fact, the benefits of each best practice can be expressed in terms of contribution to SDGs. The specific goals related to a key policy area and local territory always overlap one or more SDGs.

5.3 Key enablers and success factors

Success and failure factors refer to those aspects that promote the design, adoption and implementation of the various local initiatives in our case studies. The following table provides a summary of the enabling conditions and key success factors identified.

One of the most important success factors for local innovation policies is the collaboration with stakeholders. The stakeholders relevant for this analysis are citizens, businesses, other cities, higher-level public authorities, academics and technical experts. Each group of stakeholders has a precise role in the studied initiatives and their action is critical for the case's success. All the projects show how a collaborative network among local public administration, private companies, citizens, experts and higher-level authorities can be an essential element for implementing a policy response to climate change issues. Our findings are consistent with Malborg's remark that "inter-organizational collaboration in networks and partnerships is supposed to promote the potential for learning and innovation needed for environmental transformation and

sustainable development" (Malmborg, 2007, p. 1730). In general terms, the role of the interaction with other groups is critical "since the challenges in (regional) sustainable development and industrial transformation exceed the capacity of individual actors" (Malmborg, 2007, p. 1737).

Tab. 2: Main enabling conditions and key success factors for each best practice

Main enabling conditions and key success factors	***Shijiuyang ecological wetland***	***The Eco-Mileage System***	***Copenhagen's climate resilient neighbourhood***	***Tshwane Food and Energy centre***	***Move BRT and Mobicentro project***	***Buenos Aires' recycling centre***	***Zero emissions building plan***
	- Academic and technical support - Public participation and awareness -Financial support from higher levels of government	- Partnerships with private companies - Public awareness and participation	- Local citizens support and contribution with local knowledge - City-to city collaboration	- Mentorship by an agriSETA accredited service provider - Knowledge sharing and training in the commercial market hub -Shift in government's attitude	- Shift in government's attitude and action -Citizens' awareness	- Shift in government's attitude towards sustainable initiatives and recycling - Advertising campaign	- Local government's commitment in the past years -Compliance and enforcement tools

For example, in the case of the Shijiuyang ecological wetland, the Jiaxing government stated that scientific and technical support from the Ecological Environment Center of Chinese Academy of Sciences was essential to perform research and development on environment protection and upgrade water management practices. Moreover, the public showed a collaborative approach from the beginning, voluntary helping from trees planting to wetland security and guarding. Citizens were defined "the builders, beneficiaries and protectors of the environment" (UN-Habitat, 2011).

City-to-city collaboration is another critical enabler for the implementation of an innovative local policy approach or instrument. As it can be seen in the case of Copenhagen's Climate Resilient Neighborhood where Copenhagen's

authorities collaborated with New York, "city-to-city collaborations allow individual cities and networks to learn from each other, and co-produce innovative approaches to building urban resilience" (ICLEI, 2017, p. 12). This collaborative approach is essential also for avoiding pitfalls by learning lessons from others. This type of collaboration between two cities can be the first step towards wider city networks and global stakeholders in line with SDG 17 which asks for global partnership for sustainable development (ICLEI, 2017).

Another important element required for the majority of the projects to be successful and to enable innovations for sustainable development is sustained and ongoing training. Depending on the project, training sessions could be the essential element to start the project, but also to increase the awareness of the public about sustainable solutions. In some projects, the learning process is materialized through an education center, as in the Tshwane Food and Energy Centre where a central hub has been built to facilitate the exchange of ideas between farmers living in the centre and visitors. This commercial market hub is called "Central Farm" and it has different applications. It "acts as a training and recreation centre and, has tourism spin-offs" and it is the place where the market takes place for the 25 farmers and surrounding families. In brief, it is the symbol of the "integrated concept of living, working and production" (Dimmer, 2016). Training, capacity building and the improvement of knowledge and skills are all elements that can be considered essential for the project to start and are continually strengthened thanks to the Central Farm where training and mentoring activities take place. Specific enablers for the development of the project are mentorship continually provided by an Agri-SETA[1] accredited service provider and, mostly for its start, the "two-week training course on farming and business development" that beneficiaries had to take and (Tshwane Economic Development Agency, 2014). The initial training course was the starting point of a learning process made possible through the external support coming from an accredited provider and the sharing of ideas and knowledge in the commercial market hub.

Another aspect facilitating the project's success and, in turn, enabling the public to embrace sustainable innovations towards a greener economy is an

[1] Agri-SETA stands for Agriculture Sector Education Training Authority. It provides "opportunities for social, economic and employment growth for agri-enterprises through relevant, quality and accessible education, training and development in both primary and secondary agriculture, in conjunction with other stakeholders in agriculture" (http://www.agriseta.co.za/Default?page=1&page2=2).

advertising campaign such as in the case of Buenos Aires Recycling Centre. In this case, it was important for enhancing social awareness on the issue of waste management, even if some considered the green agenda developed by the government "more of an advertising campaign than an ecological policy" (Quiroga, 2015).

5.4 Challenges and implementation barriers

Turning now to the challenge issue, it is important to emphasize that "barriers and enablers for the adoption of eco-innovations and the activation of green economy transitions can be seen as 'two sides of the same coin" (Tapia & Menger, 2015). This means that enabling factors sometimes consist in measures reducing or removing eco-innovation barriers and, reversely, barriers often stem from the lack of enabling conditions for sustainable innovations. For this reason, enablers and barriers are tightly related to each other and overlapping.

Even if our case studies essentially focus on best practices that can be successful examples of local innovation instruments geared at sustainability, they all have encountered challenges and in the path for their implementation. Some of these barriers are highly context-specific, representing challenges related to the local idiosyncrasy and they cannot be generalised. The next lines hence focus on the challenges that are shared across most of our case studies. The following table provides a summary of the challenges found in each best practice implementation.

Perhaps the most recurrent challenge found in the case studies are financial constraints. This challenge is shared regardless of the development context and funding mechanisms in place.

For example, Seoul Metropolitan Government has experienced difficulties associated with a tight budget in the implementation of the Eco-Mileage program. The problem was solved thanks to partnerships and cooperative approaches with private companies and financial institutions, but also manufacturers and retailers (Seoul Solution, 2018). Moreover, since the project was taken as a benchmark by other local governments and gained the recognition of "first citizen-participating greenhouse gas reduction program implemented by a local government in Korea", the Ministry of Environment gave an important financial support to the city's government (Seoul Solution, 2018). Also the authorities of Jiaxing faced the same difficulty as the Chinese project requested

high costs that were borne by different levels of public authority since the project was of national concern. For this reason, the total investment was supported not only by the local government but also by the regional and central one.

Tab. 3: Main barriers and challenges for each best practice

Main barriers and challenges	***Shijiuyang ecological wetland***	***The Eco-Mileage System***	***Copenhagen's climate resilient neighbourhood***	***Tshwane Food and Energy centre***	***Move BRT and Mobicentro project***	***Buenos Aires' recycling centre***	***Zero emissions building plan***
	- Willingness and collaboration between local, provincial and central authority due to high costs	- Tight government's budget - Lack of participation of disadvantaged people - Information sharing between energy providers and users	- Improving pedestrian areas and maintaining roads for vehicles and parking	- Different local problems in one combined solution - External financial support	-Achievement of social benefits	- Initial residents' opposition	- Shift from energy consumption to GHG emissions requirements

In Tshwane, the government provided 90% of the core funding towards full implementation and it tries to "attract partnerships for external funding and the pooling of resources" by presenting the project at COP21, C40 and ICLEI platforms (Dimmer, 2016, p. 46).

In some cases, the lack of a comprehensive focus, for example neglecting one or more pillars of sustainability, and in particular the social dimension, could also be considered a challenge for the innovative project. For example, connecting the objective of social inclusion with the efficiency of the transit system has been a challenge for the government of Belo Horizonte partially solved with the implementation of two different but complementary projects.

Furthermore, some projects such as the Eco-Mileage system have faced lack of participation due to the technology requested to take part in the program and

technical difficulties. The first was solved with the help of some volunteers. The second was related to information sharing as "energy providers were reluctant to share their information on citizens' energy consumption because they thought the information was confidential". Then eventually, Seoul Government guaranteed energy and gas companies a safe security system and, in this way, it convinced them to collaborate (Seoul Solution, 2018). This barrier related to information sharing can create delays in the time schedule. In fact, evidence shows that "close collaboration between diverse groups with different priorities, visions, and professional 'languages' sets a slower pace, as deliberations and compromise must precede action" (ICLEI, 2017, p. 17). The Eco-Mileage example shows one more time that the implementation of innovative sustainable policy instruments affects different stakeholders and effective collaboration between them is the element that paves the way to success. In conclusion, local residents' opposition is another difficulty that could occur in the path towards the implementation of innovative sustainable policy instruments and approaches. In fact, local residents initially opposed the construction of the Recycling Centre because of its location in Buenos Aires' suburbs.

6. Discussion and conclusions

In the context of increasing attention towards innovation for sustainable development as the only solution to drive a green economy and a sustainable development, this study focuses on innovative policy instruments and approaches enabling this type of innovation.

The role of sustainable innovation is emphasized both in UN's SDGs and EU's Europe 2020 Strategy and related Action Plans. Studies have dedicated little attention to the local perspective in relation to policies enabling innovation for sustainable development. However, local governments are crucial for the implementation of these instruments and to enable a green economy. Different local challenges spacing from management of resources to the reduction of inequalities require individual specific measures which together form a common universal action in the path towards sustainability. Local authorities are the only actors who can localize the global SDGs, experimenting projects locally with citizens and all the society stakeholders in the transition towards sustainable development. This idea is demonstrated by the best practices collected in this

research, which represent the concrete actualization of the "think globally, act locally" principle.

The purpose of this research was to study how innovative policy instruments or approaches for sustainable development are successfully applied at the local level. In order to answer this question, seven best practices of cities implementing innovative policy instruments and approaches driving innovation for sustainable development around the world have been studied paying attention on the key enabling conditions and main barriers. The cases considered resulted in an improvement of the living conditions in the local area and of the quality of life of residents along with economic, environmental and social benefits. For this reason, they can be taken as illustrative examples for other cities willing to develop policies driving sustainable development. Each case tries to achieve the general objective of reaching sustainable results through different measures facilitating the development or adoption of innovations for sustainable development by local citizens, private companies and all other groups of societal stakeholders.

A key aspect identified in all best practices, and thus considered the most important enabler for sustainability innovations is participation and collaboration among stakeholders. Our best practices show that strong and positive collaboration between stakeholders can lead to successful implementation of policy instruments. Upper levels of governments can collaborate by providing financial support, reinforcing and adding credibility to the project; private companies are the main actors of public-private partnerships and can provide knowledge and expertise together with experts and scholars; citizens can have an active role in the implementation of the project and other cities which are source of learning and innovation through city-to-city collaboration. Our findings support the claim that "to make a major change, it is necessary to get all stakeholders involved, including the public, private sector, many government branches" (OECD, 2018). Another important element is represented by knowledge development and awareness raising. The case studies demonstrate how training is an important element to ensure successful implementation of the initiatives. In some cases, an advertising and awareness raising campaigns can also be critical for the success of the project by attracting public attention to it. Last but not least, government's will and overall sensitivity towards sustainability can also be considered a cross-cutting success factor. The main challenges found consist first and foremost in the absence of the mentioned enablers, illustrating that often innovation barriers and enablers can be

considered “two sides of the same coin”. Specific challenges identified in the best practices’ implementation are the lack of financial support from stakeholders, the harmonization of multi-domain goals; the presence of technology requirements for participation in the initiative when e.g. internet access is required; and initial residents’ opposition that can be partially solved with engagement and awareness programs.

In conclusion, this work provides some insights and lessons for other cities willing to implement sustainable projects in order to achieve a green economy and to make their territories safer, more inclusive and resilient as reflected by SDG 11. Albeit being very diverse, the seven best practices only cover a limited range of policies in a restricted number of local areas. This study does not aim at providing general conclusions and policy recommendations, but at delivering some insights on this topic through some examples of successful practices. Further research could validate the relevance of our findings for other innovation for sustainable development approaches implemented in other cities.

Acknowledgments

Arianna Pegoraro would like to thank Dr. Carlos Tapia and the Circular Economy Team of Tecnalia Research & Innovation for the opportunity given to work with them on the Green.eu project and for their help and supervision during the development of the Master’s Thesis.

References

Antonioli, D., Borghesi, S., & Mazzanti, M. (2016). Are regional systems greening the economy? Local spillovers, green innovations and firms’ economic performances. *Economics of Innovation and New Technology*, *25*(7), 692–713. https://doi.org/10.1080/10438599.2015.1127557

C40 Cities. (2018). Cities 100: Tshwane - Small scale farming reaps big community benefits. Retrieved from https://www.c40.org/case_studies/cities100-tshwane-small-scale-farming-reaps-big-community-benefits

Dallara, A., & Rizzi, P. (2012). Geographic Map of Sustainability in Italian Local Systems. *Regional Studies*, *46*(3), 321–337. https://doi.org/10.1080/00343404.2010.504703

Dimmer, K. (2016). Back to the land. *Earthworks*, (32).

EEA. (2012). Environmental indicator report 2012: Ecosystem resilience and resource efficiency in a green economy in Europe.

EPA. (2018). Wetlands Protection and Restoration. Retrieved from https://www.epa.gov/wetlands

European Commission. (2011). Innovation for a sustainable future- The Eco-Innovation Action Plan (Eco-Ap). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions*. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0899&from=EN

European Commission. (2015). Closing the Loop: An EU Action Plan for the Circular Economy." Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 2015. http://ec.europa.eu/environment/circular-economy/index_en.htm

European Commission. (2018a). Europe 2020 strategy. Retrieved from https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/framework/europe-2020-strategy_en

European Commission. (2018b). The Eco-innovation action plan. Retrieved from https://ec.europa.eu/environment/ecoap/about-action-plan/objectives-methodology

European Commission. (2019a). The European Green Deal. *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions*. Retrieved from https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

European Commission, & European Environment Agency. (2018). About- Climate ADAPT. Retrieved from https://climate-adapt.eea.europa.eu/about

Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The Circular Economy – A new sustainability paradigm? *Journal of Cleaner Production*, *143*, 757–768. https://doi.org/10.1016/J.JCLEPRO.2016.12.048

Glcn (Global Lead City Network on Sustainable Procurement). (2018). Tshwane. Retrieved from http://glcn-on-sp.org/cities/tshwane/

Global Opportunity Explorer. (2018). About Global Opportunity Explorer. Retrieved from https://goexplorer.org/about/

Horbach, J. (2008). Determinants of environmental innovation-New evidence from German panel data sources. *Research Policy*, *37*(1), 163–173. https://doi.org/10.1016/j.respol.2007.08.006

ICLEI. (2017). Resilient Cities Report 2017 Tracking local progress on the resilience targets of SDG 11, 1–28. Retrieved from https://resilientcities2018.iclei.org/wp-content/uploads/2017/11/RC2017_Report_Online_26102017_Final-compressed.pdf

Inno4sd.net. (2018). Introduction to the Project content : Eco-innovation. Retrieved from http://www.inno4sd.net/sdgs/introduction/introduction-to-the-project-content.kl

Jang, E. K., Park, M. S., Roh, T. W., & Han, K. J. (2015). Policy instruments for eco-innovation in Asian countries. *Sustainability (Switzerland)*, *7*(9), 12586–12614. https://doi.org/10.3390/su70912586

Kanda, W., Hjelm, O., & Bienkowska, D. (2014). Boosting eco-innovation : The role of public support organizations. *XXV ISPIM Conference on Innovation for Sustainable Economy and Society*, (June). Retrieved from http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A725365&pid=diva2%3A725365&dswid=1163

Legambiente. (2010). Think Globally, Act Locally. Retrieved from https://www.legambiente.it/contenuti/articoli/think-globally-act-locally

Malmborg, F. Von. (2007). Stimulating learning and innovation in networks for regional sustainable development : the role of local authorities, *15*, 1730–1741. https://doi.org/10.1016/j.jclepro.2006.08.014

OECD. (2011). Better policies to support Eco-innovation. *OECD Studies on Environmental Innovation*.

OECD. (2018). The Eco-Mileage System. *Observatory of Public Sector Innovation*. Retrieved from https://www.oecd.org/governance/observatory-public-sector-innovation/innovations/page/theeco-mileagesystem.htm#tab_lessons

Oltra, V. (2008). Environmental innovations: indicators, stylised facts and sectoral analyses. *DIME Working Papers on Environmental Innovation*, *7*(7), 1–31.

Quiroga, C. (2015). How "Green" is Buenos Aires' Ecological Agenda?, *TheBubble*. Retrieved from http://www.thebubble.com/green-buenos-aires-ecological-agenda/

Rogge, K. S., & Reichardt, K. (2016). Policy mixes for sustainability transitions: An extended concept and framework for analysis. *Research Policy*, *45*(8), 1620–1635. https://doi.org/10.1016/j.respol.2016.04.004

Seoul Solution. (2018). Eco-Mileage System. Retrieved from https://www.seoulsolution.kr/en/content/eco-mileage-system-1

Tapia, C., & Menger, P. (2015). Stocktaking Session: Identification of Policy Needs with Respect to the Implementation of Ecoinnovation Policies at the Regional and Local Levels. A Particular focus on the MENA Region and the Water- Food-Energy Nexus. WP5: Integration and operationalizat. *European Global Transitional Network on Eco-Innovation, Green Economy and Sustainable Development (Green.Eu)*.

The Ellen MacArthur Foundation. (2015). Delivering the circular economy: A toolkit for policymakers. Retrieved from http://www.ellenmacarthurfoundation.org/books-and-reports

The Transformative Actions Program (TAP). (2018). What is the tap? Retrieved from http://tap-potential.org/about-tap/

Tshwane Economic Development Agency. (2014). *Tshwane story*. Retrieved from http://www.teda.org.za/tshwane-story/#fb0=74

UN-Habitat. (2011). The Best Practices Database. Retrieved from http://mirror.unhabitat.org/content.asp?typeid=19&catid=34&cid=10256

UN-Habitat (2015) Issue Paper on Inclusive Cities. United Nations Conference on Housing and Sustainable Urban Development, New York: United Nations.

UN-Habitat. (2018). Local Governments. Retrieved from http://mirror.unhabitat.org/content.asp?cid=380&catid=365&typeid=24&subMenuId=0

United Nations. (2018a). Sustainable Development Goals. Retrieved from http://www.un.org/sustainabledevelopment/sustainable-development-goals/

United Nations. (2018b). World urbanization prospects 2018. key facts. Technical report, United Nations Department of Economic and Social Affairs, Population Division.

United Nations. (2019) Sustainable Development Goals. Goal 11: Make cities inclusive, safe, resilient and sustainable. facts and figu- res. https://www.un.org/sustainabledevelopment/cities/. Accessed: 2019-01-23.

Vancouver Economic Commission. (2015). Towards the Circular Economy: Identifying local and regional government policies for developing a circular economy in the fashion and textiles

sector in Vancouver, Canada, (September), 98. https://doi.org/10.1162/108819806775545321

VVSG. (2016). Glocal. Localising the sustainable development goals. *Lokaal*. Retrieved from http://www.vvsg.be/Internationaal/Documents/2016Lokaal05_Katern EN_0305.pdf

You, N., & Kitio, V. (2005). Overview of the Best Practices Knowledge Management Framework. *United Nations Department of Economic and Social Affairs*, 1–8.

Appendix

This appendix explains in some lines the projects analysed as best practices in the research.

The first best practice is "Shijiuyang ecological wetland". The local authority of Jiaxing in China decided to build and artificial ecological wetland in 2009 in order to solve the problem of water micro-pollution that has affected the area for years. The nature-based solution implemented permits also to solve the problem of land subsidence, making the area climate resilient and to improve the conservation of ecosystem services. This project reflects the new ecology-based approach embraced by the local government and it is now ongoing. Due to the successful results it achieved, the project became a nation-level demonstration project and it is now comprised in several best-practices databases.

The second best practice is "The eco-mileage system", an initiative started in 2009 by the Seoul government, in South Korea, given the temperature increase in the area and the high energy consumption. In fact, it consists in a voluntarily based energy saving program in which citizens will receive economic incentives if they reduce their energy consumption per month by at least 10% compared to the monthly average of the previous two years. The name of the program suggests its functioning. The name comes from eco-friendly and mileage. The mileages accumulated are actually incentives perceived by the participants. Incentives comprise eco-friendly products, public transportation card replenishment, gift certificates for use in traditional markets, cultural facilities, and credit card points (Seoul Solution, 2018). This project achieved huge results in terms of energy use reduction, but it also boosts green consumption thanks to the incentives system. For this reason, it has received a lot of recognition and it is being disseminated also for being also the first citizen-participating greenhouse gas reduction program implemented by a local authority in Korea (OECD, 2018).

The third one is "Copenhagen's climate resilient neighbourhood". It consists in sustainable urban re-planning made by the city's government in order to

manage climate change-related events. Due to the problem of sea level rise and intense rainfall affecting the city, the project implemented follows an adaptation approach and comprises different solutions, spacing from engineering-based to nature-based ones. This plan permits to achieve positive results in the management of climate change and it also improves the residents' quality of life.

The fourth story of success is the "Tshwane Food and Energy Centre", a sustainable agropolitan village implemented by the City of Tshwane, in South Africa. It was created in 2015 to address different local challenges mainly the improvement of the food security and production and energy supply and security, with one combined solution. In fact, 25 unemployed families coming from the surrounding townships were offered to live and work in the village carrying out farming practices and, in this way, providing local, organic and sustainable food. All the energy used come from renewable sources. This solution achieved successful results in terms of local economic promotion and community development.

The fifth case is the "Move brt-mobicentro project", implemented by the city of Belo Horizonte, in Brazil. Due to the increasing demand for transport services, the high traffic congestion caused by the population growth and the consequent high level of air pollution, the city's authority decided to develop a sustainable transport plan comprising a bus rapid transit system, the revitalisation of pedestrian areas, the promotion of bike-sharing and other different road works. The project permits to achieve results in terms of traffic congestion and air pollution reduction, but also improvements in the quality of life and road safety.

The sixth best practice is the "Buenos Aires Recycling Centre", a project developed from 2014 by the city of Buenos Aires to manage waste flows. The recycling centre is divided into different treatment plants that are processing arid waste, dry waste, organic and forestry waste and PET. The centre is the first in South America to process four waste streams at one facility and it is equipped with an education centre where several study visits are carried out in order to educate and increase the awareness of the public.

The final successful case is the "Zero emissions building plan", developed by the city of Vancouver in Canada in 2017. In order to achieve the target of carbon emission reduction by 80% by 2050, the government implemented different strategies to structure the city with highly efficient buildings. These strategies space from the establishment of energy limits to each type of building to the creation of a Centre of excellence to stimulate skill and knowledge acquisition.

The project achieved important results in terms of carbon emissions reduction, long-term building resilience and local economic development.

(Pagina lasciata intenzionalmente bianca)