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The social effects of eco-innovations in Italian smart cities

Ilaria Beretta

Università Cattolica del Sacro Cuore, Via Trieste, 17-25100 Brescia, (Italy)

A B S T R A C T

The European Union promotes the paradigm of ecological modernization and the effectiveness of eco-innovations (European Environment Agency, 2014). This is evident, in particular, from the political and financial support that the Institution is devoting to smart cities. Thus far, most of the 'smart' projects developed in European cities focus on the theme of the environment and its efficient management (European Union, 2014).

However, what has not yet been adequately investigated is the issue of the social impact of these smart environmental projects (Beretta, 2014a, b, c). In particular, what seems important is the question of whether the projects with environmental objectives also yield beneficial results from the social point of view, with special reference to the issue of social inclusion. Who are the real beneficiaries of the projects of eco-innovation? Do the benefits extend to all citizens or are they likely to go to only some sectors of the population, often the wealthier ones, risking - among other things - promotion of the phenomenon of eco-gentrification? In more general terms, can we say that smart cities represent the 'ideal' settings for the achievement of simultaneous environmental, economic and social development?

This paper reports results from research conducted on smart environmental projects implemented in Italy and posted on the national web platform italiansmartcity.it. The project consisted in a qualitative analysis of the environmental projects presented, in order to analyze their social impacts, especially referring to the question of social inclusiveness and the risk of eco-gentrification. More generally, the analysis helps clarify whether the eco -innovations represent an effective tool for achieving sustainable development in the Italian context.

Having said that, it cannot be assumed that readers are familiar with the European and Italian contexts. Par. 1 opens with a table that gives definitions of terms which are potentially not clear. It then shows ways that the European Union is institutionalizing eco-innovation and smart cities, remaining on the latest debate on them. Par. 2 highlights the risk of the technological rut the European Union is falling into; par. 3 illustrates the main results of research carried out on the smart cities in the Lombardy Region regarding the social effects of eco-innovations; par. 4 attempts to draw a provisional conclusion.

1. Introduction

That the European Union is imbued with the paradigm of ecological modernization is well shown by the faith it has towards concepts such as green economies, smart cities, eco-innovation, technologies and so on [for a glossary of all terms, see the Appendix A]. For example, green economies, originally seen as a useful policy approach to tackle the economic and financial crisis that began in 2008, is today seen as a strategic way of delivering a fairer society in a better environment (European Environment Agency, 2014). In fact, the concept can today be understood as a way to achieve sustainable development: "essentially, the concept postulates that the transformation of the economy is a precondition for sustainable development" (Eurostat, 2013).

Eco-innovation is considered a primary enabling factor towards a green economy, especially as the policy framework for green innovation is already in place. While it is not the only element in creating a green economy, innovation can be a fundamental lever in guiding EU energy and material systems towards a radical transformation of practices. More generally, eco-innovation and green technologies are key to Europe's future and at the heart of the European Union's policies. As we read on the EU website,[1] the EU's economic prosperity and well-being is intrinsically linked to its natural environment, and the global demand for renewable energy and resource-efficient solutions will be a source of jobs and economic growth in the years to come. Above all, eco-

E-mail address: ilaria.beretta@unicatt.it.

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innovation is considered vital for delivering the objectives of the Europe 2020 Strategy.

At the same time, the EU's 7th Environment Action Programme (7EAP)[2] sets out a vision of "living well within the limits of the planet", including the need to "turn the Union into a resource-efficient, green, and competitive low-carbon economy", by 2050. Meeting these objectives will require new technologies and approaches to business, while these innovative ideas will in turn make European companies more competitive and help drive their growth. More recently, the EU adopted a Circular Economy Strategy,[3] aimed to transform Europe into a more competitive resource-efficient economy with a key role for eco-innovation in the context of job creation, growth and competitiveness, as well as in environmental protection.

In line with the institutionalization of concepts such as the green economy and eco-innovation, the EU demonstrates its strong conviction also in smart cities, as emerges in its web site (http://ec.europa.eu/index_en.htm) and above all through analysis of its numerous financial initiatives. The instruments created in order to support the Europe 2020 Strategy—in particular Horizon 2020,[4] the Framework Programme for Research and Innovation for 2014–2020—will strengthen the role of eco-innovation and provide adequate financial means for the implementation of the Action Plan post-2013. Within this Framework Programme, projects adopted in smart cities are one of the main channels of financial support.

Although the Smart City concept had always been at the centre of international debate and of national interest, we can say that, even today, there is no clear international definition: starting off from the first definitions of Smart City (among others, Eger, 1997; Coe, Paquet, and Roy, 2001; Thorns, 2002; Giffinger et al., 2007; Hollands, 2008), over time there have been many others which demonstrate how the smartness of a city can be characterised by various factors.

Numerous examples demonstrate how massive use of technology should improve the environmental conditions of the city (Hall, 2000; Kanter and Litow, 2009; Think, 2011). Some point out that technological infrastructures should serve to improve the economic growth of the city whilst others argue that the technological infrastructures should be used in general to improve the quality of the services offered to residents—covering therefore not only the urban environmental sphere but also economic and social elements (cfr., among others: Anavitarte and Tratz-Ryan, 2010; Dirks and Keeling, 2009; Gonzalez and Rossi, 2011; Toppeta, 2010; Washburn et al., 2010). Further definitions concentrate on the theme of urban administration, some underline the promoting role required by the public administration (cfr., Accenture, 2011; Traz-Ryan, Velosa, and Jacobs, 2011), others assert the importance of citizen participation in the governance of the territory and the role of social capital (cfr., Caragliu et al. 2009; Giffinger et al. 2007; Hollands, 2008; Partridge, 2004; Rios, 2008).

Given the various aspects included in the term ‘smart cities’, many authors find it lacking in specificity (Hollands, 2008; Santangelo et al., 2013). What is clear is that whatever the definition adopted, terminology is to a degree rhetorical: as Hollands explains well "what city does not want to be smart or intelligent?" (Hollands, 2008, p. 305). In other words, numerous are the studies that underline the risks linked to an over-enthusiastic adoption of the term in question. Among these, in this paper, it is apt to recall some which concentrate on the social risks to smart cities—such as internal polarization, with the weakest sectors excluded from the international network and at the service of the wealthier (and interconnected). They pointed out how technology risked not being a means of greater democracy but a further distinction in the gap between the rich and poor between those off and on—line, between those obliged to stand by and watch those in power. Hollands (2008) for example shows in the city of San Diego during the economic boom the poverty levels increased, even though in the previous decade a low level of unemployment was registered.

Another 50 authors underline how smart cities (and in particular the so-called creative cities – Florida, 2002) risked becoming polarised not only from an economic point of view, but also socially, culturally, with, on one hand the “creative” workers and, on the other, the “uncreative class” without knowledge or specialisation in technologies. Almost always, in smart cities there is inequality in work and living conditions and areas of residence (Hollands, 2008), but also in the allocation of spaces (Byrne, 1999) and opportunities for free time (Chatterton, Hollands, 2003).

Thus smart cities do not seem particularly positive places as far as class distinction, inclusion or social justice are concerned As Hollands (2008) maintains, as far as such cities can boast the creativity of diversity, tolerance and culture, they would seem more interested in attracting “creative” workers, prepared from the technological point of view rather than using information technology and art for social inclusion.

2. The risk of being in a technological rut

As recently outlined by Pope Francis (2015) in his encyclical, politics has come to submit to the efficiency-oriented paradigm of technocracy, falling into serious forms of technological determinism. The problem lies not so much in the technology itself but the use made of it: technology represents a danger to human progress because, along with the economy, it obeys selfish reasoning of private profitability. Technology cannot replace politics, mainly because it can only provide solutions to specific and temporary problems, being however unable to grasp the complex relationships between the different aspects of the ecological and social system in which we live (Beretta, 2015).

The European Union's attitude towards eco-innovation and, more generally, towards technology betrays confidence in the potential of technological innovations, deemed able to meet the different needs of society in their various manifestations. At a city government level, there are, though, numerous risks associated with a vision of this kind. First of all, we are puzzled by what Mela (2009) calls "the two-way relationship between technological innovation and social needs" or a "paradigm based on a run-spiral between technological devices (imagined as more and more advanced) and needs (represented as more and more refined)". In addition, there is the risk that the unconditional trust in technology leads one to think that all that is technological is “good” and might lead “automatically” to the transformation and improvement of the city (many authors speak, in this respect, of “technological determinism”[5]). This may mean, for example, that public authorities accept uncritically every technological solution to the problems they have to solve,[6] giving up moving any critical position against it, and allowing, therefore, that the technological option overrides a priori the political choices thus becoming in itself “political” (Vanolo, 2013, p. 47). Added to that is the risk that urban development policies are flattened "on a single model applicable everywhere and linked to the mere application of technology solutions" (Vanolo, 2013, p. 47).

Some sociologists point out that technological solutions not only risk replacing politics but seem to require changes in the individual's behaviour in social life, behaviour not only considered difficult to achieve and also unacceptable in a society that gives great importance to personal freedom from governmental intervention (Heberlein, 1974;

[2] Environment Action Programmes provide a general policy framework for the European Union's environment policy in which the most important medium and long-term goals are defined and set out in a basic strategy, where appropriate including concrete measures. They date back to 1972; since then Seven Environment Action Programmes (EAPs) have been adopted so far, their duration ranging from 3 to 10 years.

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

[4] COM (2011) 808/3 final: Communication from the Commission on Horizon 2020 — The Framework Programme for Research and Innovation.

[5] Eger, 2003; Graham, 2002; Hollands, 2008; Paquet, 2001.

[6] Among others, Dutton, 1987; Eger, 1997.

Dunlap, Lutzenhiser, Rosa, 1994). We see three main limitations associated with such blind faith in technology. First, it runs the risk of not properly interpreting the nature and complexity of the problem to be faced. Second, is the risk of not adequately assessing the effects of technological solutions. Third, the belief that every critical issue can be solved through technology.

An interesting example of how blind faith in technology may not always lead to better results can be taken from a project in Brescia which provides, among other things, the possibility - through an integrated platform to indicate in real time to operational centres which city bins are full of garbage. This is, in our opinion, certainly excellent from the urban quality of life point of view and also the efficiency of the garbage collection service. That said, it would make more sense (as indeed the major European guidelines indicate) to try to reduce the production of waste at source, also for example through policies to raise awareness on the issue. And what about all those cases in which administrations adopt a technological solution for environmental problems (for example depollution), without considering the environmental impact in terms of the solution, for example of energy consumption or of an area requiring provision of infrastructures? Researchers have estimated that the production of a new computer requires ten times its weight in fossil fuels and chemicals (while an automobile requires two times its weight) (Sample, 2004).

More generally, it has been observed that many technologies, although invented and developed to solve certain perceived problems, often create externalities (Drengson, 1984; Gibbons, 1970; Rosnen, 2004). Morozov (2013) has showed all his scepticism about the promise of digital technology to cure important problems in the book 'To Save Everything, Click Here: The Folly of Technological Solutionism'. Numerous authors have referred to the necessity for reflection which underlines aligning oneself for or against the use of technologies. Some see the technological improvement of our society as complementary to existing activist and policy efforts (Madrigal, 2013); others concentrate on the use and necessity of finding 'appropriate technology', that is, technology which adapts to the resources and needs of a particular context, both in its biophysical and socioeconomic and cultural aspects, even when not necessarily aimed at the maximum progress in technological development. "Appropriate technology" does have detractors, but possible solutions for a 'smart' philosophy in urban politics are such that the development of ICT itself could contribute to the constant innovation and circulation of appropriate technological solutions.

3. Eco-innovations within European smart cities

In EU28, over two-thirds of the population live in cities, and the proportion is growing. High density city populations increase the burden on energy, transportation, water, buildings and public spaces, so European cities represent the context where 'eco—innovation' is the most necessary. From the EU's point of view, solutions need to be found which are 'smart', i.e. both highly efficient and sustainable on the one hand, as well as generating economic prosperity and social well-being on the other. In this context, Information and Communications Technology (ICT) is considered a key enabler for cities to address these challenges in a 'smart' manner; and a smart city is defined as a city seeking to address public issues via ICT-based solutions on the basis of a multi-stakeholder, municipally-based partnership' (European Union, 2014).

Despite the current wave of discussion and debate on the value, function and future of Smart Cities,[7] as a concept it resists easy definition. At its core, the idea of Smart Cities is rooted in the creation and connection of human capital, social capital and ICT infrastructures, in order to generate greater and more sustainable economic development and a better quality of life (European Union, 2014). Usually Smart Cities are defined along six axes or dimensions[8]:

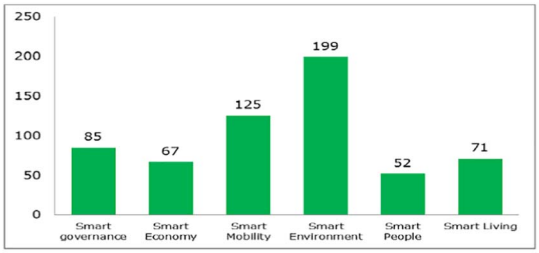
- Smart Economy: e-business and e-commerce, increased productivity, ICT-enabled and advanced manufacturing and delivery of services, ICT-enabled innovation, as well as new products, new services and business models.
- Smart Mobility: ICT-supported and integrated transport and logistics systems.
- Smart Environment: smart energy including renewables, ICT-enabled energy grids, metering, pollution control and monitoring, renovation of buildings and amenities, green buildings, green urban planning, as well as resource use efficiency, reuse and resource substitution which serves the above goals. Urban services such as street lighting, waste management, drainage systems, and water resource systems that are monitored to evaluate the system, reduce pollution and improve water quality are also good examples.
- Smart People: e-skills, working in ICT - enabled working, having access to education and training, human resources and capacity management, within an inclusive society that improves creativity and fosters innovation.
- Smart Living: ICT-enabled life styles, behaviour and consumption. Smart Living is also healthy and safe living in a culturally vibrant city with diverse cultural facilities, and incorporates good quality housing and accommodation. Smart Living is also linked to high levels of social cohesion and social capital.
- Smart Governance: joined up — city and beyond – governance, including services and interactions which link and, where relevant, integrate public, private, civil and European Community organisations so the city can function efficiently and effectively as one organism (European Union, 2014).

In 2011, The European Union mapped the situation of smart cities on its territory. The comprehensive mapping of European Smart Cities was based on a database of all 468 cities with a population of at least 100,000 within the 28 Member States of the EU. It resulted that 240 of the 468 EU-28 cities with at least 100,000 inhabitants (51% of the total) had at least one Smart City characteristic and can therefore be classed as Smart Cities. The highest absolute number of Smart Cities is found in the UK, Spain and Italy; the countries with the highest proportion of Smart Cities are Italy, Austria, Denmark, Norway, Sweden, Estonia and Slovenia. Most Smart City initiatives are still in the early phases of development, but the larger cities tend to be the most mature (with at least one fully launched or implemented initiative). The most common of the six characteristics are those associated with pan-European public goods problems—Smart Environment and Smart Mobility, present in 33% and 21% of initiatives respectively. In particular, Spanish, British, Italian, Dutch, Belgian and Nordic Member State cities can be characterised by a Smart Environment focus, but such initiatives and projects are spread throughout Europe. The characteristic of the Smart Environment is well distributed across different sizes of cities but with a slight tendency to be more common in cities of between 100,000 and 200,000 inhabitants (Fig. 1).

The figure above shows the number of the Smart Cities studied containing each of the six Smart City characteristics. Smart Environment has significantly greater representation than the other characteristics, followed by Smart Mobility. The remaining characteristics are more or less evenly distributed (around 10% coverage by all cities). This resonates with the overall impression that issues of congestion and the need to improve the overall city environment are among the foremost drivers of European Smart City policy. These two characteristics (environment and mobility) may also be more easily

[7] See Walravens and Ballon, 2010; Chourabi et al., 2012; Caragliu, Del Bo, and Nijkamp, 2009.

[8] Smart Cities, Ranking of European Medium - Sized Cities, http://www.smart-cities.eu.



Note: totals are higher than the number of Smart Cities as each Smart City can have more than one Smart City characteristic.

Fig. 1. The number of Smart Cities in the EU presenting the six Smart City characteristics.

identifiable than the others, and therefore attract political attention (there may be some quick political gains despite the potential need for a more long-term approach to all characteristics). The prevalence of environmentally-oriented initiatives may reflect the common nature of the associated issues. All cities experience environmental problems to some degree, and these issues rank high on the agendas of civil society groups and businesses (whether in relation to corporate social responsibility or as a result of energy prices and the related consequences of environmental degradation). This prevalence is also likely to reflect an emphasis coming from the community level, and other national and international sources. The transnational nature of environmental issues also suggests that it is a key area in which European institutions can add value. The emphasis on Smart Environment across the majority of cities may, therefore, reflect the significant role of large, multi-city initiatives focusing on this characteristic. Environment initiatives are relatively straightforward to identify, but some kinds of Smart initiative are more difficult to localise at the city level. The asymmetry of characteristic coverage may reflect this difficulty.

4. The social effects of eco-innovations

The positive environmental and economic effects of eco-innovations have been widely studied and documented, and a large amount of research on eco-innovation has been published over the past two decades (EEA, 2014). The role of eco-innovation and green inventions in the development of a greener and more competitive economy is seen in recent work by international institutions, such as the OECD (2008, 2010a,b, 2011, 2012, 2013) UNEP and the EU (Montalvo et al., 2011). Moreover, innovation of the technological, organisational and behavioural kind has increasingly been recognised in research studies of the determinants of environmental and economic performance as a key factor for improving sustainability in general terms, with impacts on emissions, waste and energy (van den Bergh, 2007; Mazzanti and Montini, 2010; Costantini and Mazzanti, 2013), and in particular on decarbonising the economy (Edenhofer et al., 2012). Innovation is one of the main factors that, as long as the energy mix and the economic structure also changes, can compensate for the ever-increasing entity of economies. Finally, some recent studies have moved along different tracks and provide evidence and conceptual insights on the effects of innovation on emission performances, with emphasis on sectoral and regional features (Carrion-Flores and Innes, 2010; Marin and Mazzanti, 2013; Gilli et al., 2013). These studies show that innovation can counterbalance the increased emissions caused by the scale of the economy and other technological developments (EEA, 2014).

If the environmental and economic effects of environmental high-technological interventions have been studied in Italy, there is no complementary research on the social effects of environmental policies, initiatives, projects, and so on (Beretta, 2014a, b, c). Elsewhere, studies are being conducted, particularly on the problem of 'eco-gentrification'.[9] Dooling has provided the following definition (2009, p. 621) "the implementation of an environmental planning agenda related to public green spaces that leads to the displacement or exclusion of the most economically vulnerable human population". Two internationally known cases of eco-gentrification are the cities of Copenhagen and Vancouver (Cucca, 2012).

An important effort to evaluate the risk of eco-gentrification and the social effects of environmental projects has been made in the context of wider research aimed to study the capability of 'inclusiveness' of Italian smart cities; that is the ability to include in the implemented projects also the most vulnerable population groups, such as the poor and needy, the sick, children, the elderly, immigrants. In this respect, studying smart Italian cities, the doubt arises that some environmental or sustainable mobility projects have limited social effects, or may lead to the development of forms of eco-gentrification if they are intended solely for specific social groups or specific areas of the city, inhabited by the well-off or that are undergoing a gentrification process aimed at improving their value. In the event that this happens, we are once again encountering smart cities that are likely to increase, rather than reduce, their internal social inequalities.

This paper reports the analysis of the projects of the 12 Lombardy Region's provincial capitals posted on the platform italiansmartcity.it, organized by the ANCI's Smart Cities National Observatory.[10] This platform cites a total of 1298 projects in 158 Italian local authorities, divided into eight categories: environment, energy, economy people, living, mobility, government, planning. Of the 12 provincial capitals in the Lombardy region, only 6 (Milan, Brescia, Bergamo, Pavia, Mantova and Como) have posted their projects on the platform (Fig. 2).[11]

In order to evaluate the social effects and the risks of 'eco-gentrification 'in the eco-innovation projects, the analysis took into account not only the projects referring to the environmental area, but also those belonging to mobility and energy areas, considering that many of these have environmental purposes. Overall, then, we analyzed 51 projects, broken down by city and type as follows:

Almost all projects related to the environment, despite their enormous diversity, have a positive social impact and are potentially extended to the entire population, as they always have the ultimate goal of contributing to the improvement of local environmental quality to the advantage of everyone. Examples are, in Brescia, the project Mapec.

LIFE-Monitoring air pollution effects on children for supporting public health policy, funded by the European Union through the Life + Program,[12] which aims to study the early biological effects due to exposure to air pollutants in the oral mucosa cells and the factors that may affect such damage in children of school age everywhere in Brescia, or, in Pavia, the hydro-morphological and ecological redevelopment project of the Ticino River. This project's primary objective is to restore full ecological functionality to lateral river systems to benefit from their natural self-cleansing properties in order to reinforce the absorbing system around the Asta Fluviale, and contribute to improving the water of the Ticino river. The 're-naturalisation' of a complex ecological system typical of that around the Ticino river area, adjacent to the city of Pavia, aims at both improving accessibility to the community and benefiting the environment.

Obviously, the great differences in these projects are to be found in terms of their financing. For example, if they are implemented as a result of an increased tax burden on citizens (for example through an increase in taxation, contributions, etc.), then we can no longer argue that such projects are to the benefit of all social groups, including those most vulnerable from an economic point of view. The greatest risk of

[9] Among others: Quastel, 2009; Dooling, 2008, 2012; Long, 2016.

[10] ANCI is the National Association of Italian Municipalities.

[11] This does not mean either that these projects are the only ones to be implemented in these cities, or that other cities have not implemented smart projects. As a consequence, the survey results presented in these pages refer exclusively to the information available on the web platform italiansmartcity.it.

[12] Life + Program is the EU's funding instrument for the environment and climate action.

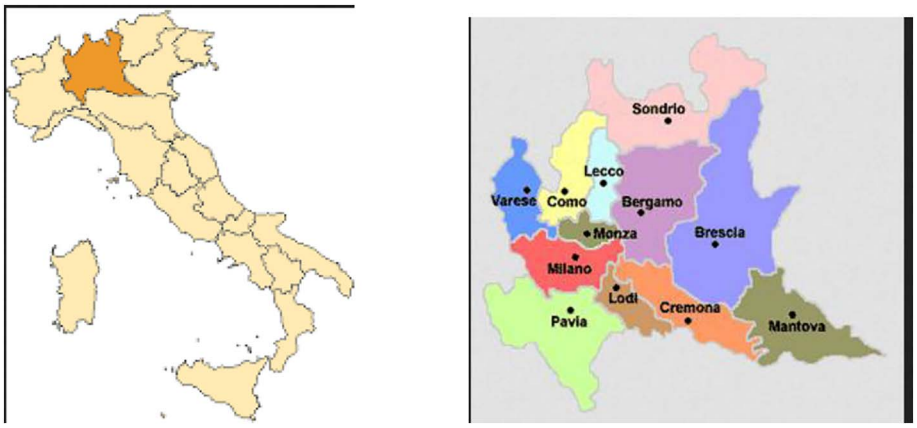


Fig. 2. The Lombardy Region and its 12 provincial capitals. Source: www.wikipedia.it.

Table 1
'Smart projects' analyzed, broken down by city and type. Source: author.

	Environment	Mobility	Energy	All projects
Milano	5	22	4	31
Brescia	3	2	5	10
Bergamo	1	2	0	3
Pavia	3	4	0	7
Total projects	12	30	9	51

projects referring to the mobility area, however, unlike those of the environmental area, is that of eco-gentrification, as they sometimes tend to concentrate only on certain areas of the city, thus offering beneficial effects for residents and users of these areas. This risk is particularly evident in the city of Milan, where as many as 22 projects concern this area of intervention (Table 1). For example, the project 'FreVue - Validating Freight Electric Vehicles In Urban Europe' consists in the creation of an internal logistics platform to Area C (the congestion charge area in the city centre) where providers give medication to pharmacies within the same Area C; the preparation of a fleet of electric powered vans for the transport of pharmaceuticals from the depository distributors to the platform; the construction of a fleet of small environmentally friendly vehicles for last mile transport, from the platform to pharmacies. The car sharing service represented by the project 'Electric City Movers' (electric quad-cycles) also risks eco-gentrification since the parking areas of these vehicles are located mainly in the city centre, to the exclusion of the outskirts.

As regards the energy area projects, however, the picture is much more complex because they often seem to have an economic barrier problem to overcome. Even though their experimentation on limited targets is funded through calls, however, it is not clear how the cost of their possible expansion can be economically supported. For example, we believe it is important to install photovoltaic panels on about fifty public buildings (Brescia's SMARTEST project), but this does not solve the problem of the high cost that individuals must cover should they want to install some on their homes. Moreover, energy projects often have a "literacy problem". As they almost always concentrate on the issue of smart grids and on citizens' participation in intelligent energy management, they do not pose the question of the need for proper training in the use of the innovative technological equipment proposed. The smart project DOMO GRID, for example, tests the benefits of intelligent electric networks connected to residential domiciles, aiming at a more reasonable consumption of energy. Dishwashers, fridges and washing machines for twenty families are connected to an Energy Management system for intelligent monitoring and management of the families in the use of this equipment, using a tablet with related app: no training is, however, planned for the use of such equipment.

5. Conclusions

In this paper, we have focused upon the actual 'intelligence' of environmental innovations, meaning by intelligence that they contribute to the achievement of sustainable.

development, a development that it is not only environmental, but also economic and social. More specifically, therefore, we have asked about the social effects of the eco-innovative interventions (smart environmental projects) in the context of Italian smart cities. Although, in fact, the European Union's confidence in technologically-advanced solutions is clear (Section 1), some empirical evidence does not always show that the benefits are distributed in a manner that is uniform among the different social groups and different areas of the city (Section 4). In such cases, the risk of the technological rut in which the European Union sometimes seems to fall, through the process of institutionalization of eco-innovations which we are frequently witnessing, proves to be valid (Section 2). This risk is due to the fact that technology is not fool-proof, cannot be a solution to every problem and often is neither 'free-standing' nor 'fair' because it is linked to specific social, political and economic contexts.

This paper reports results from research conducted on the smart environmental projects implemented in Italy and posted on the national web platform italiansmartcity.it. The project consisted of a qualitative analysis of the environmental projects presented, in order to analyze their social impacts, especially referring to the question of social inclusiveness and eco-gentrification. More generally, the analysis helps clarify whether the eco-innovations represent an effective tool for achieving sustainable development in the Italian context.

Fifty-one projects are analyzed, managed in four Lombardy Region province capitals. Referring to the three different areas considered (environmental, mobility and energy), we reach different conclusions. In fact, generally speaking, regarding environmental projects we can affirm that in the four cities we are not seeing a real risk of 'eco-gentrification' and very often the beneficial effects of projects are directed to all social groups, without exclusions. These results seem quite encouraging as they show concern from the proponents of the projects for the population as a whole and also for the weaker sections.

As far as mobility projects are concerned instead, conclusions differ in as much as in the Milan area above all a true risk of eco-gentrification emerges, found to a lesser degree in the city centre, regarding problems linked to traffic congestion and the quality of the air.

To switch to energy projects, we have to be careful about their effective economic and technological accessibility. In this case, generally speaking, we notice that the smart projects rarely result in increased access, and therefore rarely are really for the benefit of the poorest people, confirming the hypothesis that energy efficiency is often 'a luxury good' (Beretta, 2014b). The inclusiveness — including the economic one - often heralded by smart cities, then, would seem more a slogan than a reality, confirming the conclusions internationally

renowned sociologists had already drawn at the end of the past century in their urban surveys (Sassen, 1991; Harvey, 1985, 1996, 2000).

With respect to the issue of technology barriers, many projects involve citizen use, more or less advanced, of tools such as PCs, tablets, smartphones, etc., and it should be noted that only in very rare cases is there the design of a 'simplified' tool that allows access even to those who are not familiar with technology. We have never encountered relevant literacy activities.

In this context, it should be said that if the ultimate goal of eco-innovations, as affirmed by the European Union, is really the improvement of the quality of life of all citizens, then computer literacy is an aspect that should be better taken care of by local authorities and by anyone proposing projects with a view to smartness. If tools are adopted for the benefit of the whole population, then the conditions must be created so that access to these tools is universal; otherwise, paradoxically, it runs the risk that a 'potentially inclusive' project ends up forming a device that aggravates social inequalities.

Obviously, the investigation carried out so far is partial, and the results obtained are not representative of the Italian scenario. For this reason, we believe that a broadening of the research could be particularly interesting in order to strengthen (or disprove) the results achieved. In particular, the continuation of the investigation could take place by analyzing other Italian cities and considering further sources of information. Only in this way would it be possible to express a certain assessment of the real ability of smart environmental projects to represent a tool for sustainable development in Italian cities.

Appendix A

Glossary of terms used

Circular economy	Refers to a conception of production and the consumption of goods and services which are alternative to the linear model (e.g. the use of renewable resources rather than fossil combustibles). It assumes that economic systems should act as organisms in which substances are worked and used to then be reused, both in the technological and biological cycles. The "closed" or "regenerative" cycles derive from here.
Ecological modernization	A sociological school of thought which argues that technological development will make environmental protection possible. Current environmental crises suffered by Western societies are due to insufficient - not excessive – modernization of societies.
Europe 2020 Strategy	A ten-year growth strategy that aims to create the conditions for a more competitive economy with higher employment. More specifically, it aims to deliver growth that is: **smart**, through more effective investments in education, research and innovation; **sustainable**, thanks to a decisive move towards a low carbon economy; and **inclusive**, with a strong emphasis on job creation and poverty reduction.
Eco-innovation	Any form of innovation aiming at significant and demonstrable progress towards the goal of sustainable development. This can be achieved either by reducing the environmental impact or achieving a more efficient and responsible use of resources (ec.europa.eu).
Green economy	A model of development whose objective is both economic and environmental. Such a model does not, therefore counterpose a country's GDP and the reduction of its environmental impacts.
Smart cities	Cities where there is ample use of technology to the advantage of the local community.

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