Perception and Evaluation of Regional and Cohesion Policies by Europeans and Identification with the Values of Europe

PERCEIVE

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Deliverable 4.1 Report on Urban policies for building smart cities

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1. Introduction

A reasonably well-rounded and comprehensive definition of a smart city may be found in Caraglui et al (2011) who assert that a city is smart when "…..investments in human and societal capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance." There are many other definitions on offer in the publicly available literature. However, this definition, though complex is arguably necessarily nuanced. It embraces all the various dimensions (social, institutional, economic, communication technology, infrastructure and environmental management) impinging on practical 'smart city' thinking. This complexity contributes to the phenomenon whereby most people may not fully understand what is actually meant by the 'smart city 'concept (Lima 2016). Perusal of popular media and much 'grey' literature also suggests that many cities seem to claim to be 'smarter' even though the evidence suggests that strictly speaking (particularly in the light of our preferred definition) they are not. In some of these cases, simply the status of being 'wired' is deemed to indicate smartness. Yet being wired with high availability and quality of ICT infrastructure is not a sufficient or adequate definition of a smart or intelligent city.

This report begins by introducing the term 'smart city' buttressed by some critical consideration of the several definitions that are proffered in the extant literature. Then, the conceptual evolution of the 'smart city' construct is set out with reference to smart (city) policies implemented in the EU, mapped with reference to the results of a Boolean web search exercise. This analysis helps to systematically unveil the narrative used by practitioners and policy makers in shaping the

perception of smart city policies and projects. Finally, a new index of smartness is implemented based on Stochastic Multicriteria Acceptability Analysis (SMAA). The new index will consider both objective measures and citizens' perceptions of key dimensions offering value in assessing 'smartness' in city projects and policies.

2. 'Smart Cities': Brief evolutionary outline of the construct

There are numerous drivers and motivations accounting for why there is a strong policy imperative and active interest by central and local government for towns and cities to contemplate smart city thinking?

Across nations and particularly in the aftermath of the 2008 financial crisis central and local government's face increasingly tight budgets – particularly as urban population growth puts pressure on basic services such as drinking water, electricity, waste management, street and highway maintenance. Accordingly, there is a growing consensus that greater and wider use of new technologies can make cities more ***efficient*** (offering more outputs [goods/services] with lower resource inputs). Such efficiency may also be married to more effective use of human capital and technology in order to improve ***well-being*** of city residents and workers in a tangible way. Securing such well-being could solicit and reinforce further popular support and cooperation for continuous improvement and development of urban community and infrastructure capacity.

From a more functional and corporatist perspective, various makers and developers of technology see genuine ***business opportunities***. Indeed many firms such as *Cisco, IBM, Intel, Huawei, Microsoft, Siemens, and Thales* have their own 'smart city programmes'. Some concerns have thus emerged over the scale of the role of such corporate entities in terms of the power and control

they could increasingly command over cities and potentially challenging or displacing democratic/electoral oversight.

In the context of strategic national and international policy imperatives the then UK Department for Business, Innovation and Skills (2013) also highlighted other motivations for smart city policies relating to three key concerns:

(i) ***Concerns about climate change***, and the fact that 80% of the UK population live in cities, inevitably means that cities have a key role in improving energy efficiency and reducing carbon emissions, while promoting energy resilience in terms of security of supply and price;

(ii) The paradigm shift towards online entertainment and online retail/consumer services is beginning to ***change the nature of the High Street*;**

(iii) An ageing population is placing an increasing burden on adult social care, to the point where it is absorbing an ever-increasing proportion of local authority budgets.

Though the term 'smarter cities' was trademarked by *IBM* on 4th November 2011 its origins pre-date the strategic commercial framing of the 'smart city' concept where some have argued that *tech corps* seek to be portrayed as benign saviours to all contemporary urban problems (Söderström, Paasche, and Klauser 2014).

The key prefacing concepts of utopianism, systems thinking, smart growth and intelligent cities are considered in turn:

Utopianism

Arguably since Thomas More's Utopia (1516) there can be identified a utopian tradition in urban planning. For Choay (1997) this manifests itself as a therapeutic discourse featuring a diagnosis of urban problems and pursuing these with a set of 'universally valid' solutions. She defines the utopian genre as: a single voice proposing - through a narrative distinguishing between a corrupted past and a perfect and immutable future - an ideal and universally valid model of society constituted by a rational spatial form.

Systems thinking

The city has long been conceived as a system of systems. In history enlightened planners have sought to see cities function like a healthy body. Thus the words 'arteries' and 'veins' have been applied to city streets in the eighteenth century by designers who sought to model traffic systems on the blood system of the body.

The language of urban systems schematizes a complex phenomenon, stresses inter-connectivity and suggests analysis may help engineer or nurture positive transformation. (e.g. Buchanan 1992, Chadwick 2013).

Smart growth

"The smart growth concept calls for forms of urbanization that are more compact, transit- and walking-friendly, conducive to high-quality urban life, and less environmentally damaging and infrastructure hungry than present urbanization patterns." (Filion 2003) (See also Downs 2005, Handy 2005). Above all, it is sprawl, characteristic of North American urban growth since World War Two that has been targeted by the smart growth movement.

Intelligent cities

Intelligent Cities specifically explore the intersection of information technology and urban design to understand where we are, where we want to be, and how to get there. An intelligent city might reasonably be conceived as a necessary pre-condition or co-factor for the development of 'smart city' practice.

More recently the key theoretical contributions emerge from three distinct fields of study, namely:

Communication/Information Theory: An early schematic contribution is presented in Harrison and Donelly (2011) depicted as an 'Urban Information Model' formed of a number of layers.

Urban Technology/Planning Theory: Leydesdorff and Deakin (2011) stress the dynamic interplay of network densities among 3 'dynamics' namely: intellectual capital of universities, the wealth creation of industries, and the democratic government of civil society (The Triple Helix Model).

Economic Theory: Extant economic literature is somewhat partial and focuses on the contributions from human capital externalities (i.e. the spillovers to city growth/development from smarter, better educated populations) (e.g. Shapiro 2006, Fu 2007). In general, there is currently an enormous gap in the state of the contribution of economic theory. Arguably there is enormous scope for economic theory to build a more holistic model of smart cities building on key microeconomic concepts such as economies of scale and scope, user economies of scale and

scope, network externalities and network economies. The beginnings of such work can be discerned in Bettencourt (2013).

Explicit critique of the smart city concept ranges from positions of *positive constructive engagement* (hoping to improve functionality and promote better diffusion of the concept) to *fundamental objections* (viewing the concept as vector of dystopian harm that will ultimately alienate individuals and destroy democracy). This spectrum is considered in part as a labelling problem and due to a lack of definitional specificity (Hollands 2008). For some commentators "…[smart city] discourse promotes an informational and technocratic conception of urban management where data and software seem to suffice and where, as a consequence, knowledge, interpretation and specific thematic expertise appear as superfluous." (Söderström, Paasche and Klauser 2014). They also observe that "….[city] problems cannot be reduced to data problems but need to be interpreted in the light of long-standing political and scientific debates. Furthermore, we've been there before: municipalities in the 1960s and 1970s have already experienced the deleterious consequences of taking such stories about large-scale simulations being the ultimate planning solution at face value" (Söderström, Paasche and Klauser 2014) (see also Townsend 2013).

3. Spatial Coverage, Scale and Conceptual Architecture of Smart City Projects and Policies

Academic literature shows some conceptual development but increasingly features commentary based on a number of empirical studies exploring the practice, performance and review of smart city policies and demonstrator projects at various scales of geographical resolution (district, city,

area) and in different locations across the globe. We begin by systematically exploring the geographical range and scale of smart city projects. Project details are then harvested to support subsequent text analysis implemented on 'R' software.

Data on Smart City Projects were manually collected through various web sources on web. Original Google search was conducted using Boolean phrases such as "Smart Cit*" AND "project*". From the list of results obtained[1], we have only included those projects that are self-proclaimed as "smart city projects" and that are taking, or took place in the EU area. We must thereby acknowledge that the list of the projects harvested, and which we will further present, is far from exhausting and a number of other projects existed might be missing due to the lack of this very statement ("*smart*") in their description. Furthermore, it could be the case that the term "smart city" which we were looking after in our search strategy, could be translated otherwise in other native languages, resulting in a number of projects being skipped overall. Therefore, what we will further present, is a list of 114 self-proclaimed "smart city projects" for the time period 2005-2016[2] and an analysis based on this list.

Apart from Google's search engine, lists of smart city projects appeared in:

- European Commission's "*European Innovation Partnership on Smart Cities and Communities (EIP-SCC)*" official website, available here: https://eu-smartcities.eu/about
- Smart Cities Information Systems' (SCIS) website (funded by the European Commission), available here: http://smartcities-infosystem.eu/sites-projects/projects

NOMINET's (UK) official website, available here: http://www.nominet.uk/list-smart-city-projects/

[1] The full list of considered projects along with summary information including the EU founding is reported in appendix.

[2] 2005 appears to be the first year for which we have found data. There is no other reason why we choose this particular time period.

During the collection of the data, we harvested further information about each project (containing a brief overview and its objectives exactly as stated in each project) for a text analysis application. Prior to the text analysis application, a matrix was created containing the aforementioned information for each project. From this matrix, common words were excluded (e.g. "the", "a", "such" etc.)[3], along with a careful manual exclusion of words which were not associated with any meaningful point. Furthermore, in order to conduct a more detailed and deep analysis, text stemming was applied through algorithms, "cutting" the words to its roots. This also helped in identifying differences between the US and UK dictionaries (e.g. "organise" and "organize" etc.) and also account for all variations of a word's meaning in a different context (e.g. "energy" and "energy-related" would result in counting "energy" once prior to the stemming and twice afterwards). Then, after the matrix was ready to be analysed, we conducted analyses in three stages: First, an overall analysis of all the smart city projects' information (summary and objectives) pooled for all countries. Second, an analysis of the pooled smart city projects for all countries but this time we did that per year, in order to capture any potential yearly differences, e.g. identify a common trend throughout the 2005-2016 period. Finally, we did a country-level analysis (but for all years this time), in order to capture any potential differences between countries, e.g. identify different directions between countries in focusing on different aspects of "smart cities".

A total of 114 smart city projects have been found for the time period 2005-2016. A matrix containing their name, the aim, the country/countries applied, the start/end date, the total cost and the amount of EU funding received along with a URL of the project is then constructed. Analysis carried out upon that matrix yields the following results:

[3] Other words excluded are "*demonstrated*" "new", "will", "brief", "summary", "project", "one", "two", "three", "four", "five", "also", "within", "used", "aimed", "main", "overview", "aim", "using", "different", "around", "order", "research", "can", "use", "projects", "aims", "across", "concepts", and "making".

Table 1. Overall Descriptive Statistics. Source: Authors' elaboration.

OVERALL DESCRIPTIVE STATISTICS					
	Average	**Median**	**Min**	**Max**	**Std. Dev**
Period	-	4	0.5	20	-
Total Cost	€ 15,838,949	€ 9,935,996	€ 289,153	€ 68,732,990	€ 14,474,858
EU Funding	€ 8,702,454	€ 5,039,361	€ 30,740	€ 40,999,000	€ 8,452,840

Note: All countries' amounts are expressed in €, converted through yearly PPP.

Table 2. No. of projects commenced per year. Source: Authors' elaboration.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Projects Started	8	1	11	1	4	10	8	9	16	8	16	7

Note: Only 98 out of 114 projects contain information about the start/end date.

Table 3. No. of active projects per year. Source: Authors' elaboration.

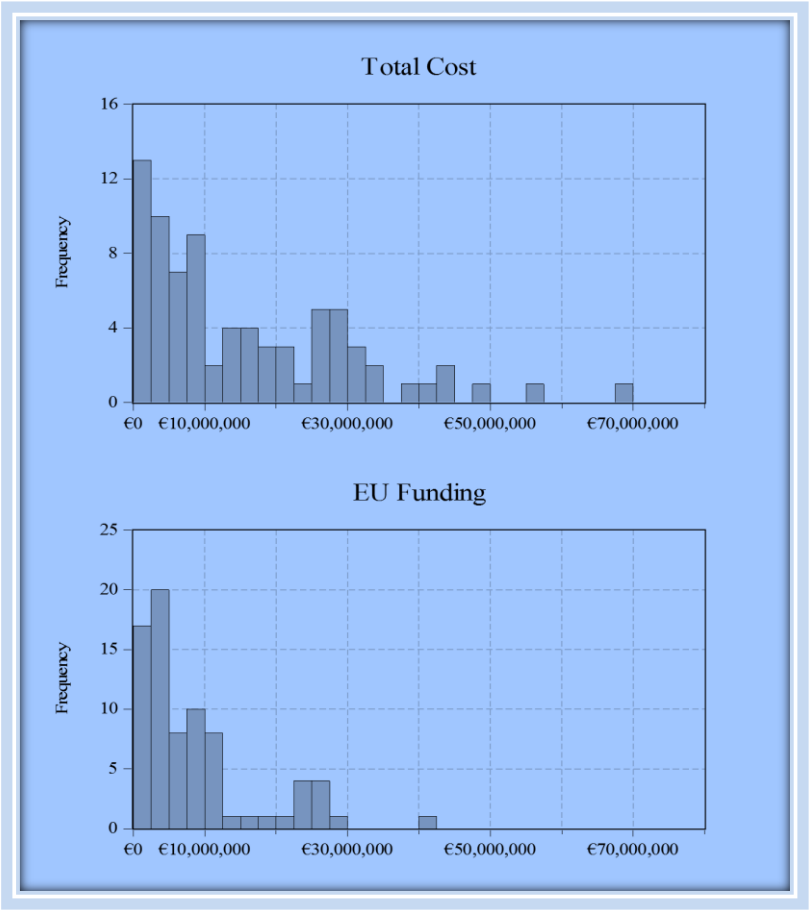
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Active Projects	8	9	20	21	25	34	40	47	56	50	50	44

The median smart city project takes 4 years to be completed and costs mil. € 9.935, while the EU funding for the same –median– project is mil. € 5.039[4].

Figure 1 depicts the histograms of the smart city projects' total cost and EU funding. The biggest proportion of the projects appears to cost between 1 and 10 mil. €.

Figure 1. Histogram of Smart City Projects' Total Cost and EU funding. Source: Authors' elaboration.

[4] Please note here that the 'Overall Descriptive Statistics' table is calculated after a balanced dataset is constructed (n=98), containing all information about the total cost, the EU funding and the time period (start/end date).



In order to make the projects comparable, their total cost is divided by the number of periods each project needs to be completed. Figure 2 below illustrates the total cost of each smart city project (per period). It is further supported by figure 3, which contains the EU funding also for those smart city projects (per period). The average participation of the EU in funding the projects (taking into account only those projects that are funded) is roughly 55%, while the median one is slightly above 50%.

Figure 2. Smart City Projects' Total Cost (per period). Source: Authors' elaboration

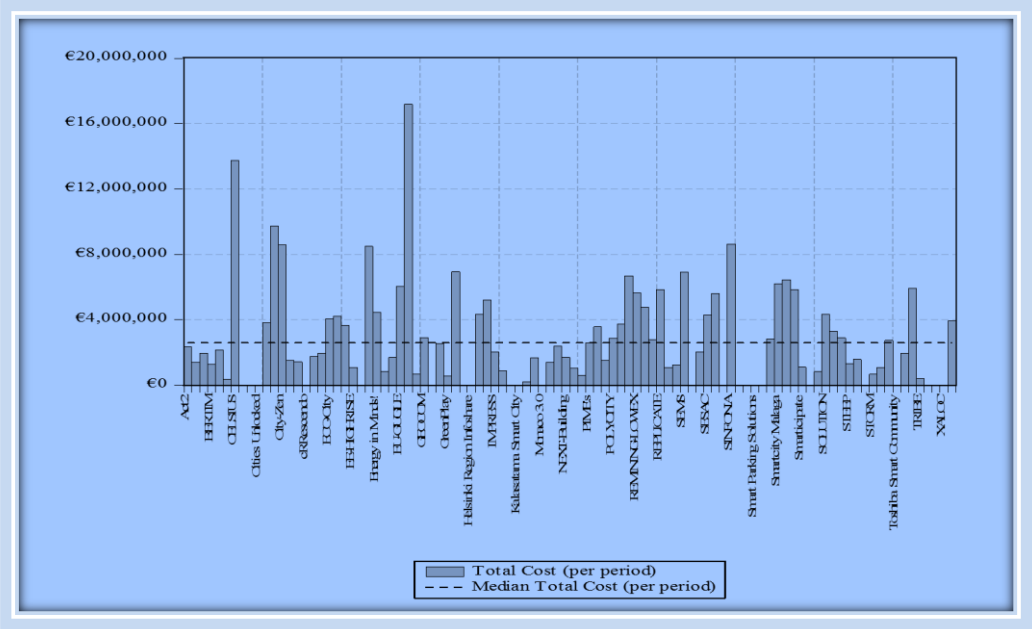


Figure 3. Smart City Projects' EU funding (per period). Source: Authors' elaboration.

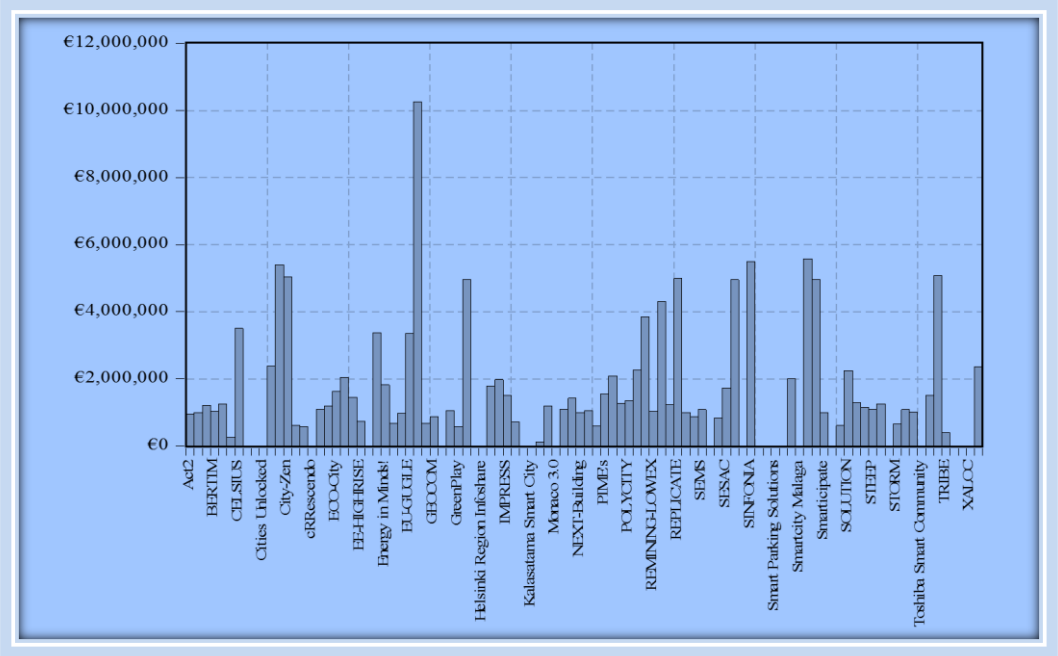


Figure 4 further illustrates the funding these projects received from the EU overall, in comparison to their tocal cost. Projects that did not receive EU funding are excluded from the bar chart.

Figure 4. Smart City Projects' Total Cost and EU funding. Source: Authors' elaboration.

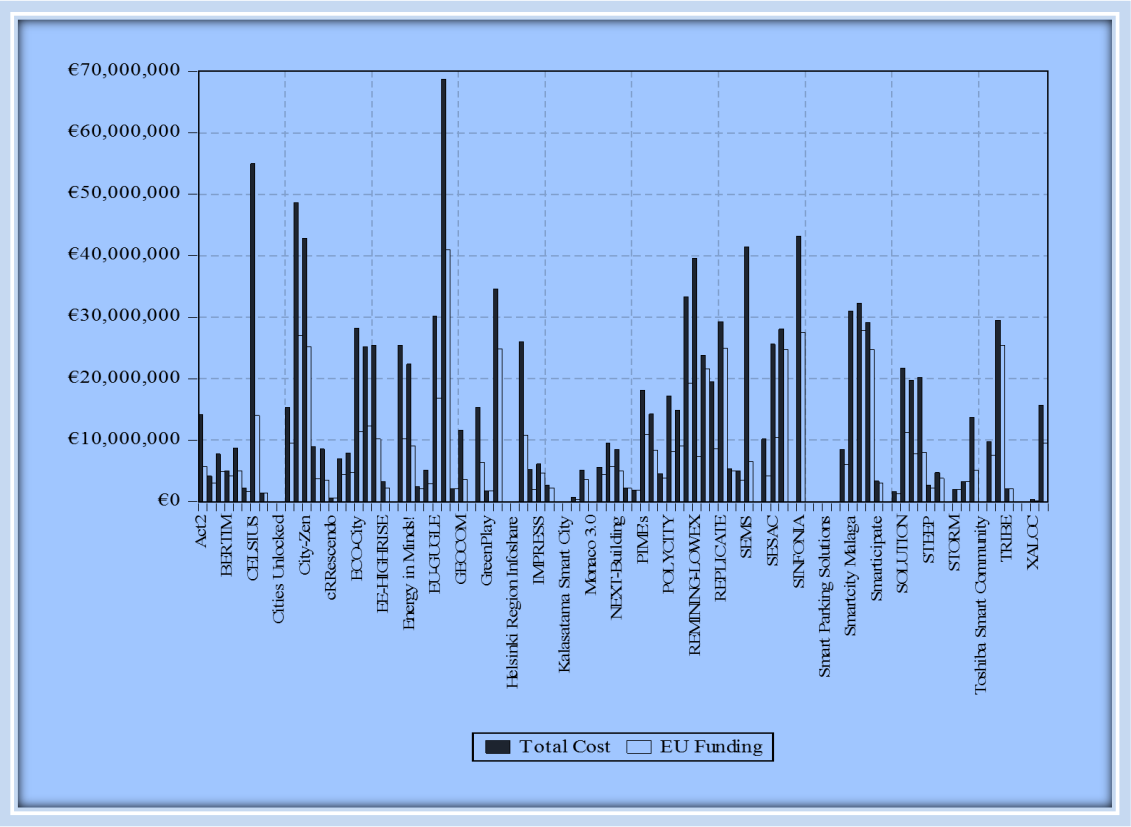
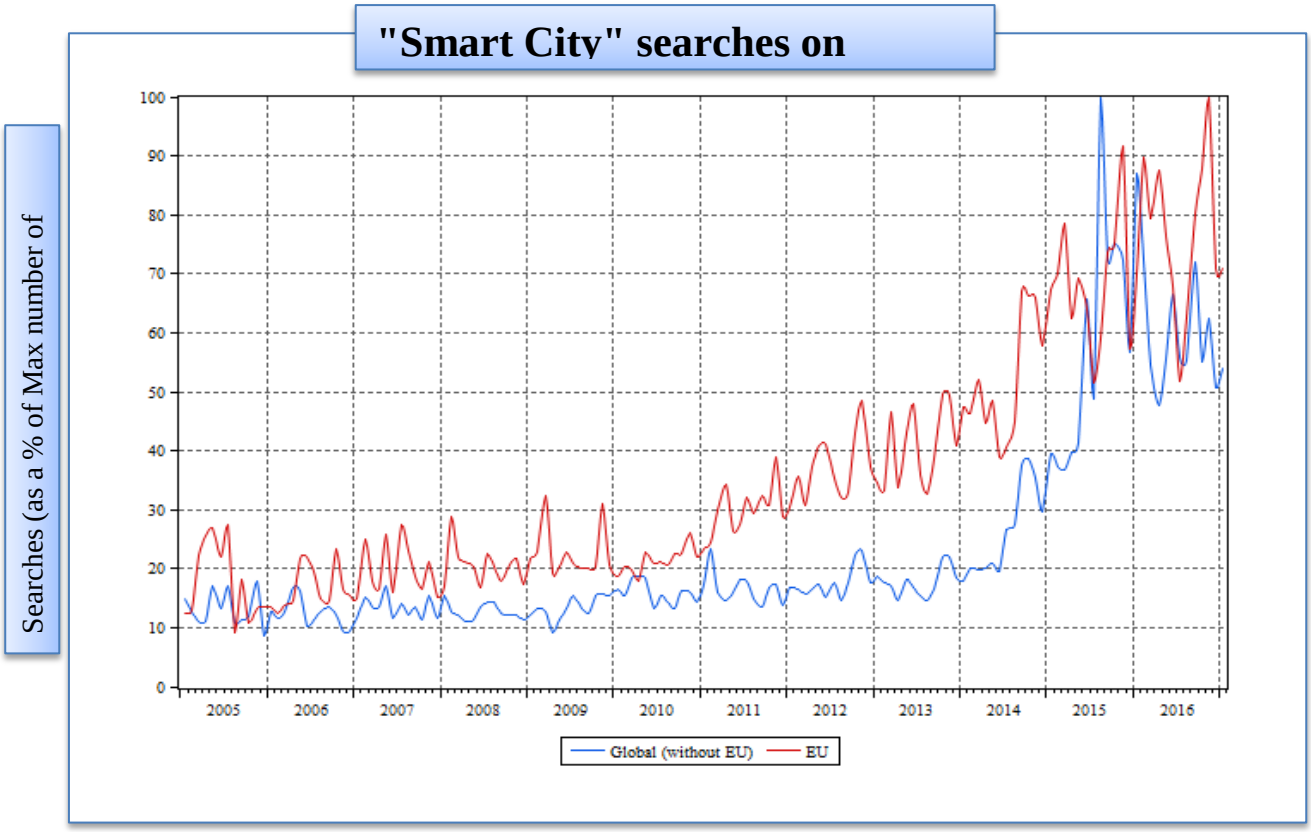


Figure 5 portrays the interest of European citizens in the concept of "Smart City" as opposed to the same interest in the rest of the world (and excluding the EU). It is captured from the searches of individuals on Google[5]. According to the figure, the EU trend seems to be higher on average. Furthermore, there's a gradual increase of that interest in recent years, which starts after 2010 for the EU countries, whereas for the rest of the world it's only noticeable after 2014. Nevertheless, the peak of that interest comes sooner for the rest of the world (mid-2015 in contrast to late-2016 for the EU). Interestingly though, for the EU area, that interest for smart cities was relatively stable and equal to around a third of the max for the period 2005-2010, implying that first, there was a

[5] Data obtained via 'Google Trends' (https://www.google.co.uk/trends/). Google does not provide the raw data (e.g. number of searches monthly), but rather their linear normalisation in the form of: (monthly # of searches / Max # of searches overall)

fair share of people exhibiting their interest from the very beginning and second, after 2010 something happened driving this interest up, reaching its peak in 2016.

Figure 5. Interest in the "Smart City" concept. Comparison between EU countries and the rest of the world.



One assumption could be attributed to the fact that the number of projects is increasing (both in absolute numbers and the number of active projects) thus producing higher media splash overall. Figure 6 illustrates a comparison of the EU trend with the number of active smart city projects per year. Furthermore, figure 7 conveys similar information, but instead of the number of active projects, it portrays the number of new projects started (at a particular month of a year).

Figure 6. EU interest in the "Smart City" concept and the number of active projects. Source: Authors' elaboration.

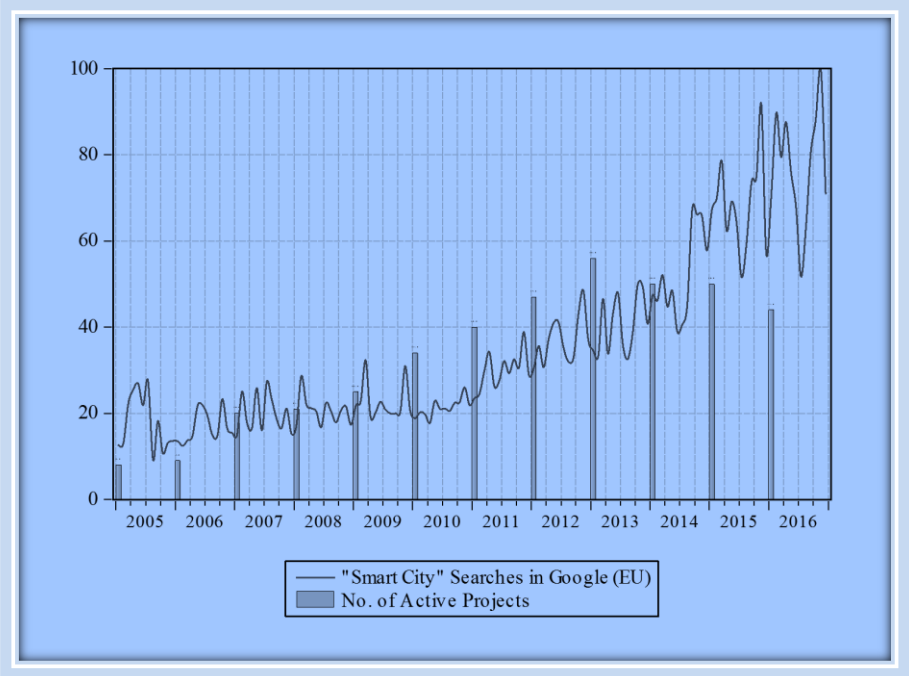


Figure 7. EU interest in the "Smart City" concept and the number of new projects. Source: Authors' elaboration.

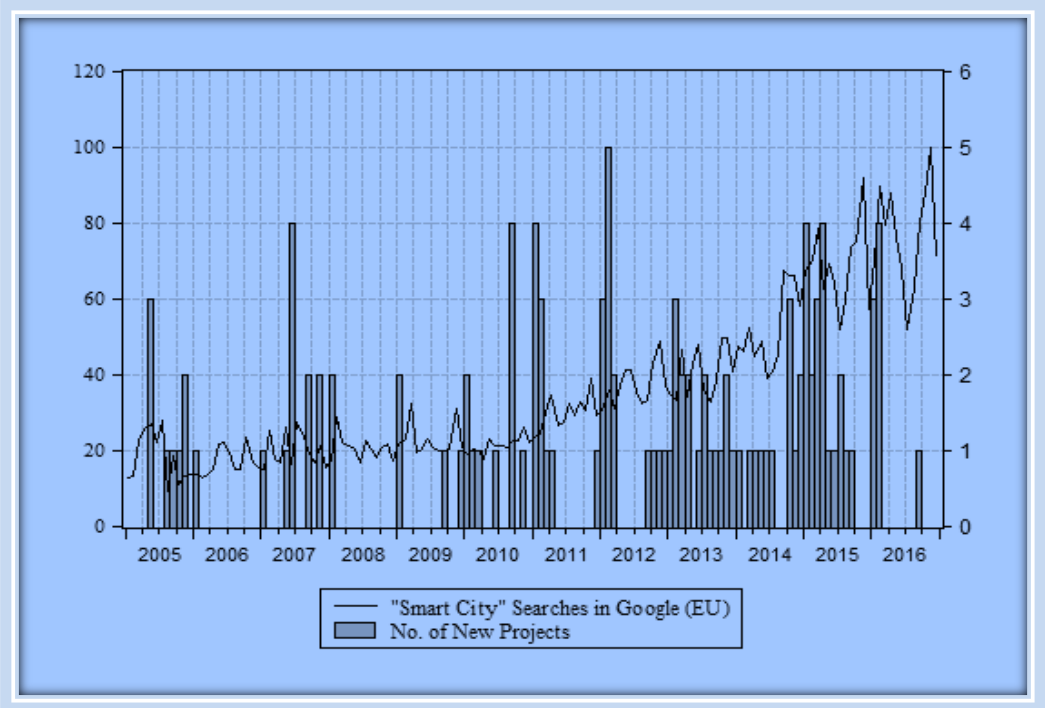
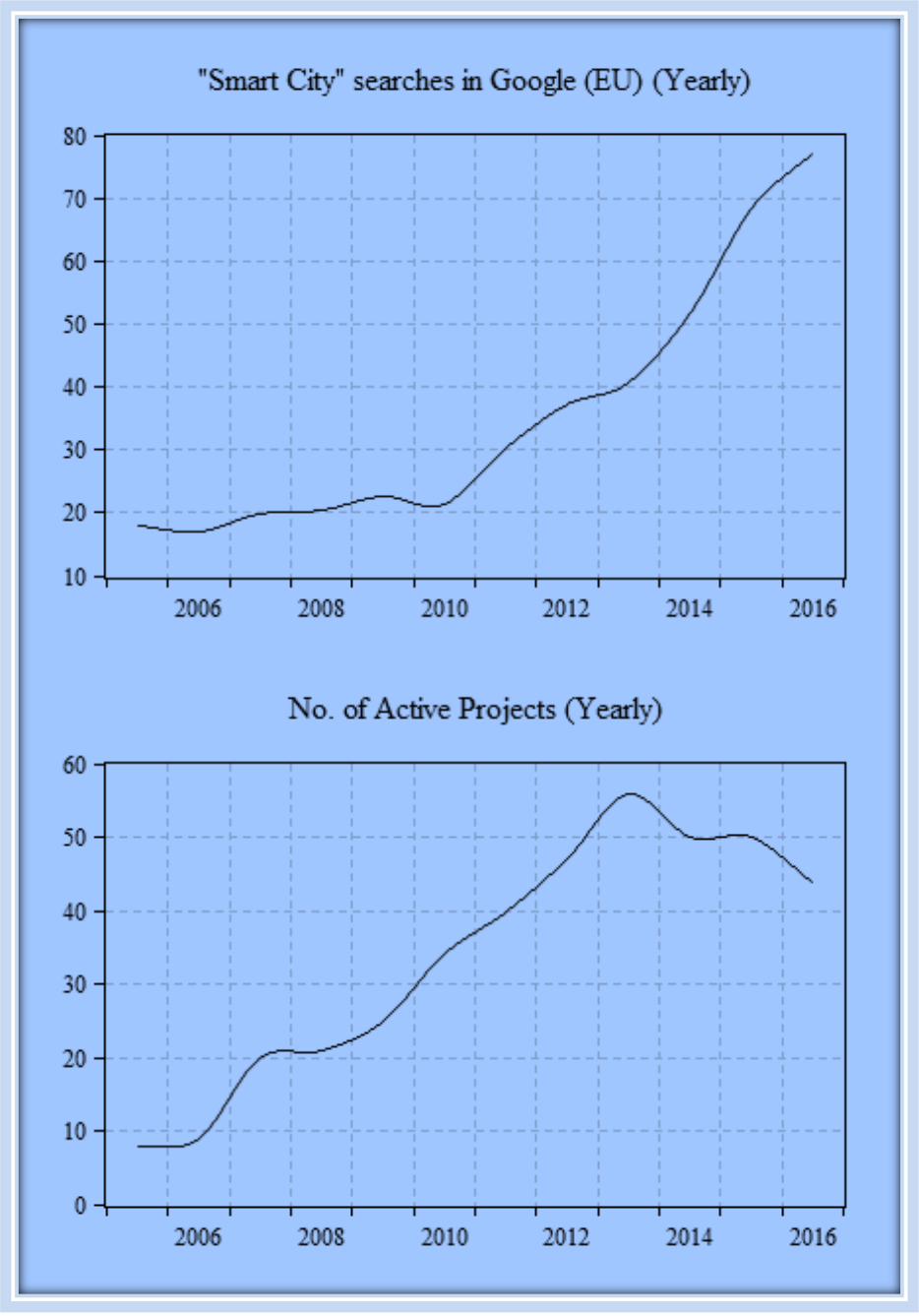


Figure 8 below is another representation of figure 5, rescaled and smoothed to better compare the relationships between the number of active projects and the interest of EU citizens in 'Smart Cities'.

Figure 8. EU interest in the "Smart City" concept and the number of active projects (both expressed yearly).



In order to test the impact of the number of active projects to the interest in terms of Google Searches, a simple regression exercise has been performed. The results are reported below.

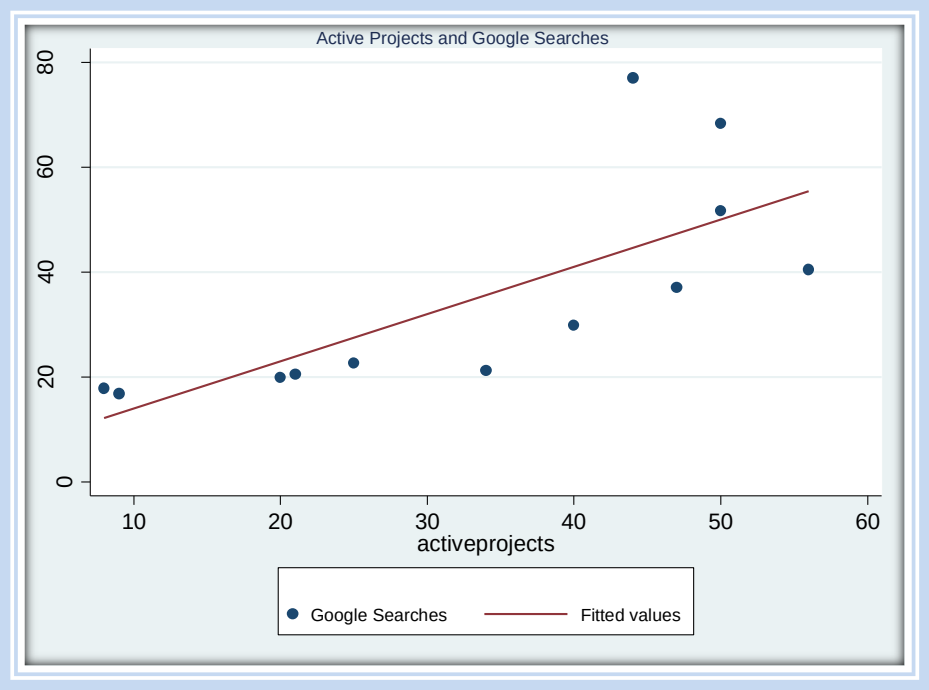
Table 4 – Active projects and Web interest in the Smart city discourse. Source: Authors' elaboration.

VARIABLES	OLS
Active projects	1.022***
	(0.130)
R-squared	0.888

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Therefore, the simple OLS exercise confirms a strong and statistically significant positive relationship between the number of active projects and the interest for the smart city discourse as measured by Google searches. The graph below reports the scatterplot of the two variables along with the fitted regression line.

Figure 9 - Active projects and Web interest in the Smart city discourse.



The Graph confirms the aforementioned positive relationship in a more intutitive way. Overall, the regression analysis along with the previous descriptive statistics confirm a kind of self-reinforcing cycle linking the projects realised, the interest for the smart cites discouse, and, in turn, it is reasonable to assume this evidence will result in further projects to be realised as the theme attracts the attention of citizens and policy makers.

Figure 10 is a heat-map illustrating the number of Smart City projects per country for the EU area, followed by a table exhibiting both the number of single projects (domestic only) and the number of total projects each country has taken part in.

Figure 10 - Heat map of Europe: Number of Smart City Projects in the time period 2005-2016

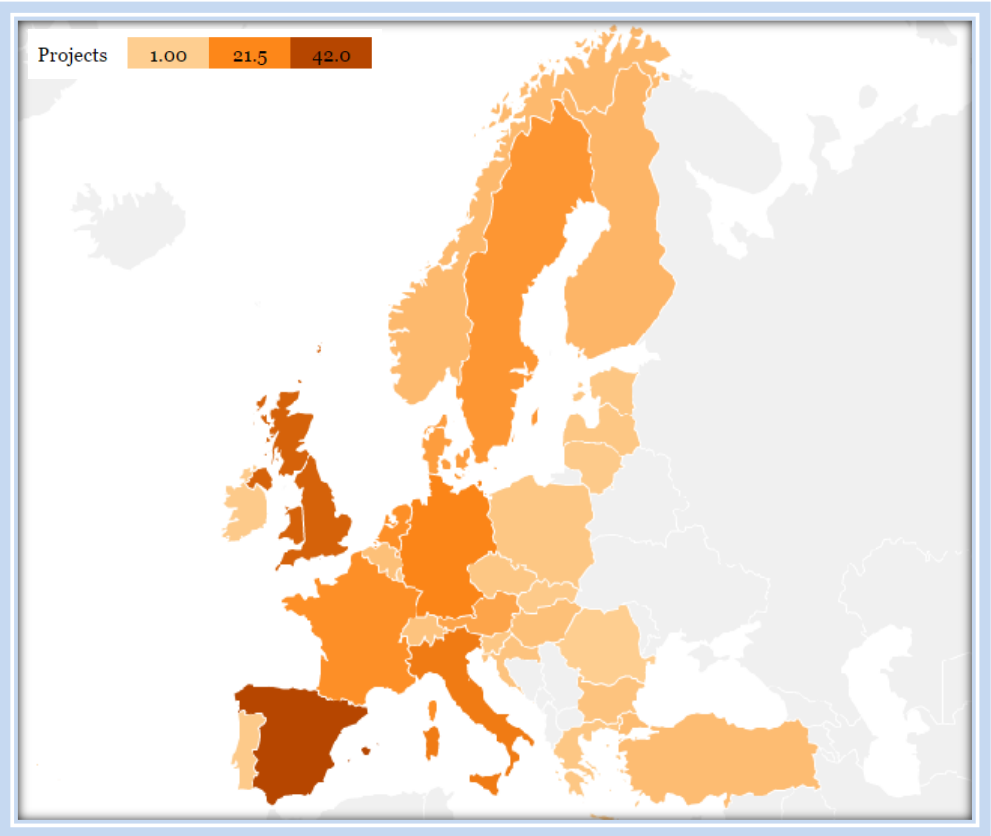


Table 5 - Number of Smart City Projects in the time period 2005-2016

Countries	# of single Projects	# in total*
Austria	1	13
Belgium	0	5
Bulgaria	0	4
Croatia	0	4
Czech	0	3
Denmark	2	15
Estonia	0	3
Finland	4	8
France	2	19
Germany	6	22
Greece	0	3
Hungary	0	5
Italy	2	25
Latvia	0	3
Lithuania	0	2
Luxembourg	0	2
Monaco	1	1

Countries	# of single Projects	# in total*
Netherlands	1	19
Norway	1	7
Poland	0	3
Portugal	0	2
Romania	0	1
Serbia	1	1
Slovakia	0	2
Slovenia	1	3
Spain	8	42
Sweden	1	17
Switzerland	0	4
Turkey	0	6
United Kingdom	17	33

**total refers to the overall number of projects these countries contributes. It includes the no. of single projects and the no. of projects they co-operate with other countries. (single = domestic)*

With the exception of the UK which has 17 single[6] projects (out of its 33 overall), the majority of the countries seem to have zero, or a few single projects.

In what follows the main results of the aforementioned text analysis are summarised. Figures 11 to 17 analyse the narrative of smart cities projects according to a variety of perspectives. More precisely, Figure 11 below reports the 40 most frequent words related to smart cities projects. Therefore, Figure 11 aims to present an overview of the most frequent terms used in describing the projects. The following Figure 12 presents a 'word cloud' based on the overall set of countries and projects here considered. Figure 13 augment the analysis by exploring the association between the most frequent terms. Figures 11 to 13 represent, therefore, a very preliminary analysis where both the time and the cross-country dimensions are somewhat neglected. This

[6] By the term 'single' we mean those projects that are being developed only within the country (e.g. domestic), whereas the total number of the projects refers to all the projects (including the single ones) for which they (the countries) co-participate. For instance, it could be the case –more like the rule, rather than the exception– that a project is applied/engineered in a number of countries, instead of just one.

phase is referred as the 'first stage' analysis in which the overall multi-national setting[7] is taken into account. In a second stage analysis the cross-country dimensions is considered. The results of the analysis considering the cross-country dimension is considered in Figure 14 and 15 which report the 40 most frequent words by country along with the related word clouds. A third stage of analysis took into account the time dimension. The related results are reported in Figure 16 and 17 repeating the same exercise (both the most frequent words and the word cloud by year.

Figure 11 - Multi countries analysis. Source: Authors' analysis.

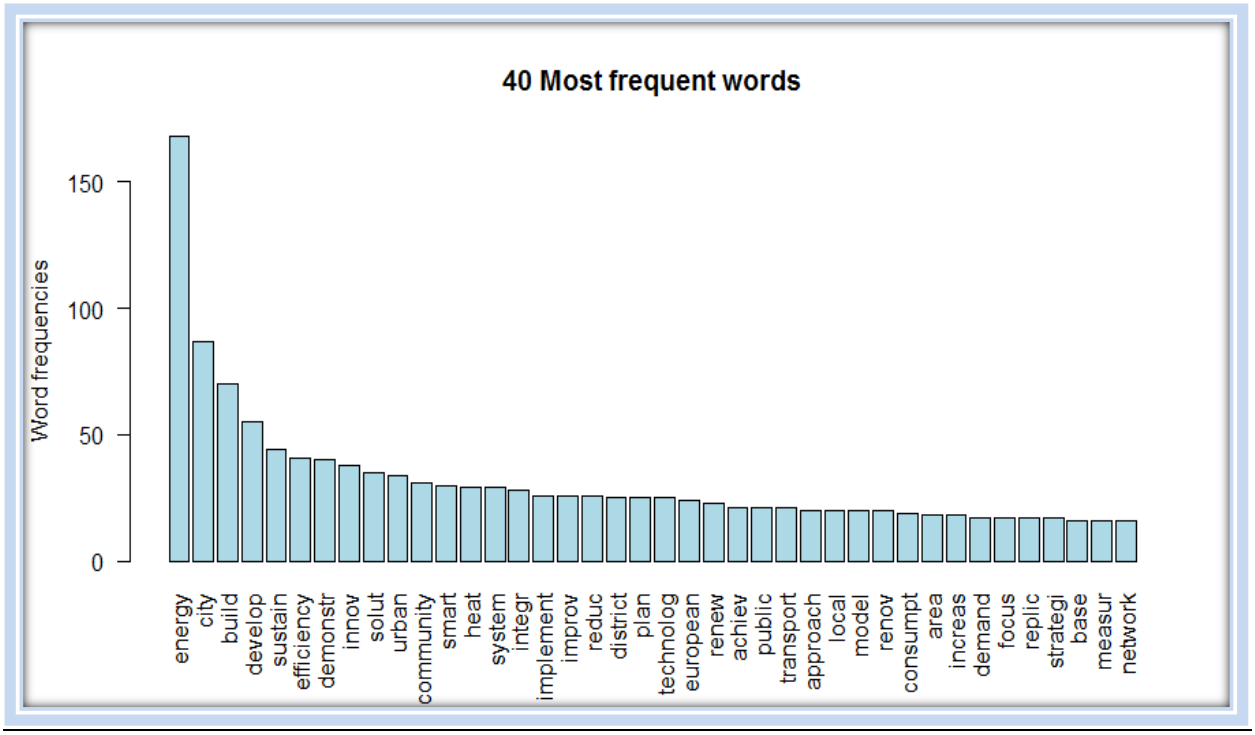
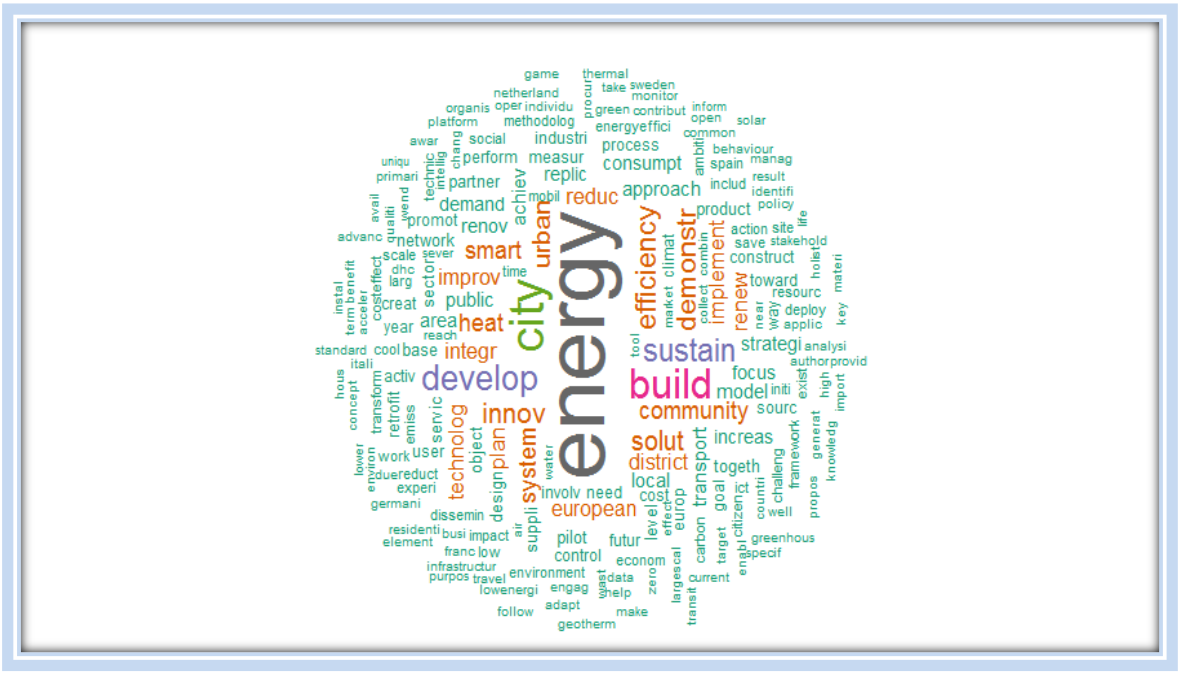


Figure 12 - Word cloud Multi countries. Source: Authors' analysis.

[7] With the term "multi-national setting", we hereby mean those projects that are carried out in a number of countries simultaneously, or projects created within collaborations of countries.



From the first stage of the analysis we may draw the following three main conclusions:

a) The word which appeared in most smart city projects' summaries is "energy". This is reflected in the visualisation of the analysis' outputs found in figures 11 and 12. Moreover, the eminence of that word in comparison to the rest is highly noticeable, being encountered more than 150 times, in contrast to below 100 times for the second word and slightly above 50 for the third one. Indeed, words that have a common root to word "energy", are the most frequently encountered in the dataset, exhibiting this way the importance of energy-related projects overall, and of course, the focus of the smart city projects towards this area.

b) It does not come as a surprise that one of the most common words encountered in the text analysis is the word "city". Since all these projects address this very topic, of 'converting' (metaphorically speaking) a city from its conventional definition, to the 'desired' one of

being "smart"[8], then "city", which is the target of those projects is of course one of the most common word. Nevertheless, going through the text analysis process manually to see what is behind this word, that gives meaning to it, almost half of the words that put "city" in the second place, are due to the word "citizen"[9] thus exhibiting the focus of those projects directly towards the citizens themselves[10].

c) What we have noticed by going through the projects and which is something also apparent in the text analysis' outputs, is the aim of most of the projects to be 'diffused' in other cities/countries after they are finished and pilot-tested. This can be drawn from the words "demonstrate" and "implement", two words commonly appeared in the scope of the projects, involving the diffusion of those ideas/projects in a demonstrating example, or even fully implemented in areas other than those of the projects.

As mentioned above, in order to further understand the context that the most frequent words have appeared in, an association of those words in regard to their 'surroundings' is presented in Figure 12. This association translates into the correlation between these words (most frequent[11]) and other words appeared in the same sentence. For instance, in the example of the word "energy", the most common words encountered in the text analysis in the same sentence with the word "energy" are "measuring", "consumption" and "action". Understandably, most projects that focus on energy are related to the measurement of consumption and the "action", in that context,

[8] The word "smart" is also included in the 40 most frequent words encountered in the text analysis.

[9] We hereby remind the reader again that the text analysis was conducted at a root level thus the word "citizen" belongs to the same root as the word "city" (which, in that case, is "cit") and counts as a plus one for its frequency. Nevertheless, since "city" is the most common word for that root, it appears as a representative word for the frequency of its root ("cit").

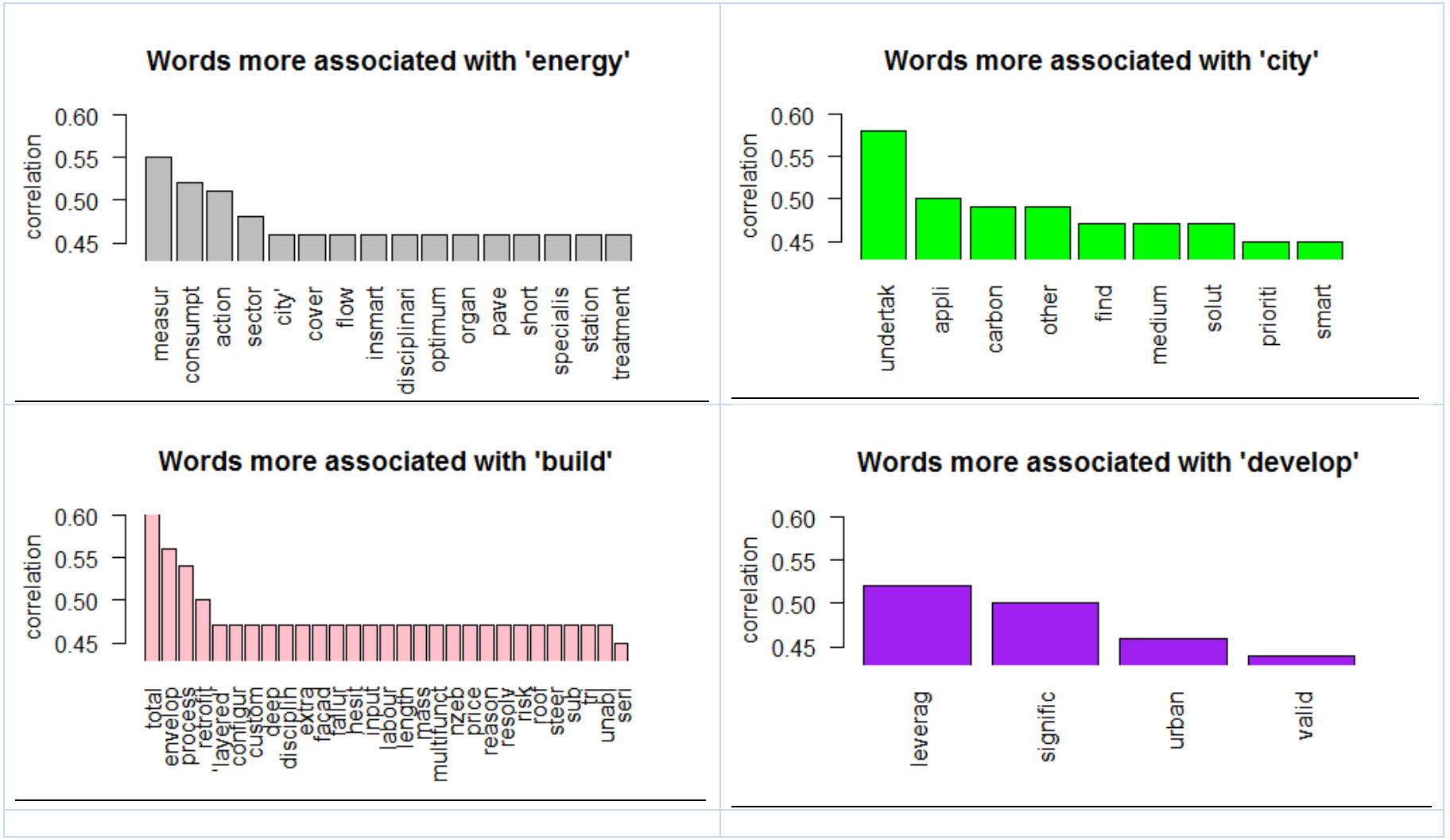
[10] A similar point (for the importance of people/citizens in the dynamic relationship examined) could be made with the word "community", which is also appeared in the most frequent words and which is directly related to the citizens themselves through projects that aim to enhance the perception of communities.

[11] Only 4 out of the overall 40 words' associations are presented in this figure. This is mainly to illustrate how our text analysis was carried out in a more detailed stage after the preliminary text analysis results were obtained.

refers to the scope of the project on reducing the consumption, using other green alternatives, or materials for that purpose, depending on each project of course. This is in line with the EC's environmental initiatives in general, and more specifically with its 7th Environment Action Programme (EAP)[12].

[12] For more, see: http://ec.europa.eu/environment/action-programme/

Figure 13 - Association between frequent terms. Source: Authors' elaboration.



For the second stage of text analysis, we wanted to see whether these (most frequent) words change between countries. In other words, whether the focus of smart city projects change from a country to another. Therefore we filtered the dataset to include only those projects that are carried out only in one country (e.g. single projects), and we run a text analysis for each and one of the countries for which we have these data. The results (most frequent words for each country) are presented in Figure 14 and 15. What we may draw from these outputs is that:

a) In general, the environmental initiative (as proxied via the word “energy”) holds the first, or one of the first places (in the form of most frequent word used) for the majority of the countries examined.

b) Nevertheless, a few countries (Austria, Finland, Germany, Spain, and United Kingdom) exhibit higher interest (according to the most frequent words used) on other initiatives such as ‘open data’, ‘information’ and ‘applications’ of interaction platforms involving the citizens. Going through the objectives of these countries’ projects ourselves, we discovered that while they still focus on “energy”-related initiatives, most of the projects we’ve found for those countries are related to data used for decision analysis purposes and dissemination of information to the citizens (e.g. from traffic, parking places and construction works to platforms with citizens engaging in communications, expressing their views/concerns on a range of issues within the community).

Figure 14- Country-Level 40 Most Frequent Words. Source: Authors' analysis.

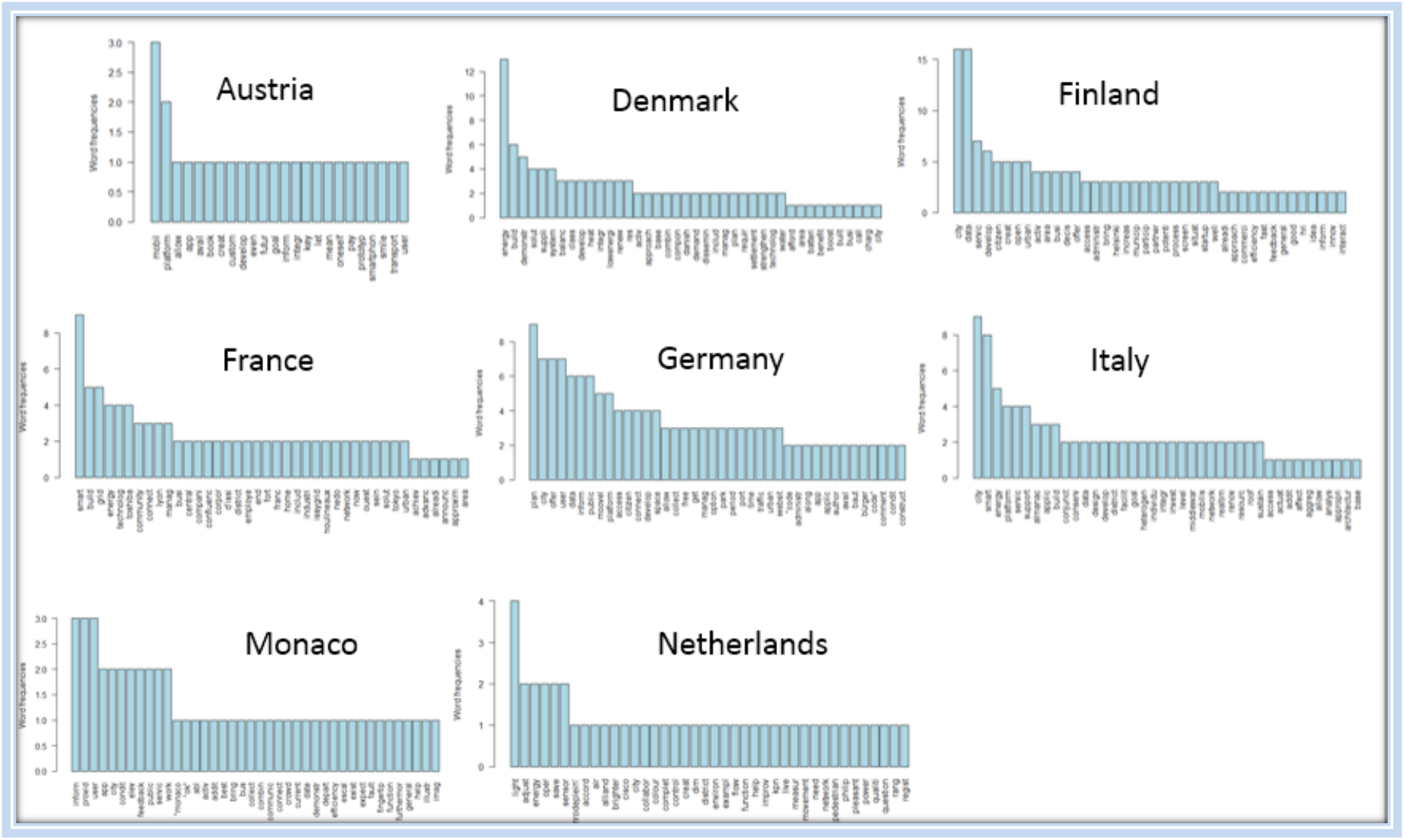


Figure 14 - Country-Level 40 Most Frequent Words (cont.). Source: Authors' analysis.

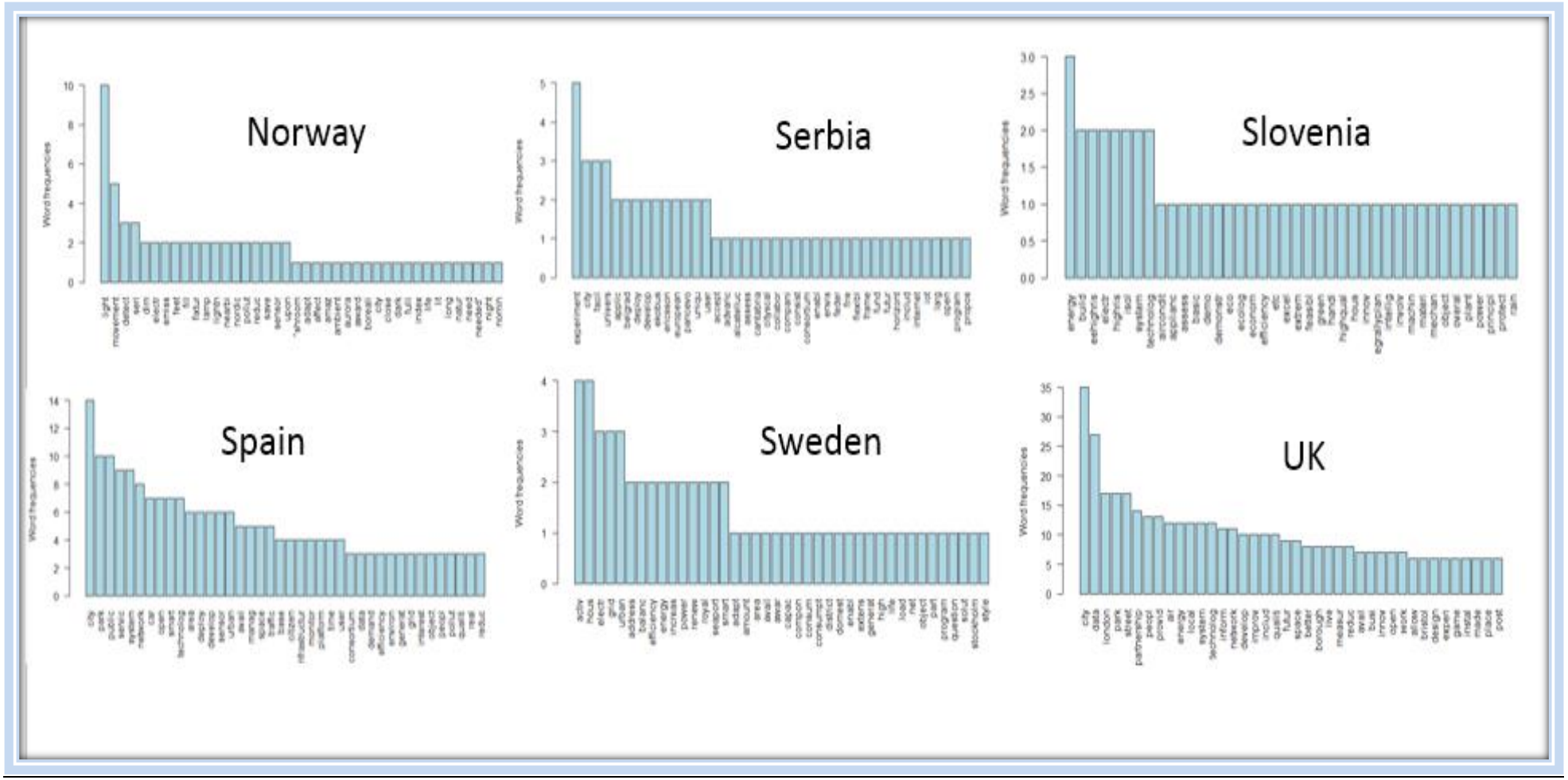
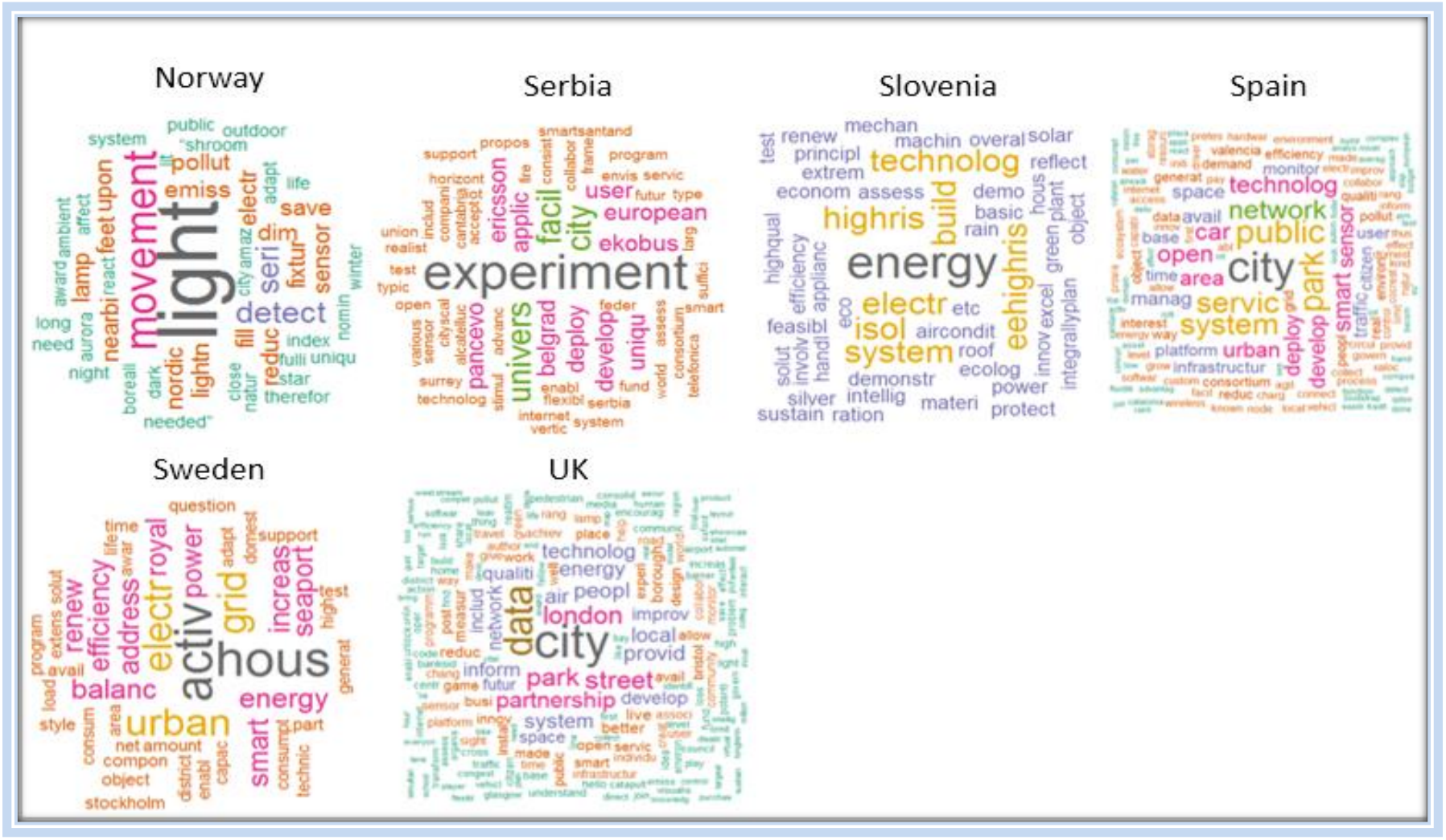


Figure 15 - Country-level Clouds. Source: Authors' analysis.

Figure 15 - Country-level Clouds (cont.). Source: Authors' analysis.



For the third stage of the text analysis, we wanted to pool all the aforementioned projects (in both the multi-national and the national settings) and see whether the orientation of the projects changes between the years in our sample (2005-2016). Therefore, we run a third text analysis for each one of the years in our sample, the results of which are found in Figure 16 and 17. What we may draw from these outputs is that:

a) In general, energy-related projects still dominate, as shown from the most frequent word being "energy" for most of the years in our sample.
b) Nevertheless, after three years of environmentally-oriented projects (as shown from the words "energy", "build", "renew"[13], "heat" for the time period 2005-2007), the orientation changes towards IoT-related projects for the next three years, 2008-2010 (as proxied by the words/roots "internet", "develop", "technolog", "data" etc.).
c) Afterwards, there's a reversal of the focus of smart city projects towards energy-related goals, which still holds to date.

Consequently, we can conclude that "energy" is the main focus/objective of the majority of the smart city projects, either on a country level, or on a multi-national setting. Moreover, this objective is still considered as the principal one when we check the yearly trend of those projects. At some point (2008-2010) it seems that it is substituted by an increasing focus on IT-related projects, but it changes to its previous state again after 2010.

[13] The word "renew" is the root of (and mostly associated with the word) "renewable", used solely in the context of energy-related projects (e.g. "renewable" energy, sources etc.)

Figure 16 - Most frequent words by year. Source: Authors' analysis.

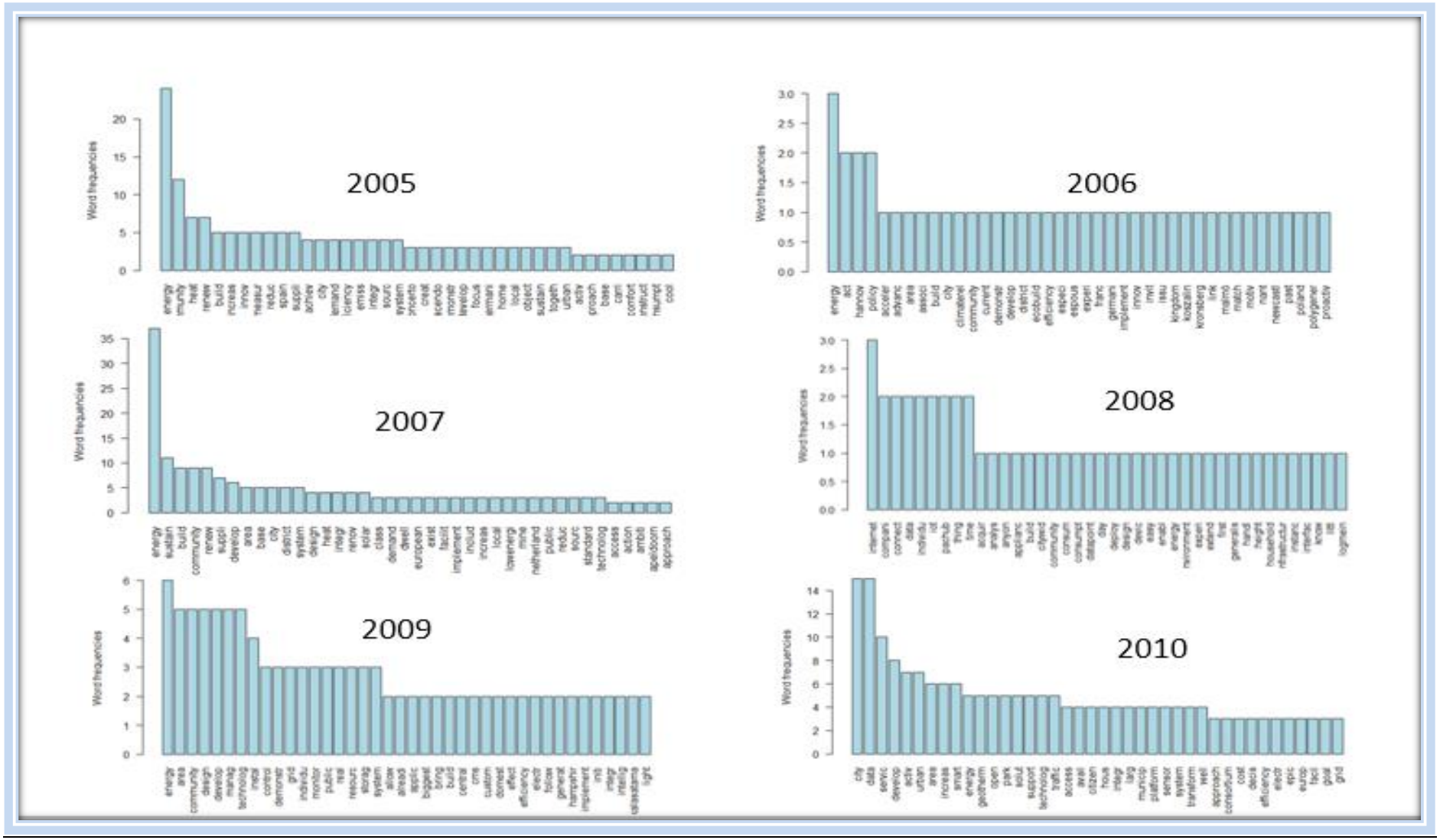


Figure 16 - Most frequent words by year (cont.). Source: Authors' analysis.

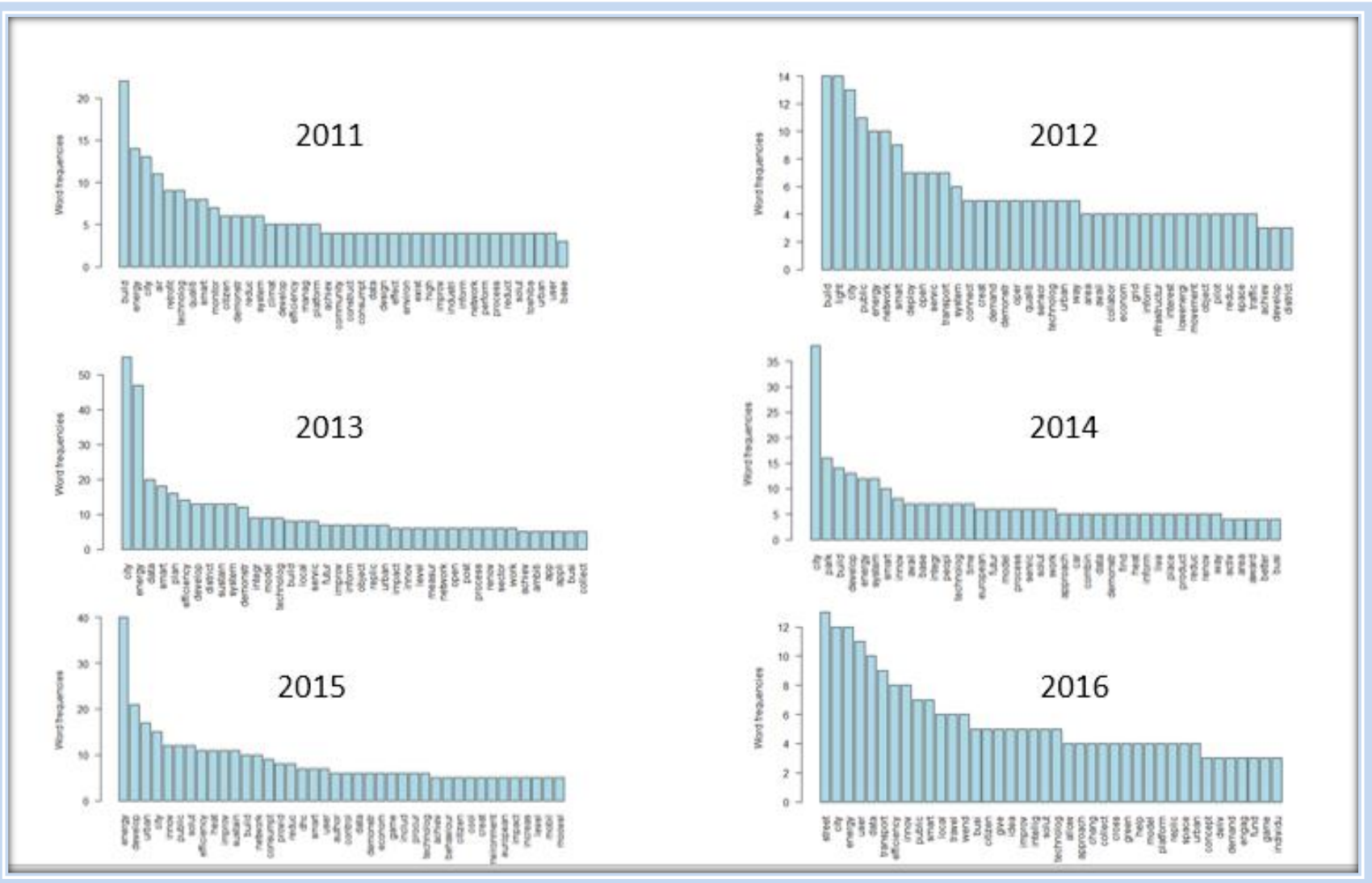


Figure 17 - Words Clouds by year. Source: Authors' analysis.

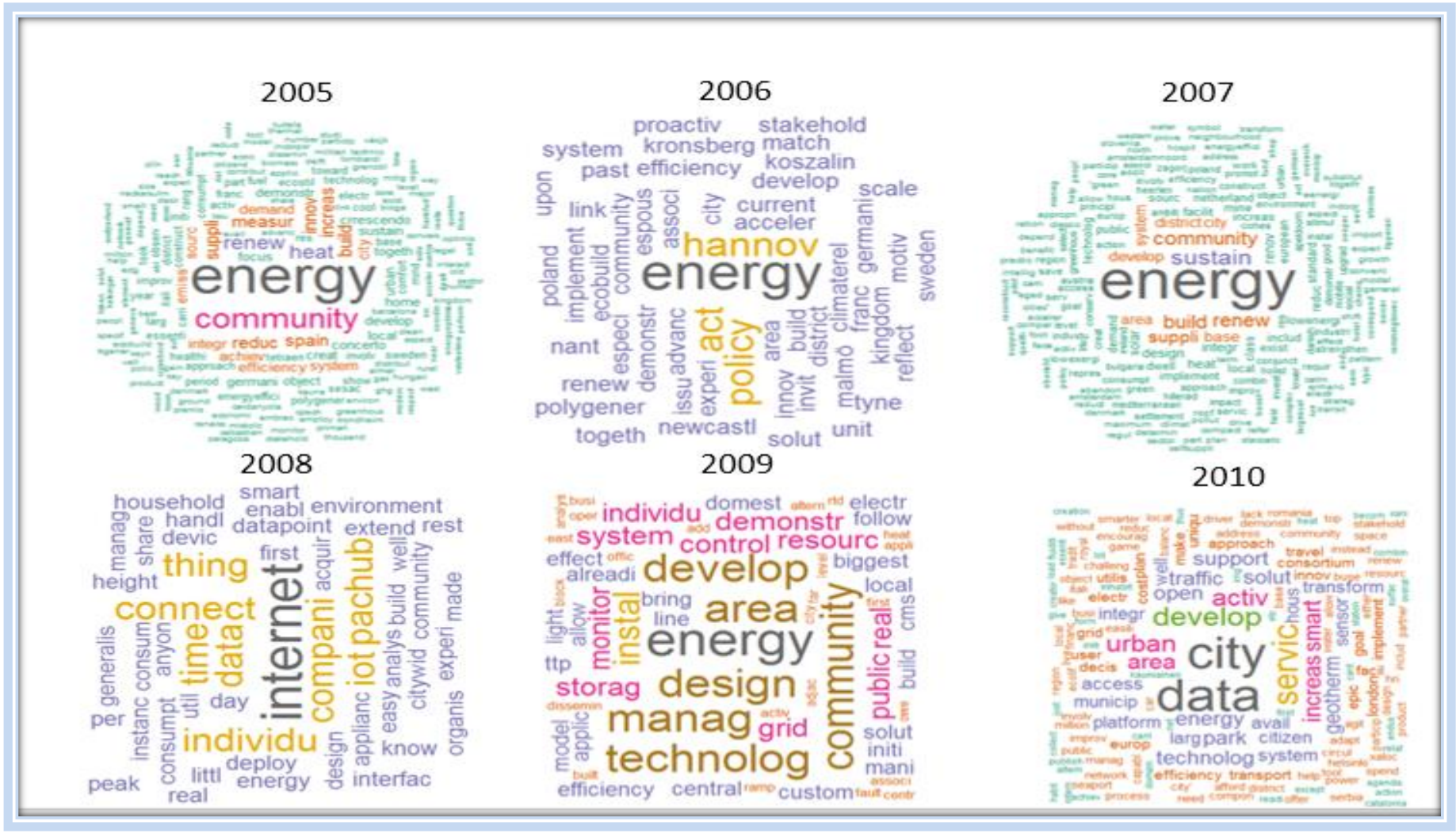
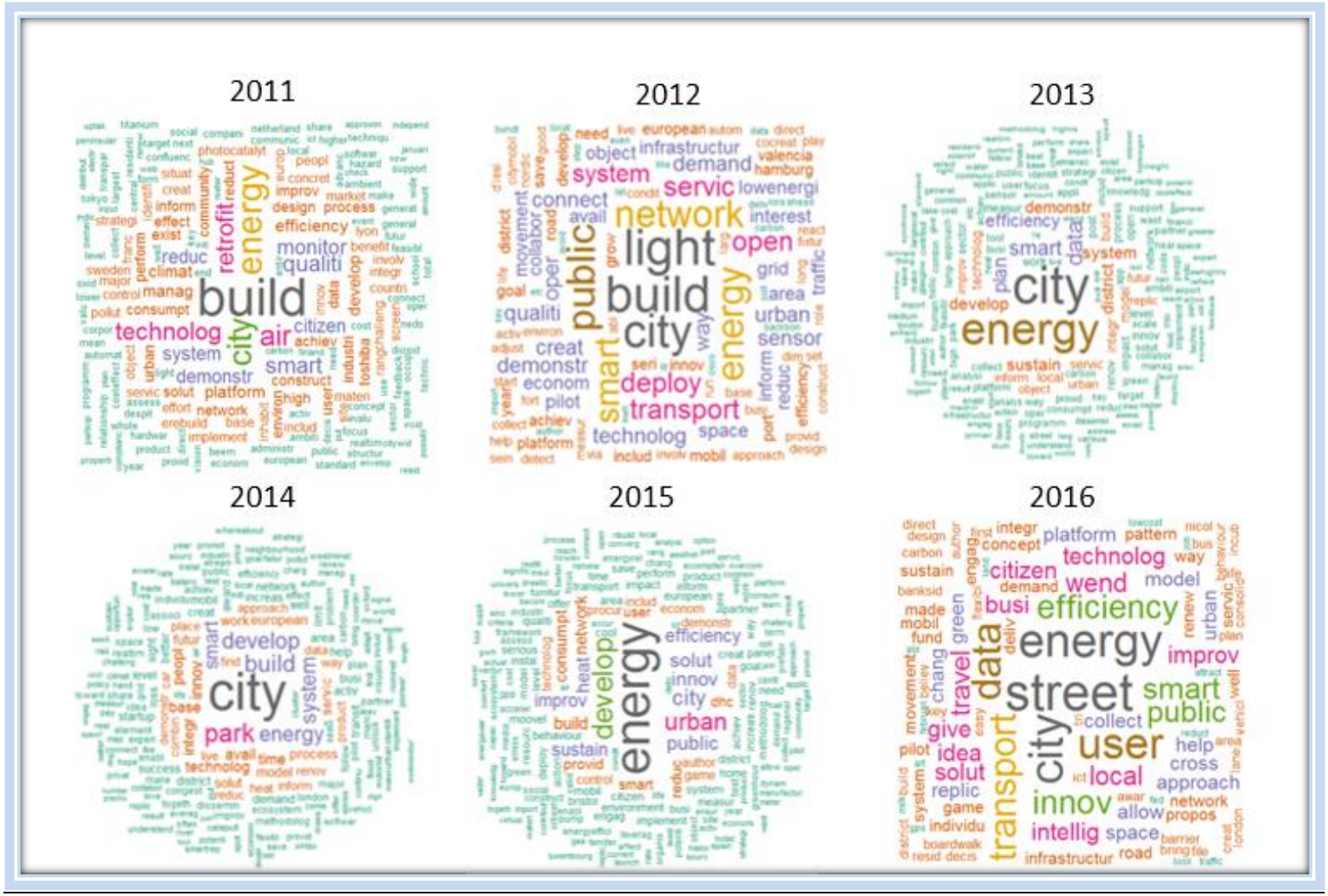


Figure 17 - Words Clouds by year (Cont). Source: Authors' analysis.



4. Measurement of 'Smartness'

There is an evolving body of research and reports devoted to measuring the intelligence of cities through establishing specific methodologies and indicators (grouped by various criteria). For example, Priano and Guerra (2014) consider Cities are complex and heterogeneous structures, which complicates comparisons between them. To address this they propose an N--dimensional measurement framework where each level or dimension supplies information of interest that is evaluated independently. As a result, the measure of a city's intelligence is the result of the evaluations obtained for each of these levels. Winters (2011) considers why smart cities are growing by investigating who moves to smart cities and who stays. Smart cities are often centres of higher education, so students moving to pursue higher education may play an important role. He finds that the greater in-migration to smart cities is mostly due to persons enrolled in higher education. Smart cities are growing in part because in-migrants often stay in the city after completing their education.

Lombardi et al (2012) propose a profound analysis of the interrelations between smart city components connecting the cornerstones of the **triple helix model**. They state that a full list of indicators, available at urban level, has been identified and selected from literature review. In the specific context of energy , Lazaroiu and Roscia (2014) present a model for computing "the smart city" and compute indices based on this. The chosen indicators are not homogeneous, and contain high amount of information. Their work deals with the computation of assigned weights for the considered indicators. The proposed approach uses a procedure based on fuzzy logic and defines a model that allows estimation of the "the smart city", in order to access external project funding.

Stochastic Multicriteria Acceptability Analysis (SMAA)

We propose to deal with the measurement issue adopting the Stochastic Multicriteria Acceptability Analysis (SMAA) (Lahdelma, Hokkanen and Salminen, 1988). SMAA can create a ranking of cities based on their smartness. We can determine the probability of each city to be the first, the second, the third and so on in the above ranking. Furthermore, for each pair of cities we can define the probability that one is better that the other or vice versa.

In doing so, our approach takes explicitly into account that one can attach different weights to considered dimensions of smartness (Helliwell, 2003; Helliwell and Barrington-Leigh, 2010). The SMAA (Lahdelma, Hokkanen and Salminen, 1988) considers the whole set of possible weights (in fact approximated through a very large sample of randomly extracted vectors of weights). Indeed, considering the whole set of possible vectors of weights, amounts to take into account all the sensibilities, ranging from the extreme ones taking into account only one or few dimensions, to the more balanced, taking into account all the dimensions. Instead, the usual approach considering a single vector of weights, uniforms all the individuals collapsing them to an abstract and unrealistic “representative agent”. We believe that the ‘representative agent’ approach has a crucial limitation when applied to the issue of smart cities. Indeed, the multifaceted nature of the smart city concept involves the judgment of a variety of agents with different backgrounds and perspectives. For instance, businessman might be reasonably more interested in the economic dimensions of the concept, especially in terms of increased efficiency and productivity, as well as on the business opportunities related to the smart city per se. However, the citizens might be reasonably more interested in the application of the above technology to everyday life, rather than to the operation of business activities. Moreover, between citizens, different categories might also express different relative preferences based on their age, gender, and income just to cite a few.

Therefore, according to the SMAA approach the issue of measuring the level of smartness of a city can be assimilated to multiple criteria decision problem. SMAA represents a Multiple Criteria Decision Aiding (MCDA) tool (Figueira et al. 2005; Ishizaka and Nemery, 2013). In a MCDA a set of alternatives $A=\{a_1,\ldots,a_m\}$ is evaluated on a set of evaluation criteria $G=\{g_1,\ldots,g_n\}$ in order to deal with decision problems such as choice of the best alternative or ranking of all the alternatives from the best to the worst. The value function most commonly used to aggregate the evaluations of alternatives from A with respect to criteria from G is the weighted sum, which, after assigning a non-negative weight w_i to each criterion $g_i \in G$, $w_1+\ldots+w_n=1$, gives to each alternative $a_k \in A$, the following overall evaluation:

$$u(a_k, w) = \sum_{i=1}^{n} w_i g_i(a_k). \qquad \text{eq. (1)}$$

In SMAA is supposed that the same evaluation of each alternative can be probabilistic. For example, if one do not know exactly the pollution percentage of a given city one can take into consideration an interval of possible values on which a distribution (very often a uniform distribution) can be assumed. Of course, if the evaluation according to the considered criterion is precise and exactly known the distribution the whole probability is concentrated in the given evaluation (technically this type of distribution is called Dirac delta). Thus in SMAA one suppose that there exists a space χ containing all the possible matrices ξ of evaluations of the considered alternatives on the criteria at hand, with ξ_h denoting the vector of evaluations of alternative a_h.

First of all, SMAA introduces a ranking function relative to the alternative a_k , with respect to the realization $\xi \in \chi$:

$$rank(k, \xi, w) = 1 + \sum_{h \neq k} \rho\left(u(\xi_h, w) > u(\xi_k, w)\right), \quad \text{eq. (2)}$$

where ρ(false) = 0 and ρ(true) = 1.

Then, for each alternative a_h, for each possible matrices of evaluation of alternatives ξ ∈ χ and for each rank r = 1, . . . , l, SMAA computes the set of weights of criteria for which alternative a_k assumes rank r:

$$W_k^r(\xi) = \{w \in W : rank(k, \xi, w) = r\}. \quad \text{eq. (3)}$$

SMAA is based on the computation (between others) of the following two indices. First, the Rank Acceptability Index (RAI) which is the relative measure of the set of weight vectors and evaluations on considered criteria for which the alternative a_k gets rank r:

$$b_k^r = \int_{\xi \in \chi} f_\chi(\xi) \int_{w \in W_k^r(\xi)} f_W(w)\, dw\, d\xi; \quad \text{eq. (4)}$$

where b_k^r represents the probability that alternative a_k has the *r-th* position in the preference ranking. Taking into consideration the whole set χ of all possible matrices of evaluations ξ ∈ χ.

Second, the pairwise winning index (Leskinen et al., 2006), which gives the frequency that an alternative a_h is preferred or indifferent to an alternative a_k in the space W of possible weight vectors and the space χ of all possible evaluations on considered criteria:

$$p_{hk} = \int_{w \in W} f_W(w) \int_{\xi \in \chi : u(\xi_h, w) \geq u(\xi_k, w)} f_\chi(\xi) d\xi\, dw. \quad \text{eq. (5)}$$

From a computational point of view, the multidimensional integrals defining the considered indices are estimated by using the Monte Carlo method. In our application to the smart cities

measurement, for the sake of simplicity, we consider a uniform probability distributions $f_W(w)$ on W. Let us remark that in this case we have exact evaluations on each criterion and thus the space χ collapses to a single multicriteria evaluations matrix.

In what follows we apply the SMAA technique to the ranking the cities from Urban Audit database (spatial alternatives $A=\{a_{1,\dots,} a_m\}$) using a set of characteristics related to the working definition of smart cities introduced in introduction as evaluation criteria ($G=\{g_1,\dots,g_n\}$) to be evaluated according to the set of weights W.

The concept of smart cities is operationalised according to the following 17 dimensions representing either direct or indirect (rather inverse) proxies of smartness attribute. Generally speaking, the proxies here considered aim to measure the result "investments in human and societal capital and traditional (transport) and modern (ICT) communication infrastructure" (Caraglui et al., 2011) as well as measures of "sustainable economic growth and a high quality of life" (Caraglui et al., 2011) along with "a wise management of natural resources" (Caraglui et al., 2011).

More in detail, 'Infant Mortality per year' aims to capture the overall performance in terms quality of life with respect to one of the most vulnerable category according to age. The variable 'Number of deaths per year under 65 due to diseases of the circulatory or respiratory systems', aims to contribute to capture the aforementioned quality of life aspect from a different angle. One taking into account the whole share of under 65 population. 'Population living in private households (excluding institutional households)' aims to capture the housing issue and the ability of a given city to deal with it. The 'Number of children 0-4 in day care or school' along with the 'Students in higher education (ISCED level 5-8 from 2014 onwards)' aim to measure the institutional

educational side of the formation of human capital. The 'Number of cinema seats' jointly with 'Cinema attendance',

'Number of museum visitors', 'Number of theatres', and 'Number of public libraries' aim to complement the above information with broader measures of human capital. The 'Economically active population' and the 'Total number of companies' aim to measure the overall level of economic activity. The set 'Share of journeys to work by car', 'Share of journeys to work by public transport', 'Share of journeys to work by bicycle', and 'Share of journeys to work by foot' aim to capture the mix of available infrastructure and its use. Finally, between the available Urban Audit data, the 'Number of days ozone O3 concentrations exceed 120 µg/m³' measures the overall environmental quality.

All the data are taken from the Urban audit dataset (http://ec.europa.eu/eurostat/web/cities).

Moreover, in order to make comparable variables expressed on different metric we normalise them w.r.t. either their minimum

$$\widetilde{x_i} = \frac{x_i - x_{min}}{x_{max} - x_{min}}; \qquad \text{eq. (6)}$$

or maximum value

$$\widetilde{x_i} = \frac{x_{max} - x_i}{x_{max} - x_{min}} \qquad \text{eq. (7)}$$

depending on the variable being a direct measure of smartness (a 'good') or an inverse measure (a 'bad'), respectively. For instance, the higher the l 'Number of days ozone O3 concentrations exceed 120 µg/m³', the lower the performance is in that respect. Therefore, the latter variable is considered as an inverse measure of *smartness* to be normalised adopting the formula reported in eq. (10). Table 6 reports variables description along the categorization of each variable according the aforementioned good/bad criterion.

Table 6 – Variable Description (all variables taken from the Urban Audit dataset)

Variable	Categorisation
Infant Mortality per year	bad
Number of deaths per year under 65 due to diseases of the circulatory or respiratory systems	bad
Population living in private households (excluding institutional households)	good
Number of children 0-4 in day care or school	good
Students in higher education (ISCED level 5-8 from 2014 onwards), total	good
Number of cinema seats (total capacity)	good
Cinema attendance (per year)	good
Number of museum visitors (per year)	good
Number of theatres	good
Number of public libraries (all distribution points)	good
Economically active population, 20-64, total	good
Total number of companies	good
Share of journeys to work by car -%	bad
Share of journeys to work by public transport (rail, metro, bus, tram) -%	good
Share of journeys to work by bicycle -%	good
Share of journeys to work by foot -%	good
Number of days ozone O3 concentrations exceed 120 µg/m³	bad

In the following steps the normalised variables are used for the computation of a smartness index.

An extract reporting a selection of the first 20 cities covered in the Urban Audit dataset in alphabetical order with regard to the first 20th ranking positions is shown in Table 18 below[14].

[14] The complete results will be available as an electronic appendix.

Table 18- Rank Frequency (extract). Source: Authors' analysis

Rank	A Coruña	Aachen	Aalborg	Aberdeen	Acireale	Adana	Aix-en-Provence	Ajaccio	Alba Iulia	Albacete	Albi	Alcalá de Henares	Alcobendas	Alcorcón	Alicante	Amsterdam	Athina	Barcelona	Belfast	Berlin
1	0	0	0	0	1	33	0	0	0	0	0	0	0	0	0	1	67	7	0	2134
2	0	0	0	0	0	43	0	0	0	0	0	0	0	0	0	6	94	8	0	1400
3	0	0	0	0	1	49	0	0	0	0	0	0	0	0	0	2	138	12	0	952
4	0	0	0	0	0	81	0	0	0	0	0	0	0	0	0	6	107	8	0	738
5	0	0	0	0	2	64	0	0	0	0	0	0	0	0	0	4	115	19	0	590
6	0	0	0	0	1	59	0	0	0	0	0	0	0	0	0	9	115	20	0	449
7	0	0	0	0	3	71	0	0	0	0	0	0	0	0	0	6	116	11	0	387
8	0	0	0	0	0	55	0	0	0	0	0	0	0	0	0	6	132	21	0	321
9	0	0	0	0	2	85	0	0	0	0	0	0	0	0	0	5	129	24	0	255
10	0	0	0	0	2	78	0	0	0	0	0	0	0	0	0	9	146	16	0	252
11	0	0	0	0	1	77	0	0	0	0	0	0	0	0	0	11	126	18	0	211
12	0	0	0	0	1	69	0	0	0	0	0	0	0	0	0	10	115	19	0	178
13	0	0	0	0	1	74	0	0	0	0	0	0	0	0	0	8	122	29	0	159
14	0	0	0	0	1	78	0	0	0	0	0	0	0	0	0	11	133	22	0	141
15	0	0	0	0	1	79	0	0	0	0	0	0	0	0	1	8	148	24	0	123
16	0	0	0	0	1	61	0	0	0	0	0	0	0	0	0	6	112	28	0	120
17	0	0	0	0	4	80	0	0	0	0	0	0	0	0	0	8	115	20	0	130
18	0	0	0	0	1	67	0	0	0	0	0	0	0	0	0	15	131	40	0	100
19	0	0	0	0	3	66	0	0	0	0	0	0	0	0	0	11	114	29	0	92
20	0	0	0	0	1	59	0	0	0	0	0	0	0	0	0	12	102	37	0	87
21	0	0	0	0	1	69	0	0	0	0	0	0	0	0	0	15	119	37	0	73
22	0	0	0	0	1	79	0	0	0	0	0	0	0	0	0	10	111	33	0	62
23	0	0	0	0	4	74	0	0	0	0	0	0	0	0	0	12	106	47	0	58
24	0	0	0	0	0	65	0	0	0	0	0	0	0	0	0	16	107	35	0	59
25	0	0	0	0	2	63	0	0	0	0	0	0	0	0	0	13	98	20	0	55
26	0	0	0	0	1	66	0	0	0	0	0	0	0	0	0	14	106	47	0	42
27	0	0	0	0	2	80	0	0	0	0	0	0	0	0	0	19	96	31	0	62
28	0	0	0	0	1	67	0	0	0	0	0	0	0	0	0	13	107	30	0	51
29	0	0	0	0	0	76	0	0	0	0	0	0	0	0	0	10	101	43	0	46
30	0	0	0	0	2	68	0	0	0	0	0	0	0	0	0	16	101	44	0	35
31	0	0	0	0	7	71	0	0	0	0	0	0	0	0	0	15	96	33	0	36
32	0	0	0	0	2	78	0	0	0	0	0	0	0	0	0	22	102	32	0	23
33	0	0	0	0	5	68	0	0	0	1	0	0	0	0	0	17	101	36	0	34
34	0	0	0	0	3	64	0	0	0	0	0	0	0	0	0	28	87	42	0	29
35	0	0	0	0	4	74	0	0	0	0	0	0	0	0	0	16	72	45	0	29
36	0	0	0	0	5	64	0	0	0	0	0	0	0	0	0	17	77	26	0	19
37	0	0	0	0	3	59	0	0	0	0	0	0	0	0	0	23	84	35	0	25
38	0	0	0	0	2	54	0	0	0	0	0	0	0	0	0	14	98	30	0	20
39	0	0	0	0	7	85	0	0	0	0	0	0	0	0	0	17	88	36	0	26
40	0	0	0	0	4	73	0	0	0	0	0	0	0	0	0	19	96	39	0	33
41	0	0	0	0	4	67	0	0	0	0	0	0	0	0	0	23	91	48	0	16
42	0	0	0	0	5	65	0	0	1	0	0	0	0	0	0	21	87	53	0	20
43	0	0	0	0	3	77	0	0	0	1	0	0	0	0	0	22	102	41	0	17
44	0	0	0	0	3	74	0	0	0	0	0	0	0	0	0	24	100	53	0	17
45	0	0	0	0	2	60	0	0	0	0	0	0	0	0	0	18	85	40	0	11
46	0	0	0	0	4	87	0	0	0	0	0	0	0	0	0	25	76	45	0	14
47	0	0	0	0	2	53	0	0	0	0	0	0	0	0	0	28	67	48	0	15
48	1	0	0	0	2	65	0	0	0	0	0	0	0	0	0	26	82	50	0	19
49	0	0	0	0	5	66	0	0	0	2	0	0	0	0	0	15	82	58	0	10
50	0	0	0	0	4	72	0	0	0	0	0	0	0	0	0	29	71	50	0	12

Each of the Rank Frequency (RF) reported in Table 18 above represents the occurrences a city 2 achieves a given rank over total number of cases considered (10,000), depending on different weights assigned to each of the 17 considered dimensions In Table 18, for example, one can see that the city of Berlin ranks first in 2134 out of the 10,000 cases (set of weights) considered. A detailed analysis of the results for the whole set of EU cities goes beyond the scope of the current analysis and it is left for future research within the general framework of the project.

Further information about the relative performance of each city can be inferred by the pairwise comparison exercise performed within the SMAA methodological framework. Indeed, the RAIs are not able to give information about the direct comparison between two city. For example, what is the probability of Paris achieving a rank higher than the London? Clearly, an answer to this and similar of questions is crucial in both 'smart' policy design and 'smart' policy evaluation as they provide information on the relative performance of potentially similar jurisdictions. In order to address this point the Pairwise Comparison Index (PCI) is computed for each couple of cities. More precisely, Table 19 shows the pairwise winning indices a_h that gives for city the probability a_h to obtain a better score than city a_k. Thus, figures reported in each row represents relative frequencies of the city in that row achieving a score higher than cities reported in columns according to the rule '*row wins against column*'.

Table 19 - Pairwise comparison index. Source: Authors' analysis

City	A Coruña	Aachen	Aalborg	Aberdeen	Acireale	Adana	Aix-en-Provence	Ajaccio	Alba Iulia	Albacete	Albi	Alcalá de Henares	Alcobendas	Alcorcón	Alicante	Amsterdam	Athina	Barcelona	Belfast	Berlin
A Coruña	10000	9909	6873	9734	767	28	9956	9961	5394	2490	9971	5146	5445	5838	3812	1668	1071	31	9917	3
Aachen	91	10000	483	5074	4	0	7985	8568	138	11	8454	109	130	144	35	4	4	0	7268	0
Aalborg	3127	9517	10000	9408	371	3	9870	9929	3595	1533	9914	3157	3445	3669	2336	685	400	6	9802	0
Aberdeen	266	4926	592	10000	3	1	8988	9528	289	81	9434	290	334	342	134	5	1	0	8209	0
Acireale	9233	9996	9629	9997	10000	691	10000	9999	8882	8282	9999	9306	9380	9496	8981	6751	5857	1068	9999	32
Adana	9972	10000	9997	9999	9309	10000	10000	10000	9973	9901	10000	9972	9967	9978	9949	9774	9626	6520	10000	589
Aix-en-Provence	44	2015	130	1012	0	0	10000	6724	27	5	6257	41	64	56	14	0	0	0	3003	0
Ajaccio	39	1432	71	472	1	0	3276	10000	12	6	4443	32	43	52	12	0	0	0	1624	0
Alba Iulia	4606	9862	6405	9711	1118	27	9973	9988	10000	2944	9985	4736	4981	5251	3841	1533	1228	56	9947	0
Albacete	7510	9989	8467	9919	1718	99	9995	9994	7056	10000	9997	7577	7814	8102	6598	3271	2367	171	9988	1
Albi	29	1546	86	566	1	0	3743	5557	15	3	10000	33	44	56	10	0	0	0	1918	0
Alcalá de Henares	4854	9891	6843	9710	694	28	9959	9968	5264	2423	9967	10000	5303	5646	3719	1604	1012	37	9914	0
Alcobendas	4555	9870	6555	9666	620	33	9936	9957	5019	2186	9956	4697	10000	5343	3379	1445	961	23	9884	0
Alcorcón	4162	9856	6331	9658	504	22	9944	9948	4749	1898	9944	4354	4657	10000	2998	1319	792	25	9867	2
Alicante	6188	9965	7664	9866	1019	51	9986	9988	6159	3402	9990	6281	6621	7002	10000	2142	1493	54	9961	4
Amsterdam	8332	9996	9315	9995	3249	226	10000	10000	8467	6729	10000	8396	8555	8681	7858	10000	3978	382	10000	2
Athina	8929	9996	9600	9999	4143	374	10000	10000	8772	7633	10000	8988	9039	9208	8507	6022	10000	646	10000	17
Barcelona	9969	10000	9994	10000	8932	3480	10000	10000	9944	9829	10000	9963	9977	9975	9946	9618	9354	10000	10000	287
Belfast	83	2732	198	1791	1	0	6997	8376	53	12	8082	86	116	133	39	0	0	0	10000	0
Berlin	9997	10000	10000	10000	9968	9411	10000	10000	10000	9999	10000	10000	10000	9998	9996	9998	9983	9713	10000	10000

5. Summary and Concluding Remarks

This report has critically considered the term 'smart city' taking into account how it is used in building the accompanying narrative deployed by practitioners and policy makers. Harnessing, quantitative and qualitative data visualization approaches, this work reports in detail on the geographical coverage, scale and project content of EU smart city projects. This project data is systematically explored, highlighting spatial and inter-temporal variations in locational density, differing project content and conceptual emphasises. The analysis seems to lead to the main conclusion that the main focus of the Smart City narrative is on energy. Indeed, the term "energy" results pivotal either on a country level or on a multi-national setting. Nonetheless, it is worth mentioning that the years 2008-2010 seem to reshape the smart policy narrative towards more IT-related projects, but based on the sample here considered this trend is not confirmed in the subsequent sub-sample where energy take again the lion-share in the Smart City narrative.

Finally, a new index of smartness using the SMAA technique is determined using data from the EU Urban Audit. The new index considering measures related to a working definition of smart city allowed the computation of both the relative ranking and the direct comparison between couple of cities taking into account different sensitivities about each of the considered dimensions.

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APPENDIX

Project	Aim	Country	Start Date	End Date	Total Cost	EU Funding	Other Funding	URL
TRANSFORM	TRANSFORM stands for an integrative approach to smart city development, including strong stakeholder involvement, data analytics and smart tooling, financial strategies and methodologies for co-creation, like service design thinking. It supports those local stakeholders, responsible for investment and policy decisions, to turn their CO2 ambitions into a Transformation Agenda and into tangible Implementation Plans	Netherlands, Denmark, Italy, Germany, Austria, France	Mar-10	May-15	€ 9,726,688	€ 7,540,000		http://urbantransform.eu/
PLEEC	By coordinating strategies and combining best practices, the PLEEC project -"Planning for Energy Efficient Cities"- will develop a general model for energy efficiency and sustainable city planning. By connecting scientific excellence and innovative enterprises in the energy sector with ambitious and well-organized cities, the project aims to reduce energy use in Europe in the near future and will therefore be an important tool contributing to the EU's 20-20-20 targets.	Sweeden, Finland, Spain, Austria, Slovenia, Denmark, Netherlands, Lithuania, Germany, Bulgaria, Estonia, UK	Apr-13	Apr-16	€ 4,490,718	€ 3,827,064		http://www.pleecproject.eu/
STEP UP	STEP UP is an energy and sustainable city planning programme that aims to assisting cities to enhance their sustainable energy action plans and integrating energy planning into their sustainable city planning. STEP UP brings together excellence in energy planning and low carbon energy projects from the four cities to create a coherent and easy-to-use model for energy planning.	Belgium, UK, Sweden, Latvia	Nov-12	Apr-15	€ 4,692,275	€ 3,749,593		http://stepupsmartcities.eu/
EU-GUGLE	Its objective is to demonstrate the feasibility of nearly-zero energy building renovation models in view of triggering large-scale Europe-wide replication in smart cities and communities by 2020. To reach this objective, the 8 pilot cities will join efforts to combine the latest research results relevant to smart renovation of groups of buildings at district level and use this knowledge to implement a balanced mix of technical, socio-economic and financial solutions adapted to local needs.	Austria, Germany, Italy, Finland, Slovakia, Sweden, Spain, Turkey	Apr-13	Apr-18	€ 30,140,290	€ 16,785,382		http://eu-gugle.eu/
InSMART	The InSMART project brings together cities, scientific and industrial organizations in order to implement a comprehensive model for enhancing sustainable planning addressing the current and future city energy needs through an integrative and multidisciplinary planning approach. This approach will identify the optimum mix of short, medium and long term measures for a sustainable energy future, addressing the efficiency of energy flows across various city sectors with regards to economic, environmental and social criteria and paving the way towards actual implementation of priority actions.	Greece, Italy, Portugal, UK	Dec-13	Dec-16	€ 2,629,866	€ 2,145,450		http://www.insmartenergy.com/
CELSIUS	CELSIUS, which stands for Combined Efficient Large-Scale Integrated Urban Systems, will enable the capture and utilization of the secondary energy that is generated within cities every day and that is otherwise lost to the atmosphere. CELSIUS demonstrates and promotes integration of smart district heating and smart district cooling, and supports committed European cities to maximize the utilization of its primary and secondary energy resources in an integrated way that minimizes its operational costs	Sweden, UK, Netherlands, Italy, Germany	2013	2017	€ 55,000,000	€ 14,000,000	YES, a cluster of companies, €12,000,000	http://www.celsiuscity.eu/

	and carbon emissions while maximizing its energy efficiency.							
R2CITIES	The purpose of the R2CITIES project is to develop and demonstrate replicable strategies for designing, constructing and managing large scale district renovation projects for achieving nearly zero energy cities. These results will open the way for new refurbishments on a European scale within the framework of new urban energy planning strategies.	Spain, Italy, Turkey	Jul-13	Jul-17	€ 14,861,751	€ 9,011,331		http://r2cities.eu/
ZenN	The ZenN project will focus on the demonstration of the feasibility (technical, financial and social) of innovative low energy renovation processes for buildings at the neighborhood scale, the identification and dissemination of promising management and financial schemes to facilitate large scale replication and the launch of ambitious replication plans at several scales (local, regional etc), with the participation of local administrations, through the implementation and study of five Near Zero Energy Renovation demonstrations projects at neighborhood scale.	Sweden, Spain, Norway	Mar-13	Mar-17	€ 15,677,564	€ 9,470,153		http://zenn-fp7.eu/
SINFONIA	It is a five-year initiative to deploy large-scale, integrated and scalable energy solutions in mid-sized European cities. At the heart of the initiative is a unique cooperation between two pioneer cities (Innsbruck and Bolzano), working hand in hand to achieve 40 to 50% primary energy savings and to increase the share of renewables by 20% in two pioneer districts.	Netherlands, UK, Norway, Czech, Spain	Jun-14	Jun-19	€ 43,147,381	€ 27,451,972		http://www.sinfonia-smartcities.eu/
Triangulum	The Triangulum project will demonstrate how a systems innovation approach based around the European Commission's SCC Strategic Implementation Plan can drive dynamic smart city development.	Netherlands, UK, Norway, Czech, Spain	Feb-15	Feb-20	€ 29,501,431	€ 25,420,602		http://triangulum-project.eu/
GrowSmarter	GrowSmarter aims to improve the quality of life for European citizens by better mobility, housing and the quality of urban infrastructure while improving the citizens economy by lower energy costs and creating as much as 1500 new jobs (on the demonstration level), reduce the environmental impact by lower energy needs by 60 % and increased use of renewable energy thus reducing GHG emissions even more, and create sustainable economic development by demonstrating and preparing a wider rollout of smart solutions.	Sweeden, Germany, Spain	Jan-15	Jan-20	€ 34,635,913	€ 24,820,974		http://www.grow-smarter.eu/home/
BEEM-UP	BEEM-UP will demonstrate the economic, social and technical feasibility of retrofitting initiatives, drastically reducing energy consumption in existing buildings, and pave the way towards massive market uptake. BEEM-UP involves building owners at 3 sites in France, Sweden and the Netherlands in implementing an innovative approach to go beyond a 75% reduction in space heat energy consumption, in addition to reducing total energy consumption.	Netherlands, France, Sweeden	Jan-11	Jan-15	€ 7,697,783	€ 4,858,848		http://www.beem-up.eu/
BUILDSmart	The objective of the Builtsmart project is to demonstrate and mainstream innovative and cost-effective techniques and methods for constructing very low-energy buildings in various climates. Residential and non-residential new buildings in Sweden, Ireland and Spain will participate in the project.	Netherlands, France	Dec-11	Sep-15	€ 8,612,311	€ 5,010,583		http://www.buildsmart-energy.eu/
City-Zen	The project has three major goals: 1. to develop more effective collaboration models and a methodology for the development of smart cities; 2. to connect with industry and have them develop technology that	Netherlands, France	Mar-14	Mar-19	€ 42,874,939	€ 25,189,520		http://www.cityzen-

	will benefit smart cities; and 3. to showcase ambitious pilot projects to the public.							smartcity.eu/
DIRECTION	The DIRECTION project aims to create a framework to demonstrate and disseminate innovative and cost-effective energy efficiency technologies in order to achieve very low-energy new buildings.	Spain, Germany	Jan-12	Jan-16	€ 6,952,963	€ 4,369,546		http://www.direction-fp7.eu/
EE-HIGHRISE	The overall objective of the EE-HIGHRISE project is to demonstrate and validate new technologies, concepts, and systems, in order to test and assess the technological and economic feasibility of innovative energy solutions in the high-rise demo building Eco Silver House	Slovenia	Jan-13	Jan-16	€ 3,255,636	€ 2,193,504		http://www.ee-highrise.eu/
GEOCOM	Geothermal Communities will demonstrate best available technologies in the use of geothermal energy combined with innovative energy-efficiency measures in three different pilot sites.	Slovakia, Hungary, Italy	Jan-10	Dec-14	€ 11,543,165	€ 3,513,704		http://geothermalcommunities.eu/
NEXT-Building	The project is about the demonstration of very low-energy buildings. In all demonstrations, the ambition is net zero carbon/energy or better (active or plus-energy house). The project paves the way for the large scale implementation of energy neutral buildings/neighbourhoods as foreseen in the Energy Performance of Buildings directive and the pilots are running more than five years ahead of the goal of the EU, to have energy-neutral new build dwellings by the start of 2019.	Netherlands, France, Denmark	Jan-12	Dec-17	€ 8,462,118	€ 4,963,808		https://eu-smartcities.eu/related_web/next-buildings-next-zero-energy-buildings-lowest-cost-using-competitive-sustainable
PIME's	The proposal brings the partners together around some central principles, such as the implementation of large-scale solar thermal and associated heat storage, the application of intelligent energy management through micro-grids and the development of new ESCO models by increasing the ownership of the inhabitants.	Spain, Norway, Hungary	Dec-09	Dec-16	€ 18,095,489	€ 10,825,320		http://www.pimes.eu/
PITAGORAS	The PITAGORAS project is focused on the efficient integration of city districts with industrial parks through smart thermal grids. The overall objective of the project is to demonstrate a highly replicable, cost-effective and highly energy efficient large-scale energy generation system that will allow sustainable urban planning of very low-energy city districts. The main focus of the project is medium (150-600ºC) and low (30-150ºC) temperature waste heat recovery from industry and its use for energy supply to cities.	Austria, Italy	Nov-13	Oct-17	€ 14,214,519	€ 8,364,786		http://pitagoraspproject.eu/
READY	READY project is a "Whole City Approach" in the sense that it will develop and demonstrate how the demand of energy and particularly the needs for fossil fuels and release of CO2 can be considerably reduced to nearly zero, and show a sustainable way to go for other European cities.	Denmark	Dec-14	Nov-19	€ 33,340,203	€ 19,213,448		http://www.smartcity-ready.eu/
SOLUTION	SOLUTION is designed to respond to the needs of an effective take-off of the European SET-Plan by demonstrating novel applications of various	Austria, Croatia, Finland,	Nov-09	Oct-14	€ 21,677,586	€ 11,235,626		https://setis.e

	energy technologies and techniques integrated in an intelligent way within model areas.	Switzerland, Slovenia						c.europa.eu/energy-research/project/sustainable-oriented-and-long-lasting-unique-team-energy-self-sufficient-communities
STEEP	STEEP project will create a process model of systems-based thinking for district energy master planning, which will be applied to 3 city districts to better understand the systems that impact upon energy use and the interventions that can be taken to meet the ambitious energy and carbon targets. These models will be enriched and validated through open innovation methodologies applied with the stakeholders.	UK, Spain, Italy	Oct-13	Sep-15	€ 2,634,773	€ 2,197,398		http://www.smartsteep.eu/
SMILE	SMILE is in keeping with the general objective of promoting innovative energy-efficient solutions for smart cities of the Mediterranean. It will also define, plan, examine, share, and promote public policies, strategies, and measures for urban transport loading solutions in an intelligent manner, promoting knowledge of public and private players in this field and at that same time achieving energy saving.	Greece, Spain, France, Croatia	2013	2015	€ 1,622,533	€ 1,216,899		http://smile-urbanlogistics.eu/about-project
FI-Ware	The goal of the FI-WARE project is to advance the global competitiveness of the EU economy by introducing an innovative infrastructure for cost-effective creation and delivery of services, providing high QoS and security guarantees. FI-WARE is designed to meet the demands of key market stakeholders across many different sectors, e.g., healthcare, telecommunications, and environmental services. FI-WARE unites major European industrial actors.	Across the whole Europe	Jan-11	Dec-14	€ 68,732,990	€ 40,999,000		https://www.fiware.eu
SUCCESS	The European Sustainable Urban Consolidation CentrES for conStruction (SUCCESS) project aims to improve the efficiency and reduce negative impacts of the construction supply chain by exploring and testing reliable and innovative solutions.	Luxemburg, Spain, Italy, France	May-15	Apr-18	€ 3,238,118	€ 3,238,118		http://www.success-urbanlogistics.eu/
Light2CAT	The goal of Light2CAT is to develop new, highly efficient visible-light-activated titanium dioxide for inclusion in concretes to be used in structures across the whole of Europe to improve ambient air quality independent, for the first time, of local climate conditions. The aim is to remove climate and seasonal considerations from the use of the materials and, through higher conversion efficiencies of the catalytic components, to reduce production costs facilitating further take up of the technology within existing markets.	UK, Spain, Italy, Denmark, Sweden	Mar-11	Mar-14	€ 5,032,106	€ 3,574,545		http://www.light2cat.eu/
CEPPI2	CEPPI2 aims to build capacity in cities on how to achieve more sustainable energy solutions through a pro-innovation procurement approach (PPI) & to demonstrate this by selectively intervening in	UK, Spain, Hungary, Poland, Germany	Apr-15	Apr-18	€ 1,294,808	€ 1,294,808		http://www.ceppi.eu/

	scheduled public tenders. The interventions will involve 5 cities with different economic & political situations & provide the case-based evidence for replication by others.							
Transition Cities	The Transition Cities project will undertake pilots and experiments in relation to the three priority areas identified above; promote new start-ups; leverage in other EU funds; enable cities to explore new institutional and business models in order to maximize impact on carbon reduction; and disseminate its findings widely across major European networks. The innovativeness of this project comes through methodology and new ways of working, as well as product development. It is hoped that its findings will influence public policy and procurement across European cities and stimulate the transition to the low carbon economy.	UK, Spain, Hungary, Poland, Germany, Italy	Jan-14					http://www.climate-kic.org/projects/transition-cities/
LIFE FUTURE	LIFE FUTURE aims to promote green public procurement, focusing on the urban furniture sector. The project will allow to overcome the difficulties encountered by persons in charge of public procurement procedures when they have to include environmental clauses in call for tenders and assess the offers received, due to their limited knowledge on environmental matters.	Spain, Belgium, Croatia	Oct-15	Mar-18	€ 605,496	€ 340,613		http://www.life-future-project.eu/
CAT-MED	The main aim of CAT-MED is the development of sustainable urban models which are based on the classical Mediterranean city; compact, complex and where the proximity of public services is determined by people's ability to access them on foot. The project is developing a system of common indicators and has carried out a pilot experience which involved the planning and design of the Green Apple. The project represents a symbol of territorial, social and technological cohesion, promoting participation and public debate through the launch of a platform for Mediterranean cities.	Greece, Spain, France, Italy	2007	2013	€ 2,123,573	€ 1,592,680		http://www.catmed.eu/index.php
Cityfied	The CITyFiED project aims to develop a replicable, systemic and integrated strategy to adapt European cities and urban ecosystems into the smart city of the future, focusing on reducing the energy demand and GHG emissions and increasing the use of renewable energy sources by developing and implementing innovative technologies and methodologies for building renovation, smart grid and district heating networks and their interfaces with ICTs and Mobility.	Spain, Sweden, Italy, Germany	Apr-14	Apr-19	€ 48,613,809	€ 27,004,955		http://www.cityfied.eu/
REMOURBAN	The project's scope is the development and validation of a sustainable urban regeneration model in three lighthouse cities that leverages the convergence of the energy, mobility and ICT sectors.	Spain, UK, Turkey	Jan-15	Jan-20	€ 23,790,405	€ 21,541,949		http://www.remourban.eu/
Free Parking Dresden	The city of Dresden offers an overview of free parking spaces in the city of Dresden. With data taken at regular intervals, the platform offers both real-time availability of free parking spaces and a prediction of free parking spaces for a time and date chosen by the user.	Germany						http://ubahn.draco.uberspace.de/opendata/ui/
Buerger baut Stadt	Bürger baut Stadt is an application to allow citizens to locate areas which are currently subject to a planning approval procedure and where new construction projects are planned. The application is supposed to lower the hurdle for public participation in both processes. Citizens can access all construction plans in a district, get informed about them and even	Germany	2012	Ongoing			YES, competition winner	http://sebastian-weise.eu/burger-baut-stadt/

	participate in an official discussion, offering their ideas and suggestions.							
PRETESIC	PRETESIC is aimed at monitoring Valencia's network of sanitary sewers in real-time to determine the quality of water and thus, establish whether elements within the network are working properly. In this way, the system is able to react against unexpected situations, avoiding possible damages that natural disasters such as floods usually provoke in cities.	Spain	Feb-12	Ongoing				http://www.libelium.com/smart_water_cycle_monitoring_sensor_network/
Shroom	A series of lamps filled with sensors that upon detection of movement up to 10 feet, light at 100% and when there is no movement nearby dim to a 10% lightning in order to save on electricity and reduce emissions and light pollution.	Norway	2012	2013			YES, whole amount	http://www.ralstonbau.com/project/shroom/
Flood Network	With sensors put in several places (and available for purchase) using ultrasonic distance measurement, Flood Network, in association with Nominet and Love Hz, provides a measurement and real-time visualisation of the levels of rivers and streams. The pilot project took place in Oxford, with aim to expand to other regions and countries as well.	UK	Oct-14				YES	http://flood.network/
Pachube	Pachube enables people to monitor and share real time environmental data from sensors that are connected to the internet. “For instance, some smart meters analyse energy consumption for utility companies and users, and can switch off household appliances at peak times. This could be extended to managing city-wide systems	UK	2008	In 2011 was acquaired by LogMeIn			YES, LogMeIn bought it for $15 mil.	http://umbrellium.co.uk/initiatives/linguine/
Hello Lamp	Hello Lamp Post is an interactive system that gives everyone in Bristol a new tool to talk with each other, through prompts and questions - all facilitated by the city's physical infrastructure. By referencing the thousands of pre-existing identifier codes that label items of street furniture across the whole city, players can send text messages to particular objects, including (but not limited to) lamp posts, post boxes, bollards, manholes, bins, or telegraph poles.	UK	Jul-13	Sep-13			£30,000	http://www.hellolamppost.co.uk/
Urbanflow	Sharing real-time data and feedback about the city to create a more efficient, transparent relationship between city administrators and citizens. The unique benefit of situated urban screens lies in their capacity to be both locally-oriented and general purpose at once. The same urban screen can show contextual, hyperlocal information as well as broader, citywide content, allowing users to peek around walls and across the city. For officials and administrators this means making the city more transparent and efficient to manage through the use of real-time data and feedback.	Finland	2011				YES	http://helsinki.urbanflow.io/
Moovel	The objective of the project is very simple, provide the user with information on how to get from point A to B, considering all the options (public and private transportation) along with the potential cost, waiting times, accessibility etc. Additionally, the project offers businesses, or other public authorities to embed their code into their websites in order to offer all these options on their clients/people when needed.	Germany	2015	Ongoing			YES, Moovel Group (Daimler)	https://www.moovel.com/intl/en
Smart Parking	Better parking space management, information about availability in real	UK	Oct-14	Oct-15			YES, Smart	http://www.s

Solutions	time saving time, congestion and reducing the CO2 emissions as people will have real-time information of availability reducing their time finding parking spots and thus making circles in order to find an available spot. SmartRep software data can also be used for vital future planning to make further improvements to Westminster's parking systems. Parking marshalls also have real-time information through e-Tickets, as well as disabled parking space are easily monitored through the software.						Parking Ltd.	martparking.com/technologies/smarteye
Chromaroma	Chromaroma, the prequel of 'WEND', was a London-based game using players' Oyster cards and Barclays Cycle Hire accounts. Points are awarded depending on the stations and journeys users complete on the London Underground and London Buses, as well as using 'Boris bikes'. It encourages competition through leaderboards	UK	Sep-10	Replaced by "WEND" in 2015			YES, Channel 4 (4iP)	http://weare mudlark.com/projects/chromaroma/
TTP & Mayflower Smart Sity Lighting	Mayflower provides a Central Management System (CMS) for controlling and monitoring public lighting installations. The aim of the project is to reduce energy consumption (50%), billing costs and CO2 emissions	UK	2009	2015			YES, SSE	http://www.ttp.com/case-studies/mayflower
Smart Retro	Smart Retro brings together startups and established private and public organisations to create new innovations and business models. For cities, the framework offers an opportunity to collaborate with startups and through them, gain valuable insights into the sharing economy, digitalization and their agile ways of working. Through the process of co-creation and testing ideas rapidly in practice, cities learn how to become enablers and partners in innovation. Bringing together cities, startups and private actors, an ecosystem for sourcing, choosing, accelerating and testing new ideas in a given theme is created.	Finland	May-14	Oct-15			YES	http://smartretro.demoshelsinki.fi/
Future Streets Incubator (x13)	Future Streets Incubator is a London-based fund for smart city initiatives. From ideas such as temporary public plazas to new street layouts, technology and infrastructure, the fund is a great way to try out innovative low-cost measures. Currently, 13 smart city projects are ongoing	UK	2015					https://tfl.gov.uk/travel-information/improvements-and-projects/future-streets-incubator#on-this-page-0
Toshiba Smart Community	Under the NEDO project, Toshiba will deliver key technologies in four areas, based on Toshiba's Smart Community concept and Smart Grid technologies: (i) the achievement of Positive Energy Buildings (PEB); (ii) remote monitoring and management of photovoltaic power generation for an electric vehicle charging system; (iii) home energy management; and (iv) a network to integrate and support Smart Community management.	France	Jan-11	Mar-16			YES, ¥5 billion	https://www.toshiba.co.jp/about/press/2011_12/pr1601.htm
Smartcity Malaga	The Smartcity Malaga project was the first real smart grid pilot project. It was launched by Endesa in 2008 and covered 4 km2 in the area of the Playa de la Misericordia and includes 11,000 domestic customers and 1,200 industrial and service customers.	Spain	2008	2013	€ 31,000,000			http://www.endesa.com/en/sustainability

								/PoliticaSostenibilidad/CompromisoTecnologia/Malaga_SmartCity
Smart Citizen	Smart Citizen uses a range of software, hardware and user input to produce a wide range of statistics to its users.	Spain	2011	2015			YES, €13,400 and $68,000 through crowdfunding.	https://smartcitizen.me/about
Smart Parking Meters	The city is hoping that the new system will help ease pollution levels, which consistently rank above the EU average. The Spanish capital continually exceeds the EU limit for nitrogen dioxide in the air – mainly released through car exhaust systems – with rates that have at times spiked five times above the limit deemed safe by the EU	Spain	Jul-14					
AURN	The AURN is the UK's largest automatic monitoring network and is the main network used for compliance reporting against the Ambient Air Quality Directives. It includes automatic air quality monitoring stations measuring oxides of nitrogen (NOx), sulphur dioxide (SO2), ozone (O3), carbon monoxide (CO) and particles (PM10, PM2.5). These sites provide high resolution hourly information which is communicated rapidly to the public, using a wide range of electronic, media and web platforms.	UK	2011					
Smart Light	Cisco, A2, Philips, Alliander and KPN collaborated on the question of the city district to create a safe and pleasant living and operating environment for the completely renovated 'Hoekenrodeplein'.	Netherlands	Oct-12				YES, a cluster of companies	
Stockholm Royal Seaport	Research project Active House objective is to enable extensive use of renewable electricity generation by adapting the Active House net load to the grid to times when renewable electricity is available (Power Balancing Capacity). The research project will further address high energy efficiency by increased consumer awareness and technical support for an energy efficient life style.	Sweden	Sep-10	2030	€ 2,200,000,000		YES, a cluster of companies	http://www.stockholmroyalseaport.com/
Sensing London	Development of new solutions to problems that are affecting built spaces. That could include anything from apps that tell asthmatics how to navigate the city with minimum exposure to air pollution, through new business models that allow our green spaces to prosper in the face of uncertain funding, to providing evidence to justify the business cases for new technologies and infrastructure, to improve human health in the long-term.	UK	Jun-13	Dec-14				http://futurecities.catapult.org.uk/project/sensing-london/
IssyGrid	IssyGrid's goal is to involve 10,000 employees and inhabitants of Moulineaux in the project in order to reduce buildings' energy consumption, through the combination of smart meters and guidelines from software	France	2012	Apr-16				
Great Manchester	The aim of the project is to stimulate business growth through app development, data services and data use, and to strengthen	UK	Aug-13					http://gmdsp.org.uk/

Data Sync	therelationships between the participating local authorities, so that they share data, knowledge and experience.							
Smart Airport Experience	London City Airport is the first airport in the world to test how the Internet of Things – a network of machines communicating with each other online – can transform operations. The aims are: a. measuring passengers' journeys using sensors in order to collect data that are to be used for decision analysis afterwards, b. delivering location based services in order to enhance a passenger's experience providing all kinds of information related to the airport, traffic, their flights etc., c. asset tracking - using technologies in order to reduce aircrafts' turnaround time.	UK	Mar-13	Mar-14			YES, £800,000 from TSB	
Glasgow Future City	Cities and their citizens generate a huge amount of data which can be used in smart ways to achieve great things. Stepping boldly into the future, Glasgow joins a network of Future Cities around the world unlocking the potential of open data.	UK	2013	2016			YES, £24,000,000 from InnovateUK	http://futurecity.glasgow.gov.uk/
Bristol is Open	Small sensors, including the smart phones and GPS devices of willing participants, will supply the three new fast networks in the centre of Bristol, with information about many aspects of city life, including energy, air quality and traffic flows. A city operating system will dynamically host this machine-to-machine communication, allowing the development of a wide range of applications.	UK	Jul-15					http://www.bristolisopen.com/
Smarticipate	Open data will be fed into the smarticipate platform which will then be displayed visually, allowing users to get real-time feedback on their proposals. The platform will be publically accessible via an app for smartphones and tablets, as well as through the smarticipate website. Users will be able to give input on specific planning cases (as determined by the three partner cities) and will have the ability to propose use scenarios for public land. All users can view suggestions made and respond to them. The 'smarticipate' platform creates a more direct connection between the local authority and its residents, allowing for public services to be tailored to those that are receiving them.	Germany	Sep-16	2019	€ 3,293,020	€ 2,997,259		http://www.smarticipate.eu/hamburg-understanding-the-city-through-open-data/
Hamburg Smart City	Smart Cities initiatives help create intelligent and more connected cities. Hamburg, one of Europe's most liveable and economically strongest cities, is growing like most metropolitan areas around the world. This growth is challenging, because political, ecological and geographical tasks are bundled into the assignment to using existing space in a new way alongside ensuring sustainability, quality of life and economic growth. The Senate of the Free and Hanseatic City of Hamburg set out in April 2014 to build the Hamburg version of a smart city.	Germany	2012					http://hamburgsmartcity.com/
Helsinki Region Infoshare	The Helsinki Region Infoshare (HRI) service aims to make regional information quickly and easily accessible to all. Essentially, HRI is a web service for fast and easy access to open data sources between the cities of Helsinki, Espoo, Vantaa and Kauniainen. The data published is mainly statistical, giving a comprehensive and diverse outlook on different urban phenomena, such as living conditions, economics and well-being, employment and transport. The data can be used in research and development activities, decision-making, visualization, data journalism and	Finland	Jun-10	2014				http://www.hri.fi/en/about/

	in the development of apps. The data may be used by citizens, businesses, universities, academies, research facilities or municipal administration.							
Whereabouts	Whereabouts London is an ongoing experiment by the Future Cities Catapult to explore how open data can be used to help cities and citizens see their environment in a new light. By blending 235 types of data, we're investigating what London could look like if we drew its boundaries afresh, grouping neighbourhoods based on how we live – not where we live.	UK	Oct-14					http://whereaboutslondon.org/
Monaco 3.0	The aim of this app is to contribute to a more efficient level of daily tasks with the aid of both technology (sensors) and human contribution (user who, in a way, acts as a sensor)	Monaco	Nov-13	Dec-15			YES, Bosch	http://blog.bosch-si.com/categories/projects/2013/12/smart-city-monaco-3-0-bosch-technology/
Kalasatama Smart City	Owing to good transport connections, the area has thousands of jobs, and the redevelopment will bring many new offices and new commercial space to the area. The new residential blocks will offer versatile housing alternatives. The shoreline and canals will be lined by a long promenade. A former power plant in adjacent Suvilahti turned into a cultural centre adds to the charm of the area.	Finland	2009	2030		YES, partly from ERDF		http://en.uuttahelsinkia.fi/kalasatama
Smile	Within the project smile the key for the mobility of the future was developed: the prototype of an integrated mobility platform with a smartphone app. The goal was to create a mobility platform that not only allowed the user to inform oneself about all available means of transport but to even let the customer book, pay and use them.	Austria	2012	May-15				http://smile-einfachmobil.at/index_en.html
XALOC	The XALOC system will improve traffic management in urban areas and reduce what is known as "agitated traffic", traffic caused by drivers circulating and looking for a place to park. Reducing the volume of agitated traffic will allow for a substantial improvement in circulation fluidity in urban areas and thus contribute to effective reductions in pollution and an increase in citizen satisfaction.	Spain	2010		€ 289,153	€ 30,740		
Cities Unlocked	Cities Unlocked draws on the expertise of Future Cities Catapult, Guide Dogs and Microsoft to better understand and improve the experiences of individuals living with sight loss.	UK	Nov-14	Ongoing			YES, Innovate UK and Microsoft	http://www.citiesunlocked.org.uk/
Ekobus	EcoBus uses instruments mounted onto the existing public transportation vehicles in order to monitor a set of environmental parameters over a broad city area. Sixty public transportation vehicles are equipped with these devices, which detect and measure six parameters: temperature, relative humidity, carbon monoxide, carbon dioxide, nitrogen dioxide, as well as a vehicle location.	Serbia	Sep-10	Dec-13	Sub-project of Smart Santander	Sub-project of Smart Santander		
EPIC	To be the first choice service innovation and delivery platform for medium sized (50.000 – 500.000 habitants) cities across Europe, where any city	Across the whole Europe	Nov-10	May-13	€ 5,080,000	€ 2,900,000		http://www.e

	can cost-effectively share, access and adapt a range of services to meet the needs of most, if not all, their citizens.							pic-cities.eu/
Smart Santander	Through thousands of sensors, the city's main functions and facilities will be easily accessible to all users/services. (e.g. availability of parking lots, traffic intensity, parks irrigation, transportation, environmental monitoring etc.)	Spain	Sep-10	Dec-13	€ 8,465,355	€ 6,000,000		http://www.smartsantander.eu/
iCity	The project responds to the growing demand from social stakeholders to provide services of public interest based upon the exploitation of available public information, digital assets and infrastructure. In doing so, the project encompasses the concept of Open Data with a novel approach of Open Infrastructures where the available municipal ICT networks already deployed in urban spaces will be made available and accessible to open innovation ecosystemswith the objective of maximizing the number of deployed services of public interest.	Spain	Jan-12	Jan-13	€ 5,210,472	€ 1,979,980		http://www.icityproject.eu/content/presentation
ALMANAC	The goal of ALMANAC was to develop an IoT platform enabling synergies between existing resources and services in the city for a more efficient and sustainable urban living. With special focus on the waste and water domains, demonstration of selected Smart City services and applications was carried out in the City of Turin, Italy.	Italy	Sep-13	Aug-16	€ 4,100,000	€ 3,000,000		http://www.almanac-project.eu/
Wend	Through a game-like experience, Wend gathers data from our everyday movements and uses them for Decision Analysis, in order to change Transport networks in such a way that will be optimal for all parties involved.	Across the whole Europe	2016	ongoing				http://weare mudlark.com/projects/wend/
City2Mobil2	CityMobil2 is setting up a pilot platform for automated road transport systems, which will be implemented in several urban environments across Europe. Automated transport systems are made up of vehicles operating without a driver in collective mode. They are deemed to play a useful role in the transport mix as they can supply a good transport service (individual or collective) in areas of low or dispersed demand complementing the main public transport network.	Across the whole Europe	Sep-12	Dec-16	€ 15,286,790	€ 9,500,000		http://www.citymobil2.eu/
TRIBE	The TRIBE project aims to contribute to a change in citizens' behaviour towards energy efficiency in public buildings, through their engagement in the experience of playing a social game, linked by ICT to real time data collected from five pilot buildings hosting around 1300 regular users (employees, tenants, etc.) and almost 12000 eventual users (visitors).	Spain, Turkey, France, Sweden, Austria	Feb-16	Jan-21	€ 2,000,033	€ 2,000,033		http://tribe-h2020.eu/
STORM	The STORM project tackles energy efficiency at district level by developing an innovative district heating & cooling (DHC) network controller. It aims to demonstrate that thanks to a smart DHC network controller energy savings can reach up to 30%.	Netherlands, Sweden	Mar-15	Aug-18	€ 1,972,126	€ 1,972,126		http://storm-dhc.eu/
SMARTER TOGETHER	To deliver smart and inclusive solutions and to improve citizen's quality of life SMARTER TOGETHER sets out to find the right balance between smart technologies on one hand and organisational and governance dimensions on the other. While people ensure sustainability, industry - the necessary technology, governance ensures large-scale replication through its systematic approach and institutional learning	Austria, Germany, France, Spain, Bulgaria, Italy	Feb-16	Jan-21	€ 29,119,448	€ 24,742,979		http://smarter-together.eu/

SmartEnCity	SmartEnCity's main objective is to develop a highly adaptable and replicable systemic approach towards urban transformation into sustainable, smart and resource-efficient urban environments in Europe.	Spain, Estonia, Denmark	Feb-16	Jul-21	€ 32,201,606	€ 27,890,139		http://smartencity.eu/
Shar-LLM	The Sharing Cities 'lighthouse' programme is a proving ground for a better, common approach to making smart cities a reality. By fostering international collaboration between industry and cities, the project seeks to develop affordable, integrated, commercial-scale smart city solutions with a high market potential.	Portugal, UK, Italy	Jan-16	Jan-21	€ 28,045,835	€ 24,753,945		http://www.sharingcities.eu
REPLICATE	The REPLICATE project will generate smart city business models, and tailor-made solutions in the areas of energy, transport and ICT. There will be pilot actions in energy efficiency, efficient and sustainable transport and integrated infrastructures. The key to the project's approach is in recognising the inherent complexity of urban challenges and the distinctiveness of individual cities. It advocates innovative approaches to citizenship, with the aim of involving citizens as stakeholders at all stages of its activities to help co-create appropriate solutions and services which celebrate and work successfully with the characteristics and context of each individual metropolitan area in each lighthouse and follower cities.	Spain, UK, Italy	Feb-16	Jan-21	€ 29,250,564	€ 24,965,263		http://replicate-project.eu/
OrbEEt	OrbEEt proposes an ICT-based framework to induce behaviour change toward energy efficiency by transforming energy measurements into personalised feedback delivered through engaging user interfaces. OrbEEt is establishing a holistic organisational energy performance framework that will boost standardised energy performance rating practices by incorporating business and behavioural information.	Austria, Spain, Bulgaria, Germany	Mar-15	Feb-18	€ 1,776,625	€ 1,776,625		http://orbeet.eu/
OPTi	The OPTi project aspires to create a long-lasting impact by rethinking the way district heating and cooling (DHC) systems are architected and controlled. The overarching goal is to create business benefit for the industry as well as to ensure optimal end-consumer satisfaction. OPTi will deliver methodologies and tools that will enable accurate modelling, analysis and control of current and envisioned DHC systems. The methodology will be deployed both on a complete system level, and on the level of a building(s).	Spain, Sweden	Mar-15	Oct-17	€ 2,100,130	€ 2,100,130		http://www.opti2020.eu/
MORE-CONNECT	MORE-CONNECT develops prefabricated, multifunctional renovation elements for the total building envelope (façade and roof) and installation/building services. These elements can be combined, selected and configured by the end-user, based on their specific needs. This information can be used as input into advanced Building Information Modelling systems to control and steer the further production process of these elements. In this way unique individual series can be made in a mass production process at the same low price of mass production.	Latvia, Estonia, Netherlands	Dec-14	Nov-18	€ 5,557,263	€ 4,364,749		http://www.more-connect.eu/
IMPRESS	IMPRESS will leverage on the potential of prefabrication by developing a new range of easy to install panels, which can reduce energy demand while preserving and/or improving building aesthetics.	Romania, UK, Italy	Jun-15	Nov-18	€ 6,072,790	€ 4,552,465		http://www.project-impress.eu/
GreenPlay	The GreenPlay project aims to raise awareness among citizens through the implementation of a real time monitoring energy consumption platform and the development of a serious game. The project is expected to have	France, Spain	Mar-15	Feb-18	€ 1,705,500	€ 1,705,500		http://www.greenplay-

	an impact in terms of energy consumption, with a 30% decrease in consumption at the test homes.							project.eu/
FLEXYNETS	FLEXYNETS will develop, demonstrate and deploy a new generation of intelligent district heating and cooling (DHC) networks that reduce energy transportation losses by working at "neutral" (15-20°C) temperature levels. Reversible heat pumps will be used to exchange heat with the DHC network on the demand side, providing the necessary cooling and heating for the buildings. In this way, the same network can provide contemporary heating and cooling.	Spain, Italy	Jul-15	Jun-18	€ 1,999,364	€ 1,999,364		http://www.flexynets.eu/en/
ENTROPY	The ENTROPY project aims to design and deploy an innovative IT ecosystem targeted at improving energy efficiency through consumer understanding, engagement and behavioural changes.	Spain, Italy	Sep-15	Aug-18	€ 2,439,468	€ 1,997,593		http://entropy-project.eu/
EnerGAware	The EnerGAware project will develop and test, in 100 affordable homes, a serious game that will be linked to the actual energy consumption (smart meter data) of the game user's home and embedded in social media and networking tools. The EnerGAware solution will provide an innovative IT ecosystem in which users can play to learn about the potential energy savings from installing energy-efficiency measures and changing user behaviour.	UK	Feb-15	Jan-18	€ 25,441,300	€ 10,115,890		http://energaware.eu/
SCHOOL OF THE FUTURE	The aim of the School of the Future project was to design, demonstrate, evaluate and communicate shining examples of how to achieve the high performance building of the future.	Norway, Denmark, Italy, Germany	Feb-11	Jan-16	€ 4,974,936	€ 3,473,360		http://www.school-of-the-future.eu/
RIBuild	The RIBuild project will result in comprehensive guidelines on how to install internal thermal insulation in historic buildings. The purpose is to reduce energy consumption in historic buildings in order to meet the EU 2020 climate and energy targets	Latvia, Sweden, Switzerland, Belgium, Denmark, Italy, Germany	Jan-15	Jan-20	€ 5,331,375	€ 4,962,375		http://ribuild.eu/
NEED4B	The overall objective of the project is to develop an open and easily replicable methodology for designing, constructing, and operating new low-energy buildings, aiming at a large market uptake.	Spain, Sweden, Turkey, Belgium, Italy	Feb-12	Jan-18	€ 9,488,961	€ 5,681,652		http://need4b.eu/
E2REBUILD	E2ReBuild project investigated, promoted, and demonstrated cost-effective and advanced energy-efficient retrofit strategies that create added value for existing residential buildings and endorse end-users to stay and build a dynamic society. The vision of E2ReBuild was to transform the retrofitting construction sector into an innovative, high-tech, energy efficient industrialized sector.	Sweden, Netherlands, UK, France, Finland, Germany	Jan-11	Jun-14	€ 7,843,339	€ 4,716,490		http://www.e2rebuild.eu/
BERTIM	BERTIM will develop a prefabricated solution providing the opportunity to renovate buildings, with a view to improving energy performance, air quality, aesthetics, comfort, and property value at the same time, while ensuring low intrusiveness during renovation works.	Sweden, Spain, Denmark, France	Jan-15	Jan-19	€ 4,995,208	€ 4,148,435		http://www.bertim.eu/
TetraEner	The TETRAENER project was based on the premise of creating residential communities where external energy dependency is reduced by optimising the supply/demand balance through an improvement in energy efficiency and the use of renewable energy sources, together with demand monitoring and control applications.	Spain, Switzerland	Nov-05	Nov-10	€ 13,610,623	€ 5,039,361		https://setis.ec.europa.eu/energy-research/project/tetraener-

								optimal-balancing-demand-and-supply-through-res-urban-areas
STACCATO	With the STACCATO project three European capital districts demonstrated sustainable energy concepts in existing representative residential areas. The urban areas all faced technical arrears and a lack of social cohesion. These large-scale demonstration sites, in combination with research and development aimed at innovative and reproducible renovation concepts and approaches, served the purpose to accelerate the transition to a sustainable energy supply in existing housing areas in Western and Eastern Europe.	Netherlands, Bulgaria, Hungary	Sep-07	Nov-14	€ 20,166,712	€ 8,013,499		http://www.concerto-staccato.eu/
SORCER	The SORCER project was based on energy efficient dwellings with a maximum use of sustainable energy in two communities: Hillerød and Apeldoorn. As part of the project, Hillerød and Apeldoorn worked on very ambitious developments and their cooperation increased the impact of the demonstration, helping Europe to reduce dependence on energy imports, increase sustainability and stimulate growth and jobs.	Netherlands, Denmark	May-07	Oct-13	€ 19,735,100	€ 7,768,278		http://cordis.europa.eu/project/rcn/85689_en.html
SERVE	The SERVE project implemented a series of actions in the field of sustainable energy with the overarching goal of creating a sustainable energy region in the district of North Tipperary in Ireland. The project actions included energy upgrades for existing dwellings in the region, installation of renewable energy heating systems, construction of an eco-village and the development of a district heating system.	Ireland	Nov-07	Oct-12	€ 10,145,303	€ 4,107,404		http://servecommunity.ie/
SEMS	The intention of SEMS was to promote sustainable and capable energy saving and optimizing projects. The long term overall objective of the four core communities is the self-supply of energy from renewable sources. This involved considerably lowering the energy consumption of the four communities and achieving a renewable energy supply rate of, respectively, 39% to 62% of the remaining end energy in the electricity and heat sector demand within five years.	Austria, Poland, Luxembourg, Germany	Jun-07	May-13	€ 41,464,075	€ 6,483,174		http://www.sems-project.eu/
RENNAISANCE	The RENAISSANCE project aimed to create sustainable model districts in Lyon and Zaragoza. The promotion of an innovative district development is carried on this project as to energy efficiency and the ratio of renewable energy. In order to facilitate the emergence of green district and to tend, in the long run, towards Post-Carbon Cities, this is necessary to invent new tools and to disseminate them.	Spain, France	Nov-05	Nov-12	€ 19,509,644	€ 8,563,971		http://www.renaissance-project.eu/
REMINING-LOWEX	REMINING-LOWEX dealt with the redevelopment of European mining areas into sustainable communities by integrating energy supply and demand, based on low-exergy principles. The project created two sustainable mining communities (Heerlen and Zagorje) with 50 to 100% CO2 reduction and 60% RES compared with standard national practices.	Croatia, Netherlands	Jun-07	Jun-14	€ 39,565,400	€ 7,226,357		http://cordis.europa.eu/project/rcn/85695_en.htm
POLYCITY	The POLICITY project dealt with different aspects of urban development:	Spain, Italy,	May-05	May-11	€ 17,172,715	€ 8,051,096		http://www.p

	new construction and tr-generation energy supply in Cerdanyola del Valles at the city edges of Barcelona (Spain); the conversion of an old city quarter in Turin (Italy) with energy distribution based on the heating network and with thermal cooling; and new building constructions on a large former military ground in the town of Ostfildern near Stuttgart (Germany) with biomass heat and electricity supply.	Germany						olycity.net/
HOLISTIC	The HOLISTIC project was based in selected zones in Dundalk, (Ireland), Mödling (Austria) and Neuchâtel (Switzerland), where it aimed to stimulate a paradigm shift in the use of energy within these communities to more sustainable patterns. The project demonstrated how this transformation can be initiated in three typical communities by acting on every aspect of community life - housing, school, hospital, hotel, shops, leisure facilities and industry.	Ireland, Austria, Switzerland	Jun-07	May-13	€ 25,988,883	€ 10,713,441		http://cordis.europa.eu/project/rcn/85667_en.html
Green Solar Cities	Green Solar Cities offered a policy for cities focusing on a holistic approach, which includes good, energy-efficient construction and buildings installations leading to comfort and a good indoor climate, combined with the use of optimised energy supply systems together with a local contribution from renewable energy sources.	Austria, Denmark	Jun-07	May-13	€ 15,306,861	€ 6,305,000		http://www.greensolarcities.com/
Energy in Minds!	The project aimed to reduce the use of fossil energy and CO2 emissions in the building sector by 20 to 30% in the four communities within a five-year period. To reach this goal a wide range of measures were taken to reduce the energy consumption and increase the use of renewable energy.	Austria, Sweden, Czech, Germany	May-05	May-10	€ 22,329,642	€ 9,065,860		http://www.energy-in-minds.de/
Concerto AL Piano	The project aimed to implement energy retrofitting at the district level and to mobilise investment in energy conservation in conjunction with building renovation and maintenance. Some of the project's general goals included upgrading the energy standards at the district level, to affect building rehabilitation and reconstruction.	Italy	Sep-07	Aug-13	€ 8,528,620	€ 3,474,367		http://concerto-al-piano.eu/
CLASS1	The Municipality of Egedal decided in 2005 to strengthen the energy requirements for a new settlement called Stenloese South. All the dwellings in in this neighbourhood were to be built with an energy demand corresponding to the Danish low-energy standard referred to as "low-energy class 1" – or lower. This meant that the energy consumption was to be 50% below the Danish BR08 energy regulations. The CLASS 1 project was conceived around this new settlement, adding energy renovation of public buildings, balanced renewable energy supply, R&D activities, training and dissemination.	Denmark	Nov-07	Oct-13	€ 8,926,366	€ 3,648,788		http://www.class1.dk/
ECO-City	The aim of the ECO-City project was to demonstrate innovative integrated supply and demand side energy concepts in three communities in Denmark/Sweden, Spain and Norway: respectively the cross-border community of Helsingør and Helsingborg, and the communities of Tudela and Trondheim.	Norway, Sweden, Spain, Denmark	Oct-05	Dec-12	€ 28,197,533	€ 11,391,749		http://www.ecocity-project.eu/index.html
SESAC	The SESAC project aimed at showing how local economies are able to thrive at the same time as reducing their CO2 emissions. This was translated into innovative energy measures in both new building development projects and the renovation of existing buildings. These	Sweden, Netherlands, France	May-05	May-11	€ 25,605,888	€ 10,375,632		http://cordis.europa.eu/project/rcn/87914_en.html

	measures focused on heating and cooling from renewables, using available waste heat for heating, using all heat generation for electricity production, and making all new buildings and retrofits energy-optimised.							
ECO-Life	ECO-Life aimed to establish a replicable planning and implementation approach and to demonstrate innovative and integrated energy concepts in supply and demand side in municipalities in Lithuania, Belgium and Denmark to reach the goal of zero CO2.	Belgium, Denmark, Lithuania	Jan-10	Jan-16	€ 25,191,757	€ 12,255,646		http://www.ecolife-project.eu/
ECOSTILER	The ECOSTILER project took a coordinated approach towards achieving energy efficient communities. The common and essential element of the project involved the use of bio-gas and district heating systems. These acted as tools in the reduction of primary fuel consumption and CO2 emissions in the communities in question.	Netherlands, UK, Denmark	Sep-05	Aug-12	€ 25,441,300	€ 10,115,890		http://cordis.europa.eu/project/rcn/87905_en.html
cRRescendo	cRRescendo aimed to integrate a major share of sustainability into thousands of homes and their energy infrastructures. This CONCERTO project demonstrated how best to meet citizens' desire to live in comfortable energy-efficient homes in a healthy and clean environment. Essentially, it aimed to create modern, comfortable, healthy, and energy-efficient homes in Almere in the Netherlands, Milton Keynes in the United Kingdom, Viladecans in Spain, and Ajaccio in France.	Netherlands, UK, Spain, France	Aug-05	Jul-12	€ 521,281	€ 499,523		http://www.crrescendo.net/
Act2	The Act2 project aimed to accelerate innovation in renewable energy (RE) solutions and advance energy efficiency (EE) and systems for poly-generation linked together with concepts for eco-buildings.	France, Germany	Jan-06	Dec-12	€ 14,070,479	€ 5,700,637		http://cordis.europa.eu/project/rcn/85725_en.html