



colegio oficial
ingenieros
de telecomunicación

Impact Analysis of Smart City Networks in Cities' Local Government

RECI's Case



asociación española
ingenieros
de telecomunicación



Table of Contents

Abstract	3
1 Introduction.....	4
2 From Network Governance to City Networks, a New Paradigm	6
2.1 Settling the foundation for complex network governance	6
3 RECI (Spanish Network of Intelligent Cities): the case study	10
3.1 RECI as a knowledge sharing platform	12
3.2 RECI's structure and working groups.....	13
3.3 International collaboration	17
4 RECI's Impact on Spanish Smart Cities.....	20
4.1 PEST Analysis	20
4.1.1 Political impact.....	21
4.1.2 Economic impact.....	24
4.1.3 Social impact	25
4.1.4 Technological impact	26
4.2 Impact survey results	29
5 Conclusions	36
6 References	40

List of Tables

Table 1: RECI's working groups.....	14
Table 2: European Union Funded Projects with Spanish Cities Partners.....	18
Table 3: RECI's PEST analysis.....	21
Table 4: Standardisation norms approved by CTN 178 until December 2015.....	28
Table 5: Specific areas of improvement for smart cities services contracting and staff development	31
Table 6: Participants' best practices adopted by others.....	33
Table 7: Potential improvements for RECI proposed by participants.	35

List of Figures

Figure 1: Network governance structure.....	7
Figure 2: Theoretical framework, based on Cristofoli et al. (2014).....	9
Figure 3: RECI's foundation pillars.....	10
Figure 4: Map of RECI's cities (RECI 2015).....	11
Figure 5: RECI meetings facts and figures by mid-2015	16
Figure 6: Countries directly influenced by RECI.....	17
Figure 7: Economic savings produced by RECI's operational model	24
Figure 8: CMS content considering document classification (left) and replicability level (right)....	27
Figure 9: Smart cities Technical Normalisation Committee 178 structure.....	28
Figure 10: Year of adhesion to RECI of participants (left) and number of working groups where participants are involved (right).....	30
Figure 11: Perception of impact of RECI activities on local smart city activities	30
Figure 12: Quantisation of economic savings in contracting and staff expenses related areas	31
Figure 13: Good practices sharing and adoption among RECI members	32

Abstract

Since its establishment in 2012, the Spanish Network of Smart Cities (RECI) has worked towards the ultimate objective of making Spanish cities an international reference within the global 'smart' panorama. This network, originally empowered by the individual experience of many Spanish cities with presence in international smart city projects for over 10 years, has adopted a form of governance based on *complex networks*, including its own particular network coordination and management mechanisms. From this point of view, in first place this work tries to answer the question '*can these coordination mechanisms contribute to the success of the governance network?*' To provide an answer network performance in the framework of cities is studied focusing on the existing network coordination mechanisms and the abilities of the network manager.

From its original 25 funding members, RECI has progressively increased its number of members to 65 by the beginning of 2016. On the management and coordination side, RECI is formed by a president, three vice-presidents, one secretary, and one representative from each founding member. From the work point of view, RECI'S ecosystem is divided into five working groups addressing local concerns. This structure has favoured a sharing environment where all cities can learn from others' experiences and adopt the best practices that better adapt to their local needs and strategic plans. The sharing-based environment is empowered by a Content Management System (CMS) which acts as a common document repository. Overall, this environment can be considered a *fast track to learning in matters of smart cities governance and projects implementation*. Ultimately, as a consequence of this environment, an important positive impact is produced in the smart governance of these cities.

The final objective of this work focuses on providing a full picture of the overall impact of RECI on the Spanish smart cities based on a Political, Economic, Social and Technological (PEST) analysis. Apart from the information gathered in related literature, this analysis is supported by the answers provided by a sample group of RECI's members to a consultation where a series of questions in relation to their opinion about RECI's impact on their local governments were made.

Lastly, the conclusions of the study show the important role that RECI has played in the recent development of Spain as an international reference in the field of smart cities, both at a network level, with RECI's mentoring activities to other networks; and individually for Spanish cities.

I Introduction

Innovation and knowledge, supported by the information and communications technologies (ICT) are the key pillars to base the progress of cities in the coming years, making life easier for citizens, achieving a society more cohesive and supportive, creating and attracting human talent and creating a new economic fabric of high added value.

The cooperation of the public and private sectors, social collaboration without exclusions and a network work, are key elements that develop among all, an innovative space to foster talent, opportunities and quality of life in the environment urban.

This paper presents the case of RECI (Spanish Network of Smart Cities), formed by a group of the Spanish cities since 2012. Originally launched by 25 cities, RECI includes 65 cities by the beginning of 2016. For RECI, Smart Cities are those that have developed a system of innovation and networking to give cities a model to improve the economic and political efficiency and allowing social, cultural and urban development. This growth is a commitment by the creative industries and high technology and based on capabilities and articulated networks through participative strategic plans to improve the local innovation system.

In recent years, the concept of 'smart city' has been widely used by cities and commercial organizations to communicate and promote different types of initiatives or solutions in a city context. Especially in the policy arena, the concept of 'smart city' has been quite fashionable. As a result, there are various definitions for what a smart city is or which characteristics define a city as being 'smart'.

For smart cities, the main focus seems to be on the role of ICT infrastructure, although much research has also been carried out on the role of human capital/education, social and relational capital and environmental interest as important drivers of urban growth. An important focus will be on combining institutional, human and technology enablers in key domains for forward-looking and sustainable urban development.

Networking Spanish cities: Making Policy more Future Proof?

The purpose of this work reviewing RECI's network is to explore the innovation capacity at the local level spurring from this networked way of operation. This objective goes hand in hand with understanding new trends in the governance in cities.

This work aims to contribute to the literature on councillor's 'governance in complex networks and on network performance. Network performance is studied focusing on the existing network coordination mechanisms and the abilities of the network manager. Can these coordination mechanisms contribute to the success of the governance network? This is a question the work tries to answer.

The research on the Spanish Network of Smart Cities (RECI) can be positioned at the crossroad of research strands in the areas of e-government, research on ICT, methodological research in foresight and research in social sciences and the humanities studying the impacts of ICT and the digital transformation of democratic process.

First of all, in order to leverage how to assess innovation and governance, the work presents streams of literature relevant to network governance that will help to structure the analysis. Secondly, the case study is introduced, where RECI is presented against the backdrop of the literature on network governance. Next, with these two we provide a full picture of the overall impact of RECI on the Spanish smart cities. Finally, conclusions are presented.

2 From Network Governance to City Networks, a New Paradigm

Networks and networking have become very fashionable concepts in regional science terminology in the last decade, in particular in regional and urban geography: we speak about network firms, network society, and network economy but also about network cities or *city networks*.

All these networks are designed towards the ultimate objectives of exchanging and collecting of information, building reputation and trust, creating synergies, cutting down uncertainty, and boosting learning processes. Within a context of power diffusion like the case of the different cities and their governments within a country, promoting cooperation through a city network (e.g. among local stakeholders and government tiers) appears as an efficient state-level tool for an even and sustainable development of all country's cities.

2.1 Settling the foundation for complex network governance

The current literature on local governance stresses the increasing operation of councillors in complex governing networks, including public and private bodies (Copus 2015: 335). In these networks, councillors have to devise strategies to influence and shape policy decisions taken by individual players (Copus 2015:335). A second stream of literature points at the role of mixed groups as essential components of the governance structure regulating service ecosystems in cities (Connolly et al., 2014). There is also another interesting stream of literature, studying the conditions for success in shared-governance networks (Cristofoli et al. 2012).

These three different research streams provide interesting insights that help understanding networked governance. First, by showing the importance of councillors' soft power to influence public and private bodies. Second, by showing the relevance and shape of service ecosystems within the framework of city governance. And third, deeply studying shared-governance. This last stream claims that a network success would depend on: 1) the importance of formalised coordination mechanisms; 2) formalised rules to increase the liability of decisions made; 3) well organised network meetings, contractual agreements and informal relationships (Cristofoli et al. 2012); 4) contracts with partner organizations that are also key to understand the performance of these networks. Furthermore, the stream of literature studying the conditions for success in shared-governance networks makes a distinction among three forms of network governance: Shared-Participant governance, Lead Organization governance and Network Administrative Organization, following Provan and Kenins (2008). As a summary, and according to the bibliography, the structure of a network governance can be seen in Figure 1.

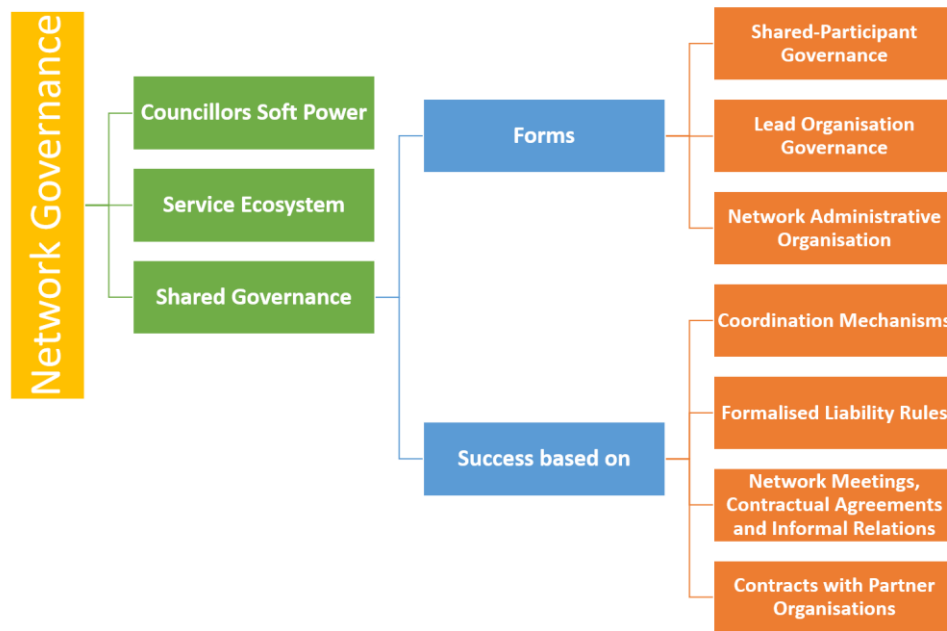


Figure 1: Network governance structure

In the recent development of public network research literature, scholars have set aside their interests on network structure and have focused on the abilities of the network manager as its abilities to predict the network performance. This focus on the network manager is based on the assumption that managerial skills have a direct impact on network performance (Kickert et al. 1997; Agranoff and McGuire 2001; Mandell 2001; Meier and O'Toole 2001). Some authors even

argue that network managers, in some cases, play an even bigger part in comparison to the network structure and mechanisms (Kort and Klijn 2011).

Against this backdrop, public network management abilities might be split into two broad categories: those who nurture the network, and those who steer it. Abilities of the former kind are typical of network '*facilitators*' and '*mediators*', while those of the latter kind are associated with network '*leaders*' (Agranoff and McGuire 2001, 2003; McGuire 2002; Cristofoli et al. 2014).

The network facilitator-mediator is expected to foster an environment for good partner interaction in order to nurture the network. This is made by establishing working rules to govern partner participation, promote information exchanges between network partners, maintain harmony and develop ways to cope with strategic and operational complexity (Kickert et al. 1997; Agranoff and McGuire 2001; O'Toole and Meier 2004; Cristofoli et al. 2014). This person is also expected to build commitment to the mission and the goals of the network, not only among network members but also among external stakeholders (Agranoff and McGuire 2001; Cristofoli et al. 2014).

Following Cristofoli et al. (2014) when it comes to steering the network, the network leader is expected to be able to perform three tasks: action planning, activating and re-planning. Action planning consists of establishing clear missions, developing focused strategies and measures for the network and for the organization in which the leader works (Agranoff and McGuire 1998; Mitchell et al. 2002). Activating consists of selecting the appropriate players and resources for the network (Mitchell and Shortell 2000; Agranoff and McGuire 2001, 2003), tapping the skills, knowledge and resources of others, gaining trust and building consensus (Agranoff and McGuire 2001). Finally, re-planning consists of altering and repositioning the network objectives when important changes occur in the network environment (Shortell et al. 2002).

Tying together the former streams of literature in a network governance environment, the mechanisms for the coordination of the network partners and the ability of the network manager to run the network are reliable predictors of a network governance performance. These predictors underlie the theoretical framework suggested by Cristofoli et al. (2014) that is also used in this work and is presented in Figure 2.

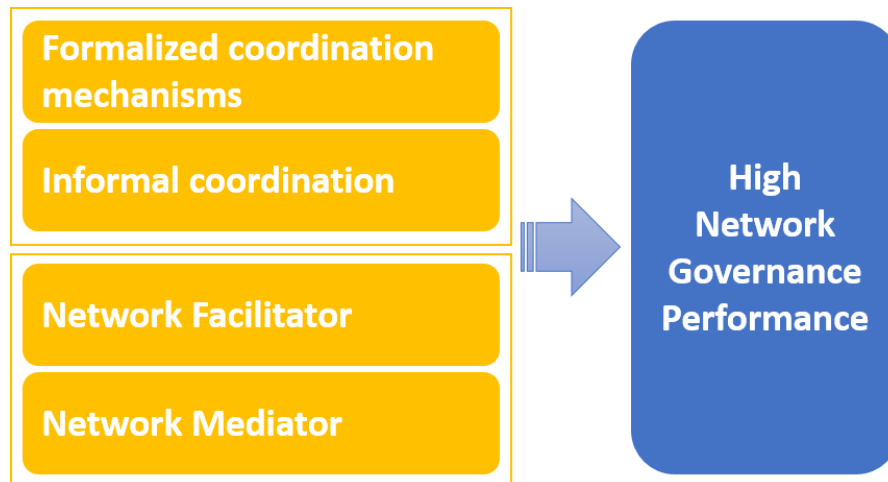


Figure 2: Theoretical framework, based on Cristofoli et al. (2014).

This network governance theoretical framework is employed as backdrop in the following section for the particular case study of RECI (Red Española de Ciudades Inteligentes, or Spanish Network of Smart Cities), where organisation and performance of this city network is thoroughly analysed

3 RECI (Spanish Network of Intelligent Cities): the case study

RECI, created in June 2011 with the signing of the 'Manifest for the Smart Cities' Innovation for Progress', is an initiative sponsored by elected councillors in Spain who are committed to create an open network to promote the economic, social and business progress of cities through innovation and knowledge, based on information and communication technologies (ICTs).

RECI is based on the final objective to exchange experiences and to work together on the development of a sustainable city management model which is sustainable and improves the quality of life of citizens. In order to achieve this, the association promotes the automatic and efficient management of urban infrastructures and services, the reduction in public spending and improved service quality, focusing on aspects such as energy saving, sustainable mobility, eGovernment, social caring or security. Therefore, RECI was founded over four main pillars to support local level development, as shown in Figure.

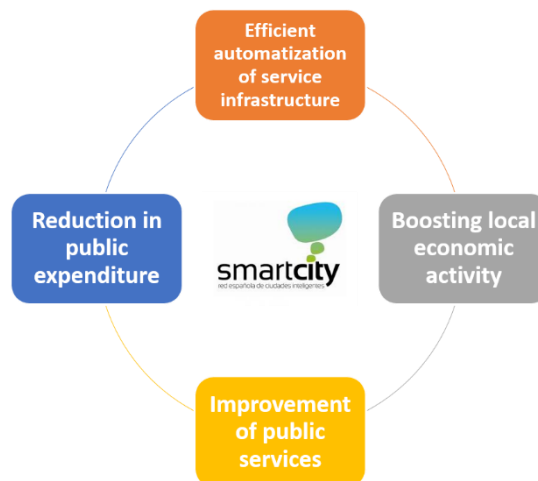


Figure 3: RECI's foundation pillars.

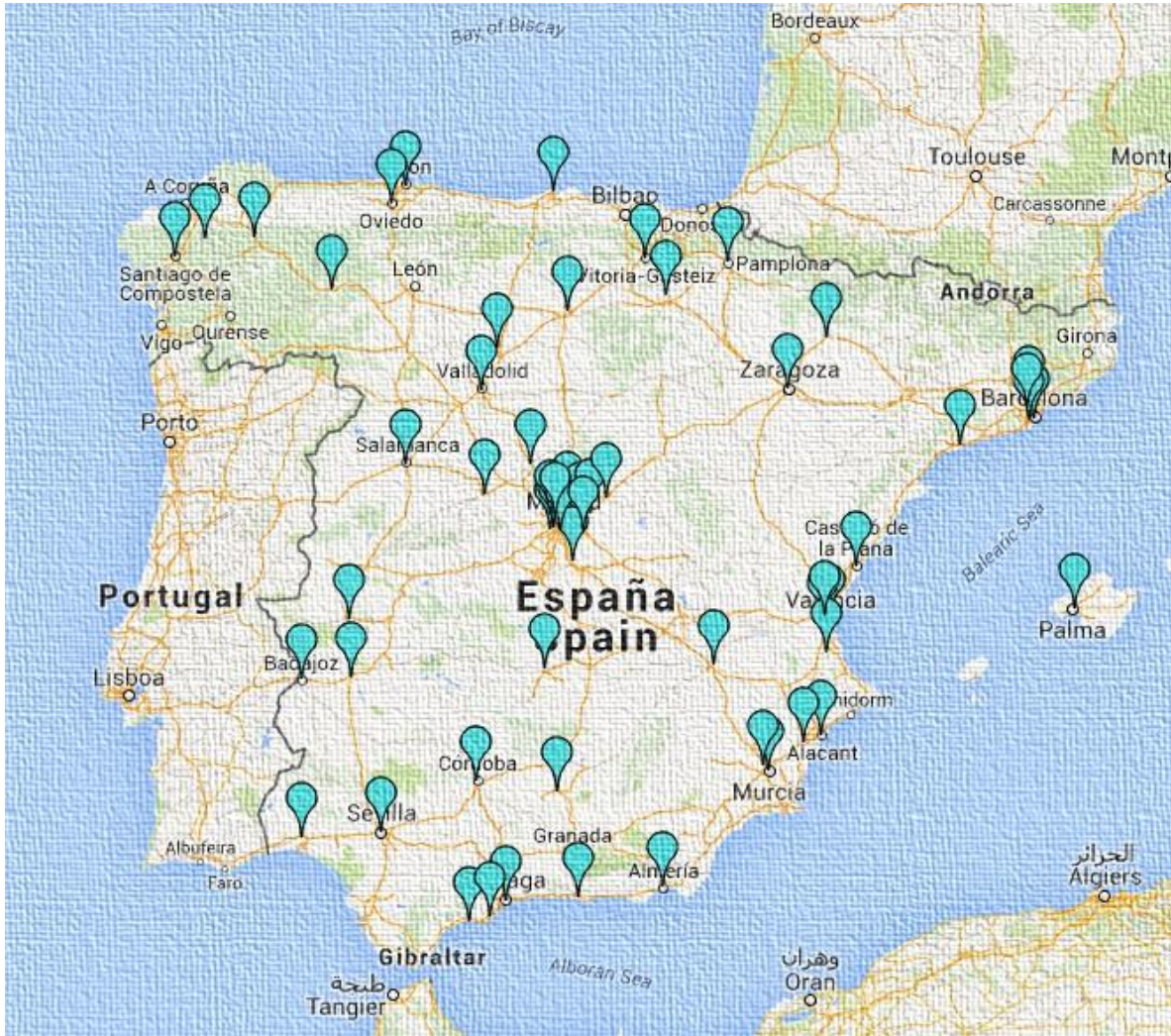


Figure 4: Map of RECI's cities (RECI 2015)

After the founding meeting held in Logroño, and several organizational working groups sessions in A Coruña and Murcia, the network was formally constituted in June 2012 in Valladolid.

RECI's creation was supported by FUNDETEC (Foundation for the Development of Information Technology in Business and Society), who played the network mediator and facilitator roles, as well as the staff technical office between 2012 and 2015. This organisation was founded as a result of a joint effort between the Public Administration and the Private Sector to establish a stable, not-for profit collaborative framework open to the participation of any organisation interested in promoting the development of the Information Society in Spain. In 2015 FUNDETEC was dissolved, transferring all technical office activities directly to RECI.

All cities that currently make up this network, with 65 members by January 2016 and on a constant growth which distribution can be seen in Figure, share the motivation that a smart city is the one which knows how to make the most of the possibilities offered by the ICT for facilitating the life to its citizens and turns the Administration into a closer, more accessible, efficient and sustainable one.

Furthermore, RECI's July 2014 Assembly approved the '*Friend Municipality*' figure for cities with less than 50,000 inhabitants which cannot become full members of the network. Thus, Abarán (Murcia), Cambrils (Tarragona), Mahón (Menorca) and Manacor (Mallorca) and Torrijos (Toledo) become the first 'friend municipalities' of RECI.

3.1 RECI as a knowledge sharing platform

RECI can be seen as a platform that offers formalized coordination mechanisms, as well as network facilitator and mediator services, to promote cooperation among cities. As part of its ICT based coordination mechanisms, the platform provides local governments with a technical document repository service, also known as Content Management System (CMS) which was donated by Santander city hall, mainly focused on documents in the fields of automatization and public service improvement. These documents help designing future policies aimed at scalable technological projects that might be replicable in other cities. Since RECI works within the limits of local competencies in Spain, areas such as health and education are out of the scope of the sharing practices. Local managers are in charge of feeding and editing the CMS with ICT resources that might be further retrieved by other local managers. These collaborative work promotes the creation of innovative bidding documentation among local governments of member cities. At the same time, it provides technical staff, civil servants, and hired labour with a wide amount of information to employ in their local projects.

The membership cost for cities is free to facilitate the inclusion of as many cities as possible. In return, the network encourages its technical members to actively participate in the cooperation activities in a pro bono way, leveraging the potential of physical and virtual social networks as a collaboration tools, offering their time and availability. Far from political parties and ideologies, the focus is put on technical questions. This collaboration entails a mix of formal and informal coordination mechanisms.

Considering the level of participation, three traction levels experienced by member cities could be considered. On one extreme, there are very active cities which have a strong traction effect on

RECI's initiatives. These cities generally have a long innovation tradition in smart city projects that dates before RECI's formation, generally as participants in European projects, and participate in other international organisations like the Covenant of Mayors, as it will be seen later on. Among them, Barcelona, Madrid, Santander and Donostia-San Sebastián. On the opposite extreme, it is estimated that around five per cent of the cities that belong to the network do not actively participate in its activities on a regular basis. Finally, most of the cities are situated in an intermediate traction level where they participate in the initiatives and contribute to promote them, but not on a regular basis.

3.2 RECI's structure and working groups

Considering its organisational structure, RECI's Board of Directors is formed by a president, three vice-presidents, one secretary, and one representative from each founding member. Since its establishment, RECI has been chaired by the Major of Santander, Mr. Íñigo de la Serna, who is also the President of the Spanish Federation of Cities and Provinces (FEMP) and, since 2015, President of the Council of European Municipalities and Regions (CEMR). In addition, Santander's City Hall also carries out the technical coordination activities of the technical office, together with general administrative and legal matters.

RECI's financial model is purely based on collaboration agreements with mass media and different types of private entities, without other external funding mechanisms such as membership fees. Despite the initial success of RECI, including a wide national and international recognition of its initiatives, this financial model is currently being reviewed in order to find a more sustainable model which allows RECI to continue growing and increase its impact on cities and citizens. This is a mandatory aspect for RECI's future when considering the adhesion rate of cities to the network since 2012.

The cooperation of public and private sectors, the social collaboration and the development of the network, are key elements that promote an innovative space that fosters the talent, opportunities and quality of life in the urban environment. For this reason, RECI's ongoing work is developed under five working groups (WG), where one or two cities act as leaders of each one of them. These five groups are: Social Innovation; Energy, Environment, Infrastructures and Livability; Urban Mobility; and Governance, Economy and Business. These groups, together with their related activities and leading cities are shown in Table I.

Table I: RECI's working groups

Working Group	Areas	Leading cities
WG 1 Social Innovation	<ol style="list-style-type: none"> 1. Accessibility 2. Culture and Sports 3. Citizen involvement 4. e-Health 5. Emergency and Security management 6. Tourism 7. Education 8. Open data 	A CORUÑA
WG 2 Energy	<ol style="list-style-type: none"> 1. Energy Efficiency dissemination 2. Municipal facilities: smart buildings, efficiency in public lighting, renewable energy installations 	MÁLAGA, SUPPORTED BY MURCIA
WG 3 Environment, Infrastructures and Livability	<ol style="list-style-type: none"> 1. Environmental quality 2. Sustainable buildings 3. Building Control automation 4. Management of public infrastructures and urban facilities 5. Parks and Public Gardens management 6. Livability 7. Urban parameters measurement 8. Waste Collection and treatment 9. Urban Planning 	VITORIA RIVAS- VACIAMADRID
WG 4 Urban mobility	<ol style="list-style-type: none"> 1. Electric vehicle (EV) 2. Intelligent Transport Systems (ITS) 	MADRID
WG 5 Governance Economy and Businesses	<ol style="list-style-type: none"> 1. eGovernment 2. New business models 3. Employment 4. e-Commerce and NFP payment platforms. 5. Cloud Computing 6. Virtual Data Centres 	VALENCIA

It is important to recognise the work of the working group leaders who assume the leadership and coordination responsibilities in a completely voluntary basis.

Due to this division, the smart city policies promoted by RECI are, mainly, sectorial policies. Member cities choose what groups they are interested to participate in based on their individual motivations and local actions. In each group, all these cities work together analysing all the areas related to the working group and defining related strategies, guided by the city councillors and by the local technical staff involved. In each working group, RECI offers local politicians and local technical staff the possibility to frame engagement and co-creation processes in multiple phases of the workflow.

The first group focuses on **social innovation**, led by the city of A Coruña. This group works on citizen participation, social services, accessibility and tourism. This WORKING GROUP is concerned with the development of city presence, participation and active listening on the Internet and on social networks. The group also works on issues of transparency and open data, where city experiences have been presented, together with the Corporate Governance Code prepared by the FEMP. In for the area of smart destinations, progress has been made on a guide to promote smart tourism with public and private collaboration (Inndea 2015).

The second working group focuses on **energy**, with the city of Murcia leading the works. Energetic efficiency and intelligent buildings are the focus of this group working on energy. Its recent works include sharing experiences of interest, such as the contract for the improvement of public lighting in Vitoria, the contract for tenders of the energy service in Alcobendas, and sharing information on the World Congress in Sustainable Building held in Barcelona. The group works on synergies between cities to submit joint proposals among RECI cities to Horizon 2020 program of the European Union.

A third working group focuses on **environment, infrastructure and livability**. The cities of Vitoria and Rivas have been leaders on these grounds at RECI. This group has focused on water, irrigation, pollution, light pollution, and waste management. This group is sharing experiences on the city regulations for water saving in Sabadell, the CAT-MED project on sustainable urban models in Valencia and the alert system for pollen in Pamplona. A subgroup of parkland and water cycle works on a draft ordinance on irrigation management and water conservation. A new subgroup to work on the application of information and communications technology to measure urban levels of noise and light pollution has been proposed (Inndea 2015).

A fourth working group focuses on **urban mobility**. Burgos and Valladolid have been city leaders on urban mobility and their focus has been on electric cars, sustainable mobility plans and alternative vehicles. This group has discussed the effects of the new state wide regulation

governing facilities for recharging electric vehicles, which came into force on July 1, 2015. As a result of the discussion, it has proposed to change the legal figure of 'system manager loads', which according to existing regulations is the only authorized supplier of energy to recharge e-vehicles, and inform of this position to the Ministry of Industry, Energy and Tourism. The group considers that this figure hampers the implementation of projects of electric mobility in Spanish cities. The group has also proposed drafting a document on bicycles in the cities of RECI.

There is a group working on **governance, economy and business**. The leader is the city of Valencia. This group has driven projects on e-administration, mobile applications, standardization and open data. Latest developments in this working group include the presentation for discussion of the 'Participate' program of the European Foundation for Information Society on citizen participation in public processes. Presentation of good practices in cities, such as Avila interoperability tool, open data Malaga, the biometric signature at Alcobendas and the platform for integrated management of Valencia. They have further focused on sharing documents on public procurement and the regulation on public sector information reuse (Inndea 2015).

On top of the annual meeting of the General Assembly Board, periodic meetings are held by the different working groups, as well as extensive virtual meetings. Some of these are monthly coordination meetings among the leaders of the different working groups, to solve both on internal rules and on the subjects of work in each of the groups. Virtual meetings are made possible using a videoconference platform donated by Rivas' local government.



Figure 5: RECI meetings facts and figures by mid-2015

Several mechanisms are put into place to allow all attendees and non-attendees to follow up with the progress of the activities carried out by the working groups. In addition, for every meeting of the technical committee a press release is published to share the advances and conclusions of the activities and meetings carried out by the working groups. However, in this meetings no minutes are taken and subsequently published, with the objective to streamline the bureaucratic aspects and to give freshness and agility to the model.

3.3 International collaboration

Despite that RECI's work is mainly focused on the evolution of Spanish cities towards a smart future, the fact that RECI has been the first city network of its kind in the world has raised the interest from other countries about its operational model and activities. This has created a different dimension of cooperation at an international level. From this perspective, RECI has had expressions of interest from countries such as Portugal, France and Italy in Europe; Latin American countries like Peru, Chile, Argentina, Bolivia, Brazil or Colombia; North America, from cities of the United States and Mexico; and other countries like Egypt and Israel. These are shown in Figure 6.

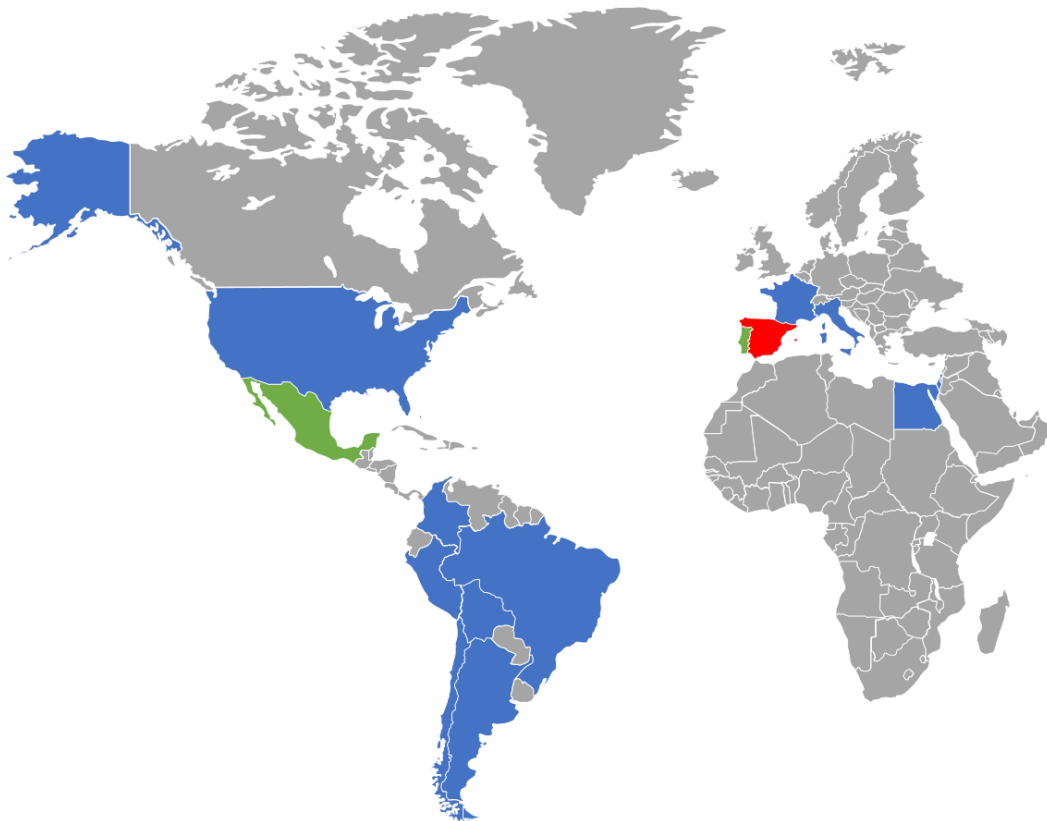


Figure 6: Countries directly influenced by RECI

For the particular case of Portugal, a similar city network based on RECI's model, RENER (Red Portuguesa de Ciudades Inteligentes, or Portuguese Network of Smart Cities), was established in 2013. As in RECI, RENER is empowered by a private non-profit organisation, INTELI, organised as a public-private cooperation to promote research and innovation in the smart cities field. Currently there is an agreement for mutual collaboration between RECI and RENER.

Apart from RECI's activities and international display, the international interest has, in many cases, emerged from the attention that some Spanish cities have received from their active role in international projects and organisations. This activities dates back more than ten years, with some cities like Barcelona having participated in European projects related to smart cities back in 2002. These have mainly been European Union Research and Innovation Programmes, such as CIVITAS (2002 - 2016), Framework Programme 6 or FP6 (2002 – 2006), FP7 (2007-2013), and the most recent Horizon2020 framework programme (2014 2020). These projects, initially oriented towards energy efficiency and clean transport, have evolved towards smart city projects with a global scope where several Spanish cities act as European models or *lighthouse cities*. Thanks to these cities, but also thanks to Spanish companies, university and research institutes; Spain tops the participation rank in European smart city projects. As an example, six RECI members are partners in seven of the Horizon 2020 Smart City projects funded to date. The different cities, funding calls and projects can be found in Table 2.

Table 2: European Union Funded Projects with Spanish Cities Partners

City	Funding programme	Project
Barcelona	CIVITAS I	MIRACLES
Burgos	CIVITAS II	CARAVEL
Donostia - San Sebastian	CIVITAS PLUS I	ARCHIMEDES
Vitoria- Gasteiz	CIVITAS PLUS I	MODERN
Palma	CIVITAS PLUS II	DYN@MO
Málaga	CIVITAS PLUS II	2MOVE2
Zaragoza	FP6 - CONCERTO	RENAISSANCE
Cerdanyola del Vallès	FP6 - CONCERTO	POLYCITY
Tudela	FP6 - CONCERTO	ECO-City
Vitoria- Gasteiz	FP7 - CONCERTO	PIME'S
Viladecans	FP7 - CONCERTO	cRRescendo
Santiago de Compostela	FP7	PLEEC
Donostia - San Sebastian	FP7	STEEP

Laguna de Duero	FP7	CITYFIED
Sabadell	FP7	DoF
Barcelona	FP7	BESOS
Madrid	FP7	MoveUs
Sabadell	H2020	TRIANGULUM
Valladolid	H2020	REMOURBAN
Barcelona	H2020	GrowSmarter
Zaragoza	H2020	CITIKES
Donostia - San Sebastian	H2020	REPLICATE
Vitoria- Gasteiz	H2020	SmartEnCity
Santiago de Compostela	H2020	Smarter Together

Also at European level, many RECI members are active participants or coordinators in other initiatives such as the Covenant of Mayors, which seeks a reduction of 20% in CO₂ emissions in European cities by 2020; and the European Innovation Partnership for Smart and Sustainable Cities (EIP-SSC), which was conceived as a marketplace for cities, universities, companies and any other smart city stakeholder to collaborate in different smart city initiatives under six different working groups. In the Covenant of Mayors, Spain is the second country after Italy in number of participant cities, with 1,454 signatory cities representing 27,101,765 citizens (63% of the Spanish population); whereas in the EIP-SSC the Spanish cities are active collaborators and participants in all events. In addition, RECI's President and Santander's Mayor, Mr. Iñigo de la Serna, holds currently the role of Co-President of the Council of European Municipalities and Regions (CEMR). It is also important to remark the actions of ICEX, a Spanish public entity which seeks the international promotion of the Spanish companies to increase their competitiveness and add value to the economy, as well as attracting foreign investment in Spain. Under the umbrella of ICEX, visits of foreign city councillors to so called intelligent city ongoing projects in Spanish cities have been arranged.

Overall, a direct consequence from this remarkable European level participation is an important contribution into RECI's members influence, knowledge and benefits for other Spanish and international cities which seek following the steps of the most advance ones.

4 RECI's Impact on Spanish Smart Cities

In order to analyse RECI's impact as a knowledge sharing platform for municipalities and city framework key stakeholders different research approaches were employed. On one hand, a PEST (Political, Economic, Social, and Technological) analysis was carried out where the most remarkable contributions to these four areas are enumerated based on successful cases. On the other hand, the information extracted from the results of a consultation carried out among a group of RECI's members is covered. Together, these two views provide a full picture of the overall impact of RECI on the Spanish smart cities.

4.1 PEST Analysis

PEST, as an analysis framework of macro-environmental factors, is also referred to as, STEP (Clulow, 2005), SEPT (Narayanan and Fahey, 1994: 199-202). The constituents of PEST can be considered as macro-environmental factors and its usefulness lies in the assumption that the success of a particular organisation or management solution cannot be understood without having the information relevant to the specific business environment (Buchanan and Gibb, 1998).





The PEST analysis, as illustrated in

Table 3 for the particular case of RECI, is expected to provide the key drivers to understand the impact of RECI in the Spanish cities. In addition this analysis will include *'the role of regulation/initiatives/projects as enablers of development in the ICT sector'* among the key factors considered.

4.1.1 Political impact

Innovative forms of smart city policies and regulations are needed to enable large scale implementation and roll-out of smart cities. Cities need an adequate set of framework conditions in the field of policy and regulations in order to be able to smarten up. New governance concepts are required to coordinate and integrate smart city stakeholders and to jointly experience and learn with new forms of governance and policy concepts to further the process of becoming a sustainable, smart city. But all this requires technical planning capabilities, more inclusive participatory and consultation processes, and greater collaboration within and across traditional policy and administrative boundaries within and between cities and communities.

Table 3: RECI's PEST analysis

	<p>Political Factors: Analyses how legal issues and government regulations affect the probability of success of RECI in the Spanish political framework. It also analysis how RECI influences policy creation and decisions taken.</p>
	<p>Economic Factors: Focuses on the economic aspects to determine whether or not RECI can play a key role in the success of smart city projects by producing savings in the processes associated.</p>
	<p>Social factors: This factors will help assess citizens' needs as well as the things which compel them to need a smart city.</p>
	<p>Technological factors: analyses how RECI activities and initiatives based on ICT influence the associated smart city technology market and its products, and the creation of normalisation documents which will influence the projects implemented by other cities and technology adopted by them.</p>

RECI is an Association created under the public law in Spain in June 2012, and officially approved by the Spanish Internal Affairs. The network has got specific groups to work deeply into different areas: Environment, Government, Energy, and Social Aspects; as has been stated in section 3.3.

But cities can learn from each other, and can collectively be analysed to yield general lessons for the circumstances in which specific strategies are appropriate, and the forms of localisation that can best contribute to success. This is especially true when more information about their real outcomes, wider impacts and long-term consequences becomes available. Therefore, the impact of RECI in that point is highly valuable. However, every city should take into account that there are many forms of scaling, and not all are equally feasible or desirable. To put the findings of this study in perspective, it is useful to distinguish between replication, scaling and ecosystem seeding.

Replication essentially means repeating successful smart city initiatives in another locale or replicating the same type of Smart City in other cities. These replicas would be based on matching the aggregate characteristics (population, income distribution, local economic characteristics, socio-economic outcomes), and deliberately creating a similar strategic vision and portfolio of (locally relevant) initiatives.

Scaling means transforming a small initiative into something bigger. This may involve increasing the volumetric size of a given project by involving more stakeholders, funding, services, and so on.

A more ambitious form of scaling involves changing the basis of an initiative from individual city projects to multi-city projects. In this case, a degree of explicit and designed deviations from replication are an explicit part of the experimental design, intended to produce relevant (control and treatment) alternatives and thereby to maximise the reliability, quality and the pervasiveness of the lessons learnt. This may also involve transfer from a city (or cluster of cities) to EU 'hosting'.

According to research undertaken by the European Parliament (European Parliament Policy Department 2014), more than 30 Spanish cities with a population in excess of 100,000 have at least one smart city initiative (including the projects specified in Table 2), making it one of the top three countries in Europe measured by the number of smart city initiatives, alongside Italy and the UK.

However, Spain performs less well when measuring the number of smart city initiatives as a percentage of its total number of cities, 51% to 75% of Spanish cities with a population over 100,000 have at least one smart city initiative, lower than the percentage of Swedish, Danish, Italian and Austrian cities with at least one smart city initiative. From a survey carried out in the

study, insufficient regulation and Government incentives to encourage investment in smart grid technologies (79% of respondents) and lack of priority in roll-out activities for intelligent transport systems by transport authorities (28% of respondents) are identified as the main factors to be addressed by the Spanish Government to improve this figures.

One positive effect is the fact that public policies might be reviewed and adapted to deal with unforeseen issues. When a city foresees limitations in the public policy pursued, this knowledge is shared in the network. **Knowledge sharing is a positive mechanism for policymakers who have to take decisions more quickly than in the past, in a rapidly evolving socio political context.**

A second positive effect is the response to forward thinking in policy making practices (Accordion, 2013). RECI is born with an idea of capturing future opportunities such as advances in science and technology regarding efficient automatization. It might be argued that the existence of RECI contributes to orient policy choices to future possibilities instead of focusing just into short-term issues.

An additional positive effect has to do with the fact that access to contacts and information may leverage differences among cities with bigger and smaller sizes.

RECI has embedded anticipatory thinking in the mechanism that allows sharing best and failed practices among city governments. According to the network's technical office, RECI has been a positive ground to work on changes in ways of private-public collaboration. In this regards, technical proposals have been approved at the political level. The existence of RECI contributes to align smart city strategies with other government levels, particularly with the national level. Thus, an important part of the work of the staff technical office entails coordination with state agencies such as SETSI (State Secretariat for Telecommunications and Information Society, or Secretaría de Estado de Telecomunicaciones y Sociedad de la Información in Spanish), INAP (National Institute of Public Administration, or Instituto Nacional de Administración Pública in Spanish), IDEA (National Institute for the Diversification and Energy Saving, or Instituto para la Diversificación y Ahorro de la Energía in Spanish), Red.es and ICEX (Foreign Trade Institute, or Instituto de Comercio Exterior in Spanish), among others.

RECI, through its technical office, has been a driving force for the creation of *Foro Sectorial de Ciudades Inteligentes*, and the normalization committee at AENOR, both state wide.

4.1.2 Economic impact

The beneficial political impact that RECI produces over the city governments gets also translated into a positive economic impact where, on one hand, cities can reduce their expenses; and on other hand, they can obtain R&D funds to develop innovative projects.

Following the Spanish proverb '*the union builds the strength*', the coordinated work carried out by RECI's members leads to savings in both time and expenses when applied to common smart city procedures, thus leading to more prepared professionals and faster execution times. Examples of these savings are seen in the form of more agile smart cities initiatives development, reduction in the contracting costs, and reduction in the expenses in relation to staff training. An example of the staff savings produced is shown in Figure 7, where the positive effect of the first 72 virtual working group meetings are shown.

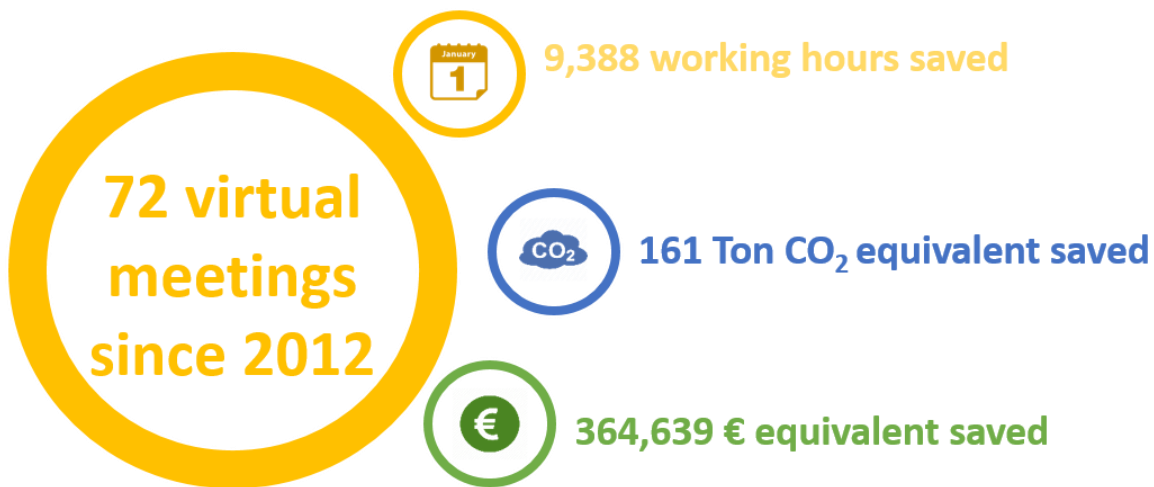


Figure 7: Economic savings produced by RECI's operational model

In addition, RECI's proactively has produced a chain reaction by stimulating the national government investment in R&D project calls in the area of smart cities. Among them, the inclusion of the National Plan for Smart Cities as the ninth pillar of the *Digital Agenda for Spain 2015 -2020* (with more than 3.1 Billion Euro allocated to fulfil the European Commission's Digital Agenda for Europe in 2015-2020) represents an unprecedented initiative of the government to help the Spanish cities empowering their local technological industry and supporting local authorities in their development as smart cities and smart tourism destinations. According to the Digital Agenda for Spain, the ultimate objective of the plan is to contribute to the economic development of cities by *maximising the impact of local ICT policies to improve the productivity and competitiveness; and transform and modernise the Spanish economy and society with an efficient and intensive use of ICT's by*

the citizens, companies and administration. By October 2015, 118.5 Million Euro had been invested in the different initiatives promoted by the plan, 98.6% of the budget allocated for 2015 and 63% of the overall budget for the plan. On top of this national investment, the international funding obtained by the different cities from international projects, like the ones enumerated in Table 2, needs to be considered as a successful economic impact from RECI's cities into the development of smart city projects in Spain that others can learn from.

Overall, the economic impact of RECI onto the Spanish cities can be considered from three different aspects:

1. Expenses reduction based on shared knowledge and staff training
2. Stimulation of the National investment on smart city projects
3. Stimulation of other RECI members to seek participation in European funded projects

4.1.3 Social impact

The social pillar of the smart city, the citizenship, is the pending activity of RECI. Many municipalities has deployed pilots together with private companies (i.e. Santander, Barcelona, and Rivas Vaciamadrid); the same happened in other European cities. In some cases the initiatives has been shared, in order to be replicated in other cities with similar requirements and similar scenarios. In other cases the initiative has not gone beyond. This can be due to political interests or maybe because the benefits has not been shared in a good way or maybe due a not properly dissemination strategy.

Understanding technology as the enabler for smart cities, the digital transformation of cities can be seen as a great opportunity to foster economic, social and cultural development. The application of technology in cities offers enormous potential when it comes to improving citizens' quality of life.

On the contrary, the perception of the technology by citizens sometimes is not clear. Sometimes due the lack of technology capabilities of citizens or maybe because they have concerns related with the security and sometimes the benefits and functionalities are not clear. Or just because does not exist a clear demand for this new services. To address this obstacles governments and the private sector must work together to educate citizens about the benefits of smart technology. For this reason, RECI can be a good stakeholder to educate the citizenship disseminating the new concepts and the results of the Pilots and initiatives deployed in other cities.

4.1.4 Technological impact

In the current *digital* society, the entire combination of Internet and Communications Technologies (ICT) appear as the main support element of for the development of society, cities and countries. In Spain, since the end of 2013, the ICT market (which normally also includes the companies specialised on digital content) has experimented a growth tendency influenced by the country's global economy. In 2014, this market has continued this growth with an economic volume of 89.894 Billion Euro (1.9% more than in 2013), 30,797 companies (3.6% more than in 2013) and 427,348 workers (5.4% more than in 2013). Overall, in 2014 this market represented 4.4% of the national Gross Domestic Product (GDP). These figures have continued improving during 2015 (Ontsi, 2015). This ICT sector growth has overlapped with the operational start of the National Government's initiative known as the *Digital Agenda for Spain* (2015 -2020) with more than 3.1 Billion Euro allocated to fulfil the European Commission's Digital Agenda for Europe in 2015-2020. This ICT development programme marks the roadmap in the ICT and electronic administration fields.

From the work carried out by RECI it is well understood that many cities share the challenges and decisions involved in their individual venture to become a smart city. In addition, some of these decisions cannot be taken in isolation by a single city, but globally with others, such as the necessity of cities to share information with each other and the mechanisms to do it. In this context, adopting common views or perspectives on certain implementation factors can play an extremely important role in the development of replicable projects which might be developed by several smart cities. This common views can be classified at three different levels:

- Common view on principles, which can be used as guidance for local authorities to define their objectives.
- Common view on performance indicators, which can help local authorities to acquire the ICT infrastructure and services which will allow achieving the objectives previously established at the same time that their progress is monitored.
- Common view on interoperability, which can ensure that all data captured by the ICT infrastructure and services of the city are adequate for their exchange with a wide range of city services.

RECI's members influence the development of this common views on smart cities development internally, with CMS document platform which allow to share best practices and internal

agreements; and externally, with their activity in the Spanish Association for Standardisation and Normalisation (AENOR).

Internally, RECI's document CMS acts as a best practice repository which sometimes leads to practices widely adopted by several RECI members, and becomes a sort of *informal norm* or common practice. One example of this situation is the development of applications and application programming interfaces (APIs) shared among RECI cities to replicate and adapt software applications locally –such as those linked to tourism. Two examples are Palma de Mallorca developments on tourist grounds and Madrid development on public traffic management. In the CMS all the documents shared are classified considering their type (i.e. document created for/by RECI, city success case, document shared by a city or company) and level of replicability (i.e. high replicability, medium replicability, low replicability). Currently the CMS counts with about 275 documents, which are classified as shown in Figure 8.

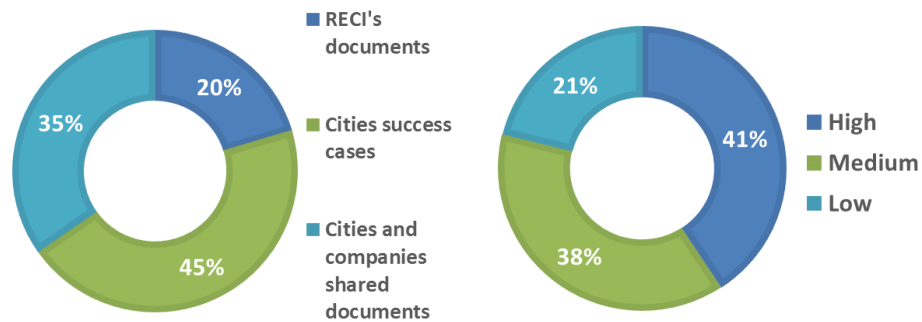


Figure 8: CMS content considering document classification (left) and replicability level (right)

Externally, AENOR, in collaboration with RECI, created in 2012 the Normalisation Technical Committee 178 for Smart Cities (CTN 178), which is divided into five subcommittees, as shown in Figure 9. RECI plays an important role within this Committee since four of its members chair four of the subcommittees, with the exception of the Touristic Destinations Subcommittee which is chaired by the State Agency for the Development of Innovation and Touristic Technologies (SEGITTUR). Other important bodies involved in the CTN 178 are the SETSI and Spanish Federation of Municipalities and Provinces (FEMP), president and vice-president respectively; representatives of several Ministries; and AENOR's technical normalisation committee 133 focused on telecommunications, more concretely its first subcommittee focused on infrastructures.

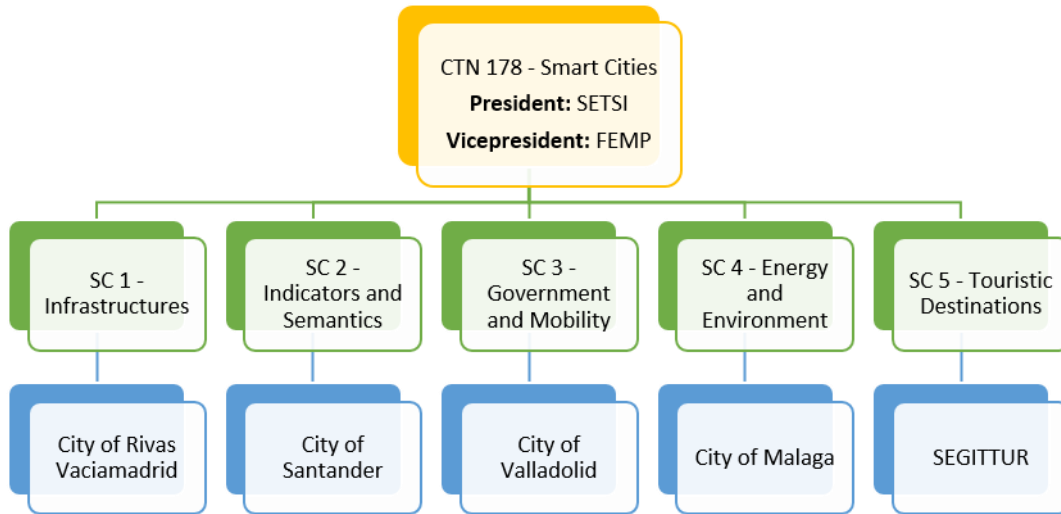


Figure 9: Smart cities Technical Normalisation Committee 178 structure

During 2015 the CTN 178 has published a total of 15 norms for smart cities, most of them in the area of infrastructures, with other 33 norms currently planned or in development (Table 4).

Table 4: Standardisation norms approved by CTN 178 until December 2015

Subcommittee	Number of WG	Norms Published	Norms Planned or in Development	Total # of Norms
SC 1 – Infrastructures	5	11	20	31
SC 2 – Indicators and Semantics	3	1	3	4
SC 3 – Government and Mobility	8	2	4	6
SC 4 – Energy and Environment	6	1	4	5
SC 5 – Touristic Destinations	5	0	2	2
Total	25	15	33	48

The cooperation of RECI’s members within each working group has positively influenced the creation of norms, in particular in the Infrastructures Subcommittee with 11 norms published to date. A good example of this influence is the creation of the norm *UNE178104 – Smart Cities – Infrastructures – Integral Management System for the Smart City*, published in October 2015. This norm seeks the interoperability of vertical services within a city with the implementation of an Integral Management System, more commonly known as *City Platform*.

By mid-2015 over ten cities had tendered a city platform implementation. Among them different choices had been pursued, from cloud to university platforms, from research open-source platforms to closed commercial versions. However, the main initial limitation found by these first cities trying to adopt a city platform relied on the fact that, by that time, there were no formal norms that city platform developers should take into account in order to make them interoperable, allowing data exchange between the verticals of a city, or between different cities with different platforms. This situation was presented by RECI's President back in 2014 while talking about choices on technological platforms:

'Everyone does their own thing, which is logical, because the sector is diverse and companies offer different products, but we should be able to create basic game rules allowing to retrieve the data obtained on a common platform (Iagua, 2014).'

The need of interoperable city platforms has not only spotted as a RECI problem, but also at international level. An example of this situation is the EIP-SCC, where several European cities and companies interested in developing city platforms have signed a Memorandum of Understanding (MoU) to put a common effort on specifying the *musts* that a city platform should meet to be considered inter-operable. This fact shows how the creation of the Spanish norm UNEI78104 on smart city platforms is an example of RECI and Spanish cities position at the top international innovation on smart cities.

4.2 Impact survey results

In order to assess the degree of impact that the activities promoted by RECI has had over the local management and the smart city approach of its members, a consultation was carried out among them. The consultation was formed by a combination of questions in two different topics: their involvement in RECI (i.e. signatory year, number of working groups they are involved and group leaderships) and the impact of RECI in their local administration. The latter was addressed using a combination of 5-level Likert scale (Likert 1932), from '1-Completely Disagrees' to '5-Completely agrees', to determine the current level of satisfaction with the impact RECI has had on their smart city activities; open-ended questions to find out specific data on impact areas and good practices, and tabulated questions to measure the economic impact.

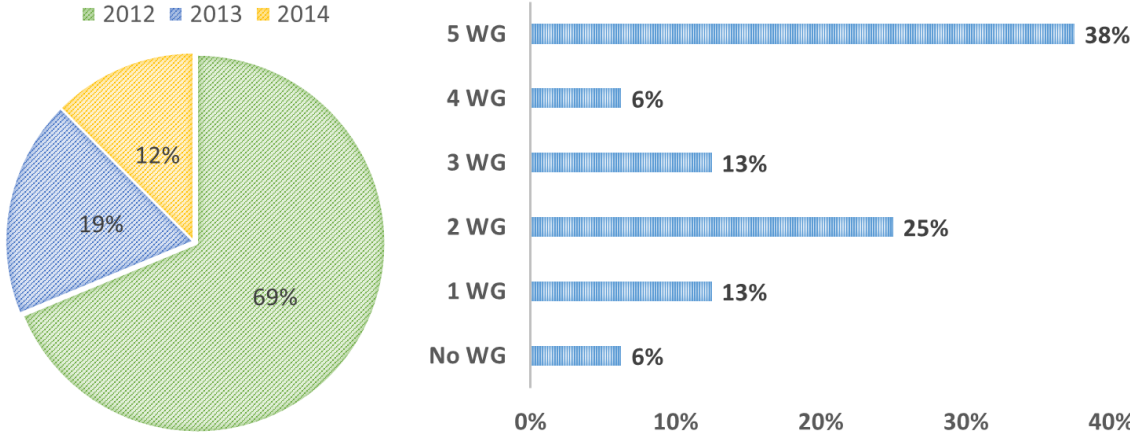


Figure 10: Year of adherence to RECI of participants (left) and number of working groups where participants are involved (right)

The replies obtained, with 64% participation, mainly corresponded to members who initially founded RECI in 2012, with the rest of participants being signatories since 2013 and 2014, as it can be seen in Figure 10. No replies were obtained from signatories from 2015. Looking at the affiliation of the members within the different working groups that form RECI, it was interesting to see how almost 40% of them were involved in the activities of five working groups, whereas the rest varied from four to none, with 25% of them involved in two working groups.

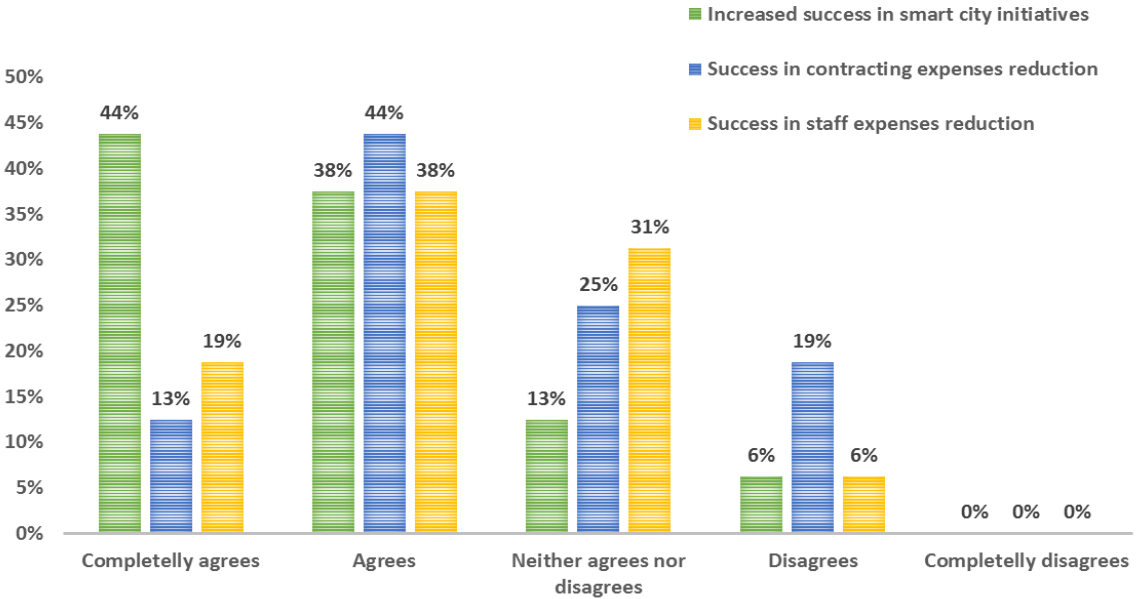


Figure 11: Perception of impact of RECI activities on local smart city activities

The impact analysis firstly targeted the influence of RECI's activities on the success of the smart city initiatives promoted by the city government, followed by the assessment of the impact on the reduction of expenses linked to adjudicating smart city services to contractors and to local government staff development. The results from the three-field analysis are shown in Figure 11.

Overall, the biggest impact is matched to the increased success in smart city initiatives where 82% of the participants either agrees or completely agrees with the impact of RECI activities in their success. Regarding savings in contracting and staff development, in both cases over 50% of the participants agree or completely agree that there is an actual saving, with the rest neither agreeing nor disagreeing, or even disagreeing as it is the case of 19% for the contracting case.

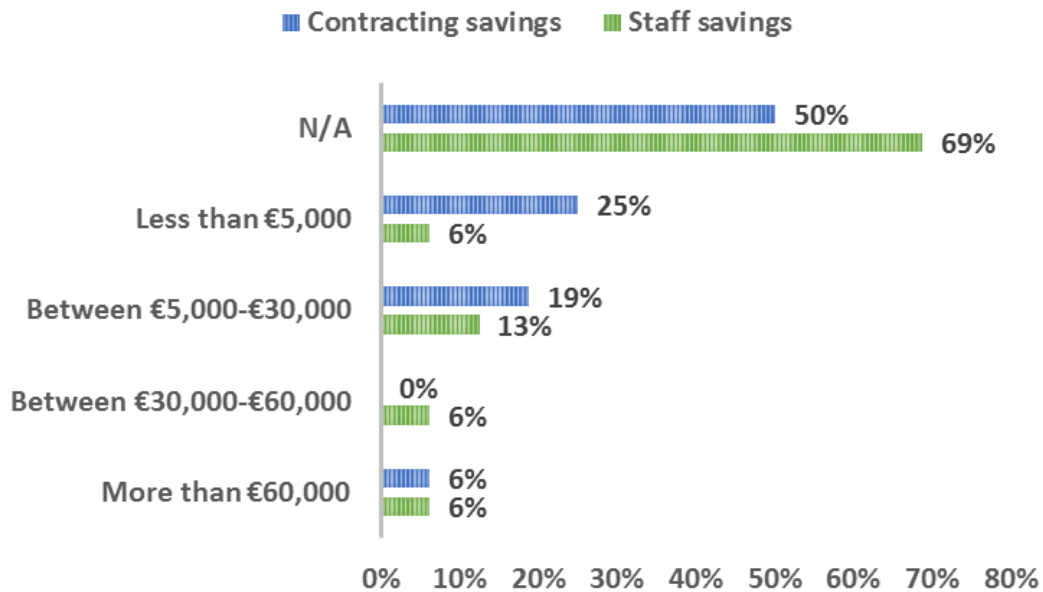


Figure 12: Quantisation of economic savings in contracting and staff expenses related areas

When quantising the level of savings, only around 50% of the participants were able to monetise this impact in their expenses, as observed in Figure 12. This indicates a necessity to introduce mechanisms, procedures and indicators for economically quantising their RECI's participation impact. Among those who were able to quantise their savings, these were mainly detected in areas related to contracting, with 6% declaring over 60,000 Euro savings in both contracting and staff expenses related activities. In particular, the economic activities benefiting from this savings are enumerated in Table 5.

Table 5: Specific areas of improvement for smart cities services contracting and staff development

Areas of improvement in relation to contracting smart city services	Areas of improvement in relation to staff development
1. Waste management	1. RECI events
2. Parking and mobility management	2. Training
3. Smart city platform	3. Discounts and free passes to conferences, workshops, fairs.
4. Energy management	4. Travel
5. Public-private partnerships in sensor-related projects	5. Common interest topics
6. Open Data, e-Government, transparency and citizen participation	6. Best practices and errors made by others
7. Define the expected quality of service by contractors	

Addressing RECI’s nature as a meeting point for innovative smart city projects and best practices learned, the consultation surveyed the participants on the level of promotion and adoption of good practices among the members. As it can be seen in Figure 13, about 90% of the participants claim that they have shared good practices using RECI’s channels. Among them, 65% are aware that their measured have been implemented by a different city. In addition, also 65% claim that they have implemented someone else’s good practices. The results display a healthy sharing-adoption culture of good practices in RECI where the mostly sharing prevails.



Figure 13: Good practices sharing and adoption among RECI members

To gather further knowledge on the type of best practices shared, they participants were specifically asked about the best practices they had adopted from other cities. These are shown in Table 6. The best practices adopted related fields expand from governance related (i.e. electronic administration, transparent governance), to tourism (i.e. Valencia city application), to project planning and execution (i.e. Torrent's smart city strategic plan and Malaga's KPIs), and energy efficiency (i.e. energy efficiency plan from Sabadell). In addition, when requested to mark the usefulness of the best practices adopted by themselves over a 5-point scale (1 to 5), an average mark of 4.4 was obtained, demonstrating a high degree of quality and satisfaction with them.

Table 6: Participants' best practices adopted by others

Best practices from other RECI members implemented
1. Valencia City application
2. Energy efficiency plan from Sabadell
3. Transparent governance from Zaragoza
4. Elaboration process of Torrent Smart City strategic plan
5. Smart city KPIs from Málaga
6. RECI's CMS has proven really useful for extracting important information
7. Electronic administration of Valencia
8. Contracting process centralised through the National Centralised Contracting System

Finally, the participants were asked about their opinion on the capacity for RECI's activities to be improved based on their experience. Out of them, 88% felt that there was still room for improvement despite that in general their perception of RECI's activities so far was positive.

Table 7: Potential improvements for RECI proposed by participants

Area of Improvement	Improvement Actions Suggested
Management	<ol style="list-style-type: none"> 1. Presentations of good practices and success cases with more technical details, maybe hosted by the cities where they are implemented with live demos. 2. More meetings hosted in Madrid to be fair on travelling for everybody. 3. Recognition system to reward the most active members, motivating a higher participation and collaboration from some passive members in the working groups initiatives. 4. Increase information in periodic communication (e.g. newsletters) with information on RECI and the technical office activities, funding calls, and other relevant information; and CMS, with meeting minutes, assembly decisions and agreements.
Projects	<ol style="list-style-type: none"> 1. Subdivision of working groups projects into smaller tasks with easier management and faster development. 2. More initiatives to address common issues where several members share a project, and therefore the contracting process, to reduce expenses such as technical specifications. 3. Translate results from the working group projects into practical results that can be extrapolated to other cities. 4. Lead project proposals for national and international calls where the interested members can take part.

Table 7 contains the summarised answers from the surveyed members when they were requested to suggest specific improvement actions. As it can be seen in the table, these actions are mainly divided into two areas, management and projects. On the managerial side, slight improvements in the internal communication channels and meetings' system are suggested. In addition, many

members agree on the necessity to promote a more active participation in the network activities from the most passive members. On the project side, a demand for more technical information is shown to help other cities replication the best practices promoted. Finally, and probably inspired by the work of some cities in European projects as previously seen in Table 2, some members request RECI to act as mentor to promote the creation of project proposals at national and international level where they can participate.

Overall, the suggestions of the members address one main desire, the effective execution of projects or initiatives in relation to smart cities. This efficiency is seen from three different angles: economic expenditure, best practises maximisation and time constrains. From the economic side, some members would like to see initiatives covering common interests in several cities rising. This would allow reducing economic costs by sharing technical specifications and contracting administrative processes. The initiative of RECI to lead projects targeting national and international funding calls is also considered another way to join efforts between cities that might be interested on the same project objectives and which can together benefit from a funding grant.

Regarding best practices, it is believed that sharing more technical details on the execution process of the success cases would allow an easier replication in other cities. This could be complemented with a more effective way to share other relevant information through RECI's Content Management System (CMS), such as meeting minutes, agreements, or practical results from the projects carried out by the working groups; and the active collaboration with other international smart cities organisations. When looking back into Figure 13 and considering the 30% difference between best practices promoted and adopted, it seems that the target should be focused on helping cities replicating best practices promoted by others.

In third place, the members express their wish to make the activities and projects propelled by RECI more time efficient by maximising the participation of all interested parties. To achieve this target, a more active collaboration of members should be promoted, together with other methods such as the subdivision of projects in smaller tasks to permit an easier and more agile management and the creation of an award system to reward the most active and committed members.

Other suggestions made expand from the need to make more open-source software tool available for their use by local authorities, to the request to centralise the network meetings in Madrid to make the travelling efforts similar for all members.

5 Conclusions

Based on the interest to assess and measure the prospects for innovation and the type of governance carried out by RECI, this document presented a thorough study about the impact of this network over its 65 member cities in Spain. With this focus, three streams of literature relevant to network governance have been brought in. Later on, these streams of literature helped to briefly structure the case study.

Assessing the conditions for success in shared-governance we have found a mix of two forms of network governance in RECI, between them, Shared-Participant Governance among its members is predominant. In addition, there are some traits of Lead Organization Governance on the role played by the technical secretariat. RECI represents the first city network of its kind, with formal ways of operation and a network leader, the mayor of Santander, and a network facilitator at the technical secretariat. Therefore, it can be considered that RECI shares features of shared-governance networks and lead organization governance, since an office, the technical secretariat, together with functions as leader as well. In conclusion, regarding the success of the network up to 2015 we may account for the existence of formalized coordination mechanisms.

Building upon the literature on conditions for success in shared-governance networks, the case of RECI confirms the insight on the importance of councillors' soft power to influence public and private bodies. Soft power is enhanced by the fact that RECI is a formal network, with service ecosystems being found within its framework of governance. These ecosystems are focused on five working groups addressing local concerns: 1) Governance, Economics and Business; 2) Urban

Mobility 3) Environment, Infrastructure and Livability; 4) Energy; and 5) Social Innovation. These ecosystems have their own leaders and mechanisms to cooperate and coordinate. Working groups allow sponsors to present their ideas, services and products, in exchange of funds that are used for the operation of the network.

Focusing on the abilities of the network manager as predictors of network performance, network managers have been found to play a relevant part, distinctive from network structure and mechanisms. The abilities of the network president to run the network are positive predictors of network governance and positive predictors of innovation. The technical office also functions as network mediator, able to foster an environment for a good partner interaction. In addition, the case study has demonstrated the important of this technical office in institutional building, establishing working rules for partner participation, and promoting information exchanges between network partners. This information exchange has been remarked by many cities as one of the most important factors in order to carry out successful smart city projects, with a very high exchange of best practices, with almost 90% of cities having promoted best practices and over 60% of them having adopted best practices from other cities.

It also builds commitment to the mission and the goals of the network both among network members and external stakeholders. These positive predictors allow for room to make policy more future proof, with limitations: RECI brings together a number of tools in a comprehensive and scalable way to ensure incremental adoption of future policy developments. When analysing the impact of RECI in the cities, there is consensus in affirming the positive impact of RECI in local governance.

This positive nurturing is not only limited to the policy or political impact, but it also expands to important economic and technological in cities. RECI members' active attitude towards innovation has produced important results in terms of international projects funding and the creation of the first national plan for smart cities projects, which has and is still allowing Spanish cities to implement innovative state-of-the-art smart city solutions which will be replicable by other RECI cities. This replicability has already led to important savings in terms of contracting services and staff development. However, there is ample room for improvement in terms of quantifying the savings and economic impact. There is an urgent need of establishing measures and indicators that would provide municipal teams with the appropriate power for assessing these economic savings. In addition, there has been a remarkable work in the field of normalisation, in particular in the technological aspects, thanks to the active work of RECI members into AENOR's CNT-178

committee and sub-committees. These norms are created taking into account other international norms, best practices from other countries and national best practices. Despite their success, as seen in the consultation, some cities find difficult to implement them due to their lack of technical knowledge. Consequently, more practical staff development (e.g. technical workshops hosted by leading cities) is seen as a path for improvement within RECI's technological side.

However, there is a lack of existence of formalized rules that increase the liability of decisions made. This means that even though organized network meetings coexist with contractual agreements and with the nurturing of informal relationships, agreements are not binding. This fact is a negative predictor of effects in network governance, and we found a good example on the limits to enact platform interoperability in RECI cities. This matter is also found in the feedback provided by the city representatives in the consultation made, where the lack of participation of some cities in the initiatives of the working groups and the proposal to create a reward system to promote an active collaboration were suggested among others. Once way suggested to increase this collaboration is dividing the current initiatives in smaller tasks where the number of cities involved is reduced in each task, consequently increasing the peer-pressure, easing the task management and achieving a faster development. Overall, a greater effort is required in management and procedures in the governance of the network, as generally required by the municipalities. This impulse to management and organization will lead to greater achievements in the network performance. In addition, the involvement of a greater number of medium-size cities would result in a significant economic improvement for them, given their difficulty in obtaining resources and capabilities so that RECI savings, synergies and good practices would have a major impact on management. Conversely this would require from RECI a greater effort of organization and management, as indicated

This operational analysis of RECI has shed light on new trends in governance in cities. The work has made a contribution to the literature on councillors' governance in complex networks and on network performance, highlighting the possibilities of network managers. At the same time, the article contribution shows the limitations coming from non-binding agreements and the potential improvements that both RECI and its members could carry on board to keep enhancing their smart city projects and leading the European smart city wave.

6 References

- Accordion, Franco. 2013. The Futurium—a Foresight Platform for Evidence-Based and Participatory Policymaking. *Philosophy and Technology*. 26:321–332. DOI 10.1007/s13347-013-0108-9.
- Agranoff, R., & McGuire, M. (2001). After the network is formed. Process, power and performance. In M. Mandell (Ed.), *Getting results through collaboration networks and network structures for public policy and management* (pp. 11–29). Westport, CT: Quorum Books.
- Agranoff, R., & McGuire, M. (2003). *Collaborative public management: New strategies for local governments*. Washington, DC: Georgetown University Press.
- Connolly, J.; Svendsenb, E.; Fisherc, D.; Campbell, L. 2014. Networked governance and the management of ecosystem services: The case of urban environmental stewardship in New York City. *Ecosystem Services* 10, 187–194. <http://dx.doi.org/10.1016/j.ecoser.2014.08.005>
- Copus, C. 2015. Ideology or Realism in Local Governance. *Croatian and Comparative Local Governance*. 15(2): 335–356.
- Cristofoli, D., Markovic, J.; Meneguzzo, M. 2014. Governance, management and performance in public networks: How to be successful in shared-governance networks. *Journal of Management and Government*. *Journal of Management & Governance*. 18:77–93 DOI 10.1007/s10997-012-9237-2.

Cristofoli D., Maccio' L., & Markovic J. (2012). Una, nessuna, centomila” recipes for a good network performance. Paper presented at the XVI IRSPM Conference, 11–13 April, 2012, Rome.

European Parliament Policy Department (2014), 'Mapping Smart Cities in the EU'. <http://www.smartcities.at/assets/Publikationen/Weitere-Publikationen-zum-Thema/mappingsmartcities.pdf>. Last retrieved December 15, 2015.

Iagua. 2014. Ínigo de la Serna aboga por crear unas reglas de juego básico para compartir información sobre Smart Cities. <http://www.iagua.es/noticias/espana/ayuntamiento-santander/14/09/03/inigo-serna-aboga-crear-unas-reglas-juego-basico> Last retrieved August 4, 2015.

Inndea. 2015. Smart City: La Red Española de Ciudades Inteligentes, entre las que se encuentra Valencia, se amplía. <http://inndeavalencia.com/smart-city-la-red-espanola-de-ciudades-inteligentes-entre-las-que-se-encuentra-valencia-se-amplia>. Last retrieved August 4, 2015.

Kickert, W. J. M., Klijn, E. H., & Koppenjan, J. F. M. (Eds.) (1997). *Managing complex networks*. London: Sage.

Kort, M., & Klijn, E. H. (2011). Public-private partnerships in urban regeneration projects: Organizational form or managerial capacity? *Public Administration Review*, 71(4), 618–626.

Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology*, 22 (140), 1–55.

Ontsi (2015). Informe anual del sector TIC y de los contenidos digitales en España 2014. Ed. 2015. Online: <http://www.ontsi.red.es/ontsi/es/estudios-informes/informe-del-sector-tic-y-de-los-contenidos-en-espaa%3%B1-2014-edici%C3%B3n-2015> [Accessed: 15th January 2016].

Mandell, M. P. (Ed.). (2001). *Getting results through collaboration networks and network structures for public policy and management*. Westport, CT: Quorum Books.

McGuire, M. (2002). Managing networks: Propositions on what managers do and why they do it. *Public Administration Review*, 62(5), 599–609.

Meier, K. J., & O'Toole, L. J. (2001). Managerial strategies and behaviour in networks: a model with evidence from U.S. public education. *Journal of Public Administration Research and Theory*, 11(3), 271–293.

Mitchell, S. N., & Shortell, S. M. (2000). The governance and management of effective community health partnerships: A typology for research, policy and practice. *The Milbank Quarterly*, 78(2), 241–289.

O'Toole, L. J., & Meier, K. J. (2004). Public management in intergovernmental networks: Matching structural networks and managerial networking. *Journal of Public Administration Research and Theory*, 14(4), 469–494.

Provan, K. G., & Kenis, P. (2008). Modes of network governance: Structure, management and effectiveness. *Journal of Public Administration Research and Theory*, 18(2), 229–252.

RECI. <http://www.redciudadesinteligentes.es>. Last retrieved August 25, 2015.

Shortell, S. M., Zukoski, A. P., Alexander, J. A., Bazzoli, G. J., Conrad, D. A., Hasnain-Wynia, R., et al. (2002). Evaluating partnerships for community health improvement: Tracking the footprints. *Journal of Health Politics, Policy and Law*, 27(1), 49–91.

Researchers: Maria Luisa Martínez, Álvaro Palomo (Ph.D.), Olga Gil (Ph.D.) and Julio Navío (Ph.D.)

Collaboration acknowledgement: Aqua-Consult Ingenieros S.L. (A-CING)



colegio oficial
**ingenieros
de telecomunicación**

C/ Almagro, 2 -1º izda.
28010 Madrid

COIT.es
coit@coit.es



asociación española
**ingenieros
de telecomunicación**

C/ General Arrando, 38
28010 Madrid

AEIT.es
aeit@aeit.es