Are the Smart Cities the most democratic?: the Spanish Case

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ABSTRACT

In the cities, the demand for a greater efficiency, sustainable development, quality life and an improved resource management have increased. Regarding this, public authorities are considering the implementation of management models in order to respond such urban environment. To this end, together with energy efficiency and protection of the environment and infrastructure, the main focus seems to be on the role of ICT. The city that implements these policies is called Smart City.

In the future, citizens not only expect accountability on governmental issues but also in aspects concerning to their daily lives. Therefore, city government should consider that to achieve a greater transparency, an increment of citizen participation is also needed. For this reason, the solution is to carry out sensitization campaigns and a political culture change that encourages digital communication networks.

Spanish governments are interested in following this new reality. Thus, since 2011, large Spanish cities have begun to share information and experiences in order to learn from each other and seek economies of scale. Thus, the aim of this study is to observe whether the Spanish cities that have achieved major accomplishments for Smart Cities are also those whose governments have achieved greater citizen participation through social media such as Facebook or Twitter.

KEYWORD

Smart city, ICT, Social Media, Facebook, Twitter, Local Government

INTRODUCTION

In recent years, urban areas have experienced considerable growth. According to the United Nations (2011), in 1990 less than 40% of the world's population lived in urban areas, but today this figure has risen to over 50%, and is predicted to continue increasing, reaching 70% by 2050.

As a result, urban areas play a vital role on the world stage, as economic centres of attraction, of knowledge sharing, of culture and of talent, shaped by a complex network of individuals, businesses, communications, water, energy, urban services, etc. People and businesses rely on urban management, in all its forms, to provide an effective framework for their activities and for their welfare.

Accordingly, many urban planners are considering how to shape the cities of tomorrow and how they should manage the scarce resources available in order to improve the quality of life for the population of these crowded spaces. In recent years, the concept of 'smart city' has come into vogue, together with expressions such as sustainable city (Camagnia et al., 1998), intelligent city (Jussawallaa et al., 1992), knowledge city (Bontje and Crok, 2006), creative city (Baylissa, 2007), innovative city (Isaksen and Wiig, 2001), ubiquitous city (Lee et al., 2008), digital city (Hongyan et al., 2012) and city 2.0. (Fraoua and Bourret, 2013).

The basic concept emerged two decades ago, regardless of the term used, and many definitions and approaches have been proposed, resulting in a situation that is confusing and vague (Caragliu et al., 2009), according to the areas and environments included. Thus, according to Giffinger and Gudrunace (2010), a smart city is one where information and communication technologies (ICT) are well established and where high priority is given to education and the relation between the city government and the population. IBM (2009) defined a smart city as one that makes use of new technologies to transform its systems in order to optimise the use of finite resources, with respect to areas such as transport, public safety, energy/utilities, healthcare, education and urban development. On the other hand, IDC Spain (2011) described it as a finite, local unit that makes a conscious effort to take a comprehensive approach to the use of ICT for real-time analysis, in order to transform its methods of governance, the essential purpose of which is to improve the quality of life of the city's residents and to ensure sustainable economic development.

In all these definitions, together with energy efficiency and protection of the environment and infrastructure, the main focus seems to be on the role of ICT, i.e., that cities must use new technologies to transform their systems and optimise the use of finite resources, improving economic efficiency and achieving political, social, cultural and urban development.

Many urban areas are carrying out smart city projects, and in recent years there has been a boom in the publication of rankings to classify cities according to their achievements in this respect and to identify those which have achieved the best results. As pointed out by Giffinger and Gudrunace (2010), these rankings guide investors as to the most appropriate cities in which to place their funds and inform urban managers of their cities' strengths and weaknesses, helping them define goals and strategies for future development.

However, the criteria used in compiling these rankings are not always the same, and in many cases the scores published are not comparable. While certain components are generally considered essential to the success of a smart city, others do not achieve this consensus(IDC, Spain 2011, Co.Exist, 2012). Furthermore, the population is a fundamental component of the smart city, since its prime function is to serve its users, and therefore citizens must play an active role and be in communication with the city governors. Although one of the criteria applied in rankings is usually that of government or governance, the indicators applied tend to focus on transparency and e-services, ignoring the use of other instruments of e-government such as social networks.

There can be no doubt that the social media are changing the way in which people access city information. Their application as a means of connection between city government and its population, therefore, is no longer a mere future possibility, but an indisputable fact (Mergel, 2013). This is due to their enormous effectiveness as a tool that enhances the involvement of citizens and other stakeholders, who thus far have had great difficulty in establishing communication links with city governors (Snead, 2013). Although it is still early to determine the ultimate role that will be played by social networking in the functioning of democratic practices, there can be no doubt that it will be of outstanding importance.

We now review the impact made by social media on smart cities, e-government and the information polity, and examine the role played by these new technologies as a means of enhancing democracy. Accordingly, our aim is to analyse whether it is the urban environments that can be considered smart cities that are making the greatest efforts to ensure that citizens have better access to city information, and thus participate to a greater degree in its governance.

SMART CITIES AND THE USE OF SOCIAL NETWORKS

In recent years, the idea of transforming urban areas into smart cities has become widely considered, and initiatives in this respect have been undertaken throughout the world. Such actions require a considerable volume of financial resources and the contributions of diverse sectors of society, including government, institutions, social organisations and the business world.

Although these initiatives vary widely, they tend to focus on three areas: a) advanced services for citizens (mobility, traffic management, parking payment systems); b) key-sector technologies (broadband and communication infrastructures, etc.); c) climate/energy sustainability (solar panels, the implementation of smart metering, the smart electrical grid, etc.) (Moren-Mata, 2012).

In view of these considerations, there is growing interest in quantifying the success of these smart city initiatives, as all involved seek a good ranking in the classification and thus to obtain competitive advantages. To create appropriate scales for this quantification, diverse smart city management models have been developed, with varying dimensions and addressing different areas of activity. For example, the European Commission communication “Smart Cities and Communities - European Innovation Partnership” (2012) selected just three priority areas: energy, transport and ICT. On the other hand, IBM (2009) considered the following components: citizens, businesses, transport, communications, water, energy, city services and other systems.

Different rankings systems do not always consider the same dimensions, as a smart city is in fact a complex, multidimensional "system of systems". Thus, Pan et al. (2011) considered four dimensions to evaluate the "smartness" of a city – Smart Environment, Smart Business, Smart Citizen, Smart Government – while IDC Spain (2011) created a five-dimension model and others such as CoExist.com (2012) and CINTEL (2013) have extended this to six, and Between (2013), up to nine (mobility, government, health, education, alternative mobility, energy efficiency, natural resources, renewable energy, broadband communication .

Furthermore, neither the number of dimensions nor the indicators used to measure any given dimension are the same, which further complicates any comparison of these rankings. Focusing on the question of governance, European Smart Cities-Project (2007) analysed the indicators used and found the following (none of which concerned social media): city representatives per resident; political activity of the inhabitants; importance of politics for the inhabitants; share of female city representatives; municipal spending per capita in purchasing power standards; share of children in day care; satisfaction with the quality of schools; satisfaction with the transparency of bureaucracy; satisfaction with the fight against corruption. Other surveys, such as that by the Committee of Digital and Knowledge-Based Cities (2013) distinguish between e-administration and e-democracy, and inquire whether information is disclosed online and as to the existence of a platform for online participation, although without entering into very much detail. In general, these indexes pay little attention to social communications networks and to the real use made of them by governments and individuals.

The use of social communications tools opens a huge range of possibilities for transformation and modernization of public administration, in contact with the citizen as the relationship between public administrations. The communication between public administration and the citizen is one of the main benefits of implementing social communication tools. Thus, there is a shift towards a more participatory model in which citizens can speak directly to politicians and elected officials. The evolution of Web 1.0 to Web 2.0 has changed the use of basic tools, such as discussion forums and open channels of contact for citizens, by the massive use of blogs as a communication channel between a politician or institution and citizens (Bertot et al., 2012)

In the political context of citizen participation through the social communication tools has been particularly visible in recent years, where the opinions expressed in blogs are becoming increasingly influential and social networking tools have become essential to many politicians.

As the use of these tools has established itself as channel to share information and opinions, citizens are taking a more active role by calling for regulation of different areas to public administration. Moreover, the Administration now has tools that allow you to be in direct contact with different groups before a decision-making process: affected citizens, qualified experts in the field, and so on. Complaints from citizens can collect a new dimension in this new environment. Also evolve mechanisms such as consumer protection because of the increased weight in this new model of communication with consumer groups, by facilitating the exchange of opinions and criticisms.

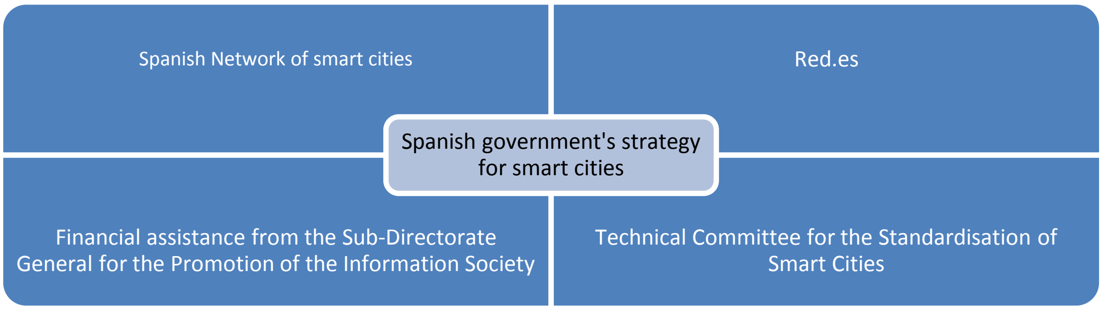
Among the social communication media, the following are some of the best known:

- Blogs: Regularly updated websites that chronologically compile texts or articles by one or more authors, the most recent appearing first, where the author retains the freedom to publish whatever he/she sees fit.
- Media sharing platforms: based on Web 2.0 applications to share, tag and classify information, these platforms not only enable users to share presentations (Slideshare), photos (Flickr), documents (Docstoc) and videos (YouTube), but also allow them to be rated, ordered and discussed with other users.
- Social networks: web sites that offer services and communication features enabling users of the network to keep in touch. Social networking sites typically allow interconnection, so that a user who has one account on Twitter and another on Facebook can connect them; thus, a message posted on Twitter will also appear on Facebook. Regarding types of social network, they include those for general use or for social purposes, such as Facebook or MySpace, and others for professional use, like LinkedIn or XING, and yet others that are more specific, for example Delicious, a management service for social bookmarking (folksonomy) via the web.
- Twitter: a microblogging platform based on 140-character messages; this is not considered a social network, but as a communication tool. Twitter allows users to send small-sized, plain text messages called tweets, which are shown in the user's home page.

PUBLIC POLICIES FOR THE CREATION OF SMART CITIES IN SPAIN

Spain is participating in this movement, and for some years various strategies have been implemented to create smart cities, supported by national public policies, coordinated by the Secretariat of State for Telecommunications and the Information Society (SETSI). The Spanish government's strategy for smart cities rests on four basic pillars (AMETIC, 2012) (see Figure 1).

Figure 1.Spanish government's strategy for smart cities



Source: AMETIC, 2012

The first is the Spanish Network of Smart Cities, which was created in June 2012 and currently has 41 members, and which has signed an agreement with the Spanish Federation of Municipalities and Provinces (FEMP) to work together and to encourage more cities to join the project. These cities are not necessarily the largest, and many have a population of around 150,000. The aim of this network is to define common technical models and services, from a municipal perspective. This approach is intended to make use of synergies among the urban areas where projects have been most fruitful. Accordingly, five working groups have been created: social innovation; energy; environment, infrastructure and urban liveability; urban mobility; government, economics and business.

Second, the Technical Committee for the Standardisation of Smart Cities (CTN/178) was created in December 2012, and in July 2013, this was followed by the publication of the first six technical standards for smart cities.

Third, as implementation of these projects requires financial assistance from the Sub-Directorate General for the Promotion of the Information Society, grants have been made available for R&D for ICT tools for smart cities.

Finally, Red.es, a public company within the Ministry of Industry, Energy and Tourism, is developing two pilot projects in the area of smart cities, in collaboration with the City Councils of Sevilla and Málaga. This Ministry also has a Technological Observatory which monitors the activities of smart cities with respect to energy efficiency, through its "Smart City Technology Roadmap", which publishes information on reference projects on smart grids and energy saving.

These projects are being funded primarily through the Strategic Energy Technology Plan, approved by the European Commission in July 2012, which includes policies to promote smart cities in the EU, and has been endowed with a budget of 365 million euros for 2013. On the other hand, since 2008 investment in ICT (and smart city projects are included in this area) by the Spanish public sector has been reduced by over 60%, and in view of the current deficit limits, it is highly likely that budgets will continue to shrink in the coming years.

Nevertheless, many urban areas in Spain are creating significant, pioneering projects in the area of smart cities, and many are coming to be global benchmarks. This is very notably the case of Málaga, which is working on enhancing energy efficiency through the introduction of electric vehicles and by transforming its distribution network into a smart grid (AMETIC, 2012). Barcelona, too, is active in the field of energy efficiency (Smart+Connected Communities Institute, 2012), while Santander is focusing on services to citizens, security, environmental sustainability and mobility (Sánchez, 2011). The success of these projects has led to Spanish cities such as Barcelona occupying leading positions in international rankings in this respect such as "10 Smart Cities in Europe" and "Top 10 Smart Cities On The Planet" (Coexist.com, 2012).

METHODOLOGY

Study population

Our starting point was the Smart City rankings compiled by IDC (2012), which analyses the 44 largest Spanish cities, and distributes them, depending on the degree of ‘smartness’, into four groups:

1. Top 5 (five highest scores)
2. Contenders (next five highest scores)
3. Players (the next 20, in alphabetical order)
4. Followers (the last 14, in alphabetical order)

The present analysis considered the municipalities that have an official Twitter or Facebook account, thus reducing the study sample to 35 cities (Table 1). The time horizon of the observations was limited to one month -the month of July 2013-, due to the recent incorporation of a Twitter account by some municipalities.

Table 1: IDC 2012 Smart City rankings and number of official Twitter/Facebook accounts

IDC 2012 Group	1	2	3	4	TOTAL
No. of cities in each IDC 2012 group	5	5	20	14	44
No. of cities with official Twitter account	4	5	14	9	32
No. of cities with official Facebook account	4	4	12	9	29
No. of cities with official Twitter or Facebook account	4	5	15	11	35

Research methodology

This analysis of the use made of social networks, as an integral part of democratisation, is divided into two phases: first, a descriptive study was made of the cities' use of their social networks; we then examined, by multiple linear regression analysis, whether the urban areas classed as smart cities are those that make more or less use or application of social networks.

To analyse smart cities' use of social networks, we examined the official website in each case, to determine the total number of social networks featured. Each network was assigned an item number, as follows, according to the links provided: 1. YouTube channel 2. Twitter account; 3. Facebook; 4. Official blog; 5. Flickr page; 6. Ivoox; 7. Tuenty; 8. FriendFeed; 9. LinkedIn; 10. Delicious; 11. Slice; 12. Formspring; 13. Flick; 14. Instagram; 15. Google+; 16. Customizable; 17. Throwplie; 18. Reddit; 19. Stumbleupon; 20. Blogger. The items are rated dichotomously – if the item is available it is scored 1, otherwise, 0.

After determining the number of social networks available to each smart city, we examined their use of the most popular social networks in Spain, namely Facebook and Twitter. This was measured by reference to diverse items on the basis of the social metrics used by Augure (2013) for relations with the media. For Twitter, the following items were verified: average number of tweets; average number of followers; average number being followed; average number of tweets retweeted by individuals; average number of lists; total number of members following the lists; average number of tweets retweeted by the city; average number of comments or questions made by individuals; average number of comments or questions answered by the city; average response time and number of days since joining. For Facebook, the following items were verified: number of posts per day; number of followers; number of times per day that city posts are shared by individuals; average number of likes for city posts per day; average number of comments by individuals, per day; average number of comments answered by the city per day; average response time; number of days since joining.

The second phase of the analysis was the explanatory part. To analyse the effect of the degree of a city's smartness on its level of Facebook and Twitter use, we must quantify the frequency and manner of use of these social networks. Therefore, we calculated a Social Networks Ratio (SNR) from the metrics offered by the various social networks and from the generic structural indicators reported by Augure (2013). The indicators comprising the SNR were the size, activity, visibility and interaction of the community.

- Size: the communicative effort made by the city in its social networking accounts and blogs;
- Activity: the estimated audience for each of the channels (number of fans, followers, etc.);
- Visibility: the total number of mentions of the city, in the different channels;
- Interaction: the real impacts of the city's online communications through viralization (file sharing, retweets, etc.).

These indicators are weighted and distributed as shown in Table 2. Given the importance of each of the four indicators, as well as being considered dependent variables within the SNR, each one was also analysed separately.

Table 2: Indicators of social network use

INDICADORES	TWITTER		FACEBOOK	
	Ítem	**%**	**Ítem**	**%**
A. Activity (ACT)	1. Average number of tweets	0,50	2. Number of posts per day	0,50
B. Size (SIZ)	1. Average number of followers	0,50	2. Number of followers	0,50
C. Visibility (VISI)	1. Average number of tweets retweeted by individuals	0,40	2. Number of times per day that city posts are shared by individuals	0,35
	3. Average number of lists	0,05	4. Average number of likes for city posts per day	0,15
	5. Total number of members following the lists	0,05		
D. Interaction (INTER)	1. Average number of tweets retweeted by the city	0,20	2. Average number of comments by individuals, per day	0,20
	3. Average number of comments or questions made by individuals	0,125	4. Average number of comments answered by the city per day	0,20
	5. Average number of comments or questions answered by the city	0,125	6. Average response time	0,10
	7. Average response time	0,05		

Source: Own Elaboration

After defining the dependent variables, according to the importance of smart cities' use of social networks in order to promote citizens' participation (Enerlis et al., 2012), the independent variable was taken as the different levels of smartness listed in the IDC classification (2012). In addition, the control variables were taken as the length of time during which social networks have been used by the city, and its location. The units of measurement and the expected relationships with the dependent variables are summarised in Table 3.

Table 3. Explanatory factors

FACTOR	MEASUREMENT UNIT	EXPECTED RELATION
Level of smartness (SMCITIES)	-IDC classification, in 4 levels, from 1 highest to 4 lowest	Negative
Duration of involvement in social networks (DUR)	- Average number of days since joining Twitter/Facebook	Positive/Negative
Location (LOC)	**-** According to the regional GDP (in € million)	Positive

Source: Own Elaboration

RESULTS

Analysis of the number of social networks used by the cities in our sample (Table 4) showed that the smart cities in the Top 5 of the IDC 2012 classification use the highest number of social networks. However, the dispersion of the data for Group 1 is the greatest of all four groups, which indicates that there are large differences among these five cities. Thus, while the Top 5 city that uses most social networks is present in 15 of these, the one that uses fewest is present in only two.

Table 4: Number of social networks used by the smart cities

IDC 2012 Group		1	2	3	4
No. of cities		5	5	20	14
No of Social Network	Mean	6,20	6	3,55	2,71
	Standard deviation	4,62	1,41	1,80	1,53
	Coefficient of Variation	0,74	0,23	0,50	0,56
	Median	5	6	3,50	2,50
	Max value	15	8	6	6
	Min value	2	4	1	0

Table 5 shows that Twitter is the social media most frequently used in our sample (32 cities), followed by Facebook (29). With respect to the use made of these platforms, it is interesting to analyse the level of activity and its significance, i.e., whether the actions taken within social networks generate a response or are of importance to the local population.

For Twitter, the average number of daily tweets by the smart cities in the top two groups is almost double that of the bottom two groups (8.63 and 8.24 daily tweets, compared to 5.18 and 4.71). However, the average number of retweets by individuals does not fit this pattern, with the ‘Contenders’ having fewer retweets than the ‘Players’ and the ‘Followers’. Regarding the smart cities’ responsiveness on Twitter, it is interesting to note, first, that the Top 5 cities receive fewest comments or questions from citizens and, secondly, that although there are no major differences between the four groups in terms of the average number of responses by the city, the response times are shorter in the Top 5 cities.

Table 5: Basic descriptors of social networks

IDC 2012 Group			**1**	**2**	**3**	**4**
No. of cities			5	5	20	14
Twitter	No. of cities with official Twitter		4	5	14	9
	1. Average number of tweets	Mean	8,63	8,24	5,18	4,71
		Standard deviation	8,22	5,86	7,94	3,73
		Coefficient of Variation	0,95	0,71	1,53	0,79
		Median	6,43	7,73	3,20	4,60
		Max value	20,20	17,40	31,66	13,20
		Min value	1,46	1	0,13	1,06
	2. Average number of followers	Mean	25.942,25	7.000,80	4.432,78	2.774,55
		Standard deviation	25.811,57	4.979,83	4.465,53	1.354,03
		Coefficient of Variation	0,99	0,71	1,00	0,48
		Median	20.811	6.504	4.058	2.850
		Max value	61.832	12.265	17.191	5.069
		Min value	315	1.112	134	1.134
	3. Average number being followed	Mean	3.050,25	694	681,85	516,33
		Standard deviation	4.002,95	932,74	1.182,93	462,29
		Coefficient of Variation	1,31	1,34	1,73	0,89
		Median	1.878,50	501	190,50	383
		Max value	8.443	2.316	3.700	1.454
		Min value	1	38	0	24
	4. Average number of tweets retweeted by individuals	Mean	203,35	8,50	12,66	15,72
		Standard deviation	266,86	8,79	26,27	19,11
		Coefficient of Variation	1,31	1,03	2,07	1,219
		Median	125,23	3,93	5,83	6,80
		Max value	562,86	22,13	102	49,33
		Min value	0,06	1,13	0,20	1,66
	5. Average number of lists	Mean	2,5	3,4	2,35	1,33
		Standard deviation	3,78	3,50	5,61	4
		Coefficient of Variation	1,51	1,03	2,38	3
		Median	1	3	0	0
		Max value	8	7	21	12
		Min value	0	0	0	0
	6. Total number of members following the lists	Mean	90	35,20	53,50	24,66
		Standard deviation	144,51	51,58	129,07	74
		Coefficient of Variation	1,60	1,46	2,41	3
		Median	28,50	0	0	0
		Max value	303	114	453	222
		Min value	0	0	0	0
	7. Average number of tweets retweeted by the city	Mean	6	0,52	0,26	1,14
		Standard deviation	9,63	0,62	0,36	1,42
		Coefficient of Variation	1,60	1,20	1,37	1,25
		Median	1,90	0,20	0,06	0,40
		Max value	20,20	1,26	1,26	4,06
		Min value	0	0	0	0,06

	8. Average number of comments or questions made by individuals	Mean	0,06	0,28	0,19	0,28
		Standard deviation	0,12	0,21	0,43	0,27
		Coefficient of Variation	2	0,76	2,22	0,96
		Median	0	0,33	0,06	0,26
		Max value	0,25	0,53	1,66	0,80
		Min value	0	0	0	0
	9. Average number of comments or questions answered by the city	Mean	0,26	0,28	0,19	0,28
		Standard deviation	0,53	0,21	0,43	0,27
		Coefficient of Variation	2	0,76	2,22	0,96
		Median	0	0,33	0,06	0,26
		Max value	1,06	0,53	1,66	0,80
		Min value	0	0	0	0
	10. Average response time	Mean	0,17	1,42	1,16	2,48
		Standard deviation	0,34	1,43	1,71	2,54
		Coefficient of Variation	2	1,00	1,47	1,02
		Median	0	1,20	0,33	1,70
		Max value	0,68	3,83	6	7,67
		Min value	0	0	0	0
	11. Number of days since joining	Mean	311,25	495,80	657,21	479,77
		Standard deviation	351,84	282,48	388,59	257,58
		Coefficient of Variation	1,13	0,56	0,59	0,53
		Median	196	416	592	514
		Max value	822	984	1.288	828
		Min value	31	250	105	128

Source: Own elaboration

On examining the items corresponding to the use of Facebook and the impact generated, the results are similar to those obtained for Twitter (see Table 6). Thus, the Top 5 cities have a greater number of daily posts and make a greater impact, measured by the number of times that people share these posts and the number of "likes" they are awarded. In contrast, the Contenders score worse than the Players and the Followers. In relation to the comments received and answered by the city council, the data differ from those for Twitter; in this case, the Top 5 receive most comments but are not most responsive, and their response times are higher than those of the Players and the Followers.

To complete the descriptive analysis, we discuss the items measuring how long the cities have been engaged in social networks. We found that in all the groups the use of Twitter is much more recent than that of Facebook (Table 6). Moreover, at least at the descriptive level, there does not appear to be a direct relationship between the history of such involvement and the level of use, for the items examined. It is important to note that although this is not reflected in Table 6, which only provides the mean data, an individual analysis of each city shows that some, despite having joined social networks only recently, have a high volume of activity and are followed by a large number of people. By contrast, other cities have an official Twitter page and have been members of Facebook for several years but rarely make use of these networks.

Table 6: Basic descriptors of social networks: Facebook

Facebook	Nº ciudades con cuenta oficial en Facebook		4	4	12	9
	1. Number of posts per day	Mean	3,65	1,80	2,23	3,31
		Standard deviation	2,21	0,99	1,51	2,551
		Coefficient of Variation	0,60	0,55	0,68	0,76
		Median	4,10	1,80	1,80	2,06
		Max value	6,26	3	4,60	7,60
		Min value	0,13	0,60	0,46	0,53
	2. Number of followers	Mean	11.341,50	2.591	4.331,16	3.042,66
		Standard deviation	16.439,17	1.428,74	4.735,97	3.651,04
		Coefficient of Variation	1,44	0,55	1,09	1,19
		Median	2.714,50	2.000	2.790,50	2.041
		Max value	39.671	5.021	17.157	13.139
		Min value	266	1.343	155	456
	3. Number of times per day that city posts are shared by individuals	Mean	20,11	3,28	15,07	7,36
		Standard deviation	20,38	3,33	26,78	8,69
		Coefficient of Variation	1,01	1,01	1,77	1,18
		Median	17,40	2,13	2,50	4,60
		Max value	45,60	8,80	83,53	30,33
		Min value	0,06	0,06	0,06	0,73
	4. Average number of likes for city posts per day	Mean	101,16	5,31	37,78	30,05
		Standard deviation	136,33	4,59	62,03	34,61
		Coefficient of Variation	1,34	0,86	1,64	1,15
		Median	35,63	4,83	17,13	13,53
		Max value	332,46	11,26	223,46	110,06
		Min value	0,93	0,33	0,13	3,26
	5. Average number of comments by individuals, per day	Mean	1,71	0,21	0,77	0,71
		Standard deviation	1,85	0,09	0,82	0,65
		Coefficient of Variation	1,07	0,45	1,07	0,91
		Median	1,03	0,23	0,43	0,53
		Max value	4,73	0,33	2,60	2,33
		Min value	0,06	0,06	0	0
	6. Average number of comments answered by the city per day	Mean	0,05	0	0,07	0,03
		Standard deviation	0,05	0	0,16	0,04
		Coefficient of Variation	1,10	0	2,12	1,23
		Median	0,03	0	0	0
		Max value	0,13	0	0,53	0,13
		Min value	0	0	0	0
	7. Average response time	Mean	21,20	0	3,57	3,16
		Standard deviation	29,79	0	8,05	6,12
		Coefficient of Variation	1,40	0	2,25	1,93
		Median	6,40	0	0	0
		Max value	72	0	24,30	18
		Min value	0	0	0	0
	8. Number of days since joining	Mean	874,50	1.224,25	758,83	837,55
		Standard deviation	240,26	190,69	372,08	446,58
		Coefficient of Variation	0,27	0,15	0,49	0,53
		Median	888,50	1.211	683	770
		Max value	1.164	1.466	1.590	1.650
		Min value	557	1.009	257	186

Source: Own elaboration

In the second phase of the study, we consider the influence of certain independent variables on the level of use of social networks. To do so, we used multiple regression analysis and, assuming that the variables studied present linear relations, applied the statistical technique of Multiple Linear Regression.

After testing the initial hypotheses of the model (linearity, homoscedasticity, normality, independence and non-collinearity), we analysed the relationship between the dependent and independent variables. From the correlation matrix (Table 7), it is apparent that there are no large, significant correlations, whether between any of the independent variables or between the dependent and the independent variables, which indicates that the fit of the models will not be very good. The only strong correlations are between the dependent variables; this makes sense because, on the one hand, the SNR ratio encompasses the four indicators of activity, size, visibility and interaction and, on the other hand, these indicators are constructed from items that are representative of the use and scope of the social networks. Thus, it is normal and foreseeable to find relationships between them.

Table 7: Pearson Correlation Matrix

	SNR	**ACT**	**SIZ**	**VISI**	**INTER**	**SMCITIES**	**TIME**	**LOC**
SNR	1							
ACT	0,7208***	1						
SIZ	0,8701***	0,3970	1					
VISI	0,9078***	0,4484***	0,8193***	1				
INTER	0,9047***	0,6250***	0,6878***	0,8253***	1			
SMCITIES	-0,2723	-0,1174	-0,4201**	-0,2112	-0,1197	1		
TIME	0,0076	-0,1656	0,0417	0,1891	-0,0520	0,0006	1	
LOC	0,3590	0,4274**	0,2783	0,2164	0,2919	0,1259	-0,1333	1

*. Correlation is significant at the 0,10 level (2-tailed). **. Correlation is significant at the 0,05 level (2-tailed). ***. Correlation is significant at the 0,01 level (2-tailed).

Table 8 shows the regression results obtained. The corrected R^2 value shows that the fit of the SNR model, which includes the four indicators, is better than that of the models for each indicator separately. As for the significance of the variables, the analysis shows that the degree of smartness according to the IDC classification is inversely related with the SNR ratio, which was used to quantify the frequency and manner of use of social networks. Moreover, this relationship is also negative and statistically significant according to the specific regression analysis carried out for the indicators of size and visibility of the social networks.

Although this relationship between the degree of smartness and the SNR ratio is an inverse one, this was expected, since in the IDC classification the Group 1 cities are those assigned the highest level of smartness, and the Group 4 ones, the lowest. Therefore, as this variable decreases, and a city is considered smarter, the frequency of use and the impact of social networks will increase.

The location variable, measured by the GDP of the autonomous region in which the city is located, is positively related with the SNR ratio, which means that smart cities located in regions with a high GDP will tend to have higher levels of use of social networks. This variable is also statistically significant in the specific models designed for the indicators of activity, size and interaction of the social networks.

Although the variable reflecting the duration of involvement in social networks is not statistically significant, in some models it presents a positive sign and in one, a negative sign. Therefore, the explanatory analysis confirms the difficulty, indicated in the descriptive analysis, of establishing the sign of relationship between this duration and the use of social networks.

Table 8: Results of the regression analysis

	RURS	ACT	SIZ	VISI	INTER
R^2	0,5350	0,3239	0,2956	0,3549	0,2102
R^2 corrected	0,4610	0,2487	0,2275	0,2731	0,1941
SMCITIES	-0,2120**	-0,1381	-0,4239***	-0,1902**	-0,09579
TIME	0,0543	-0,1153	0,1078	0,2333	-0,0085
LOC	3,74e-06**	4,88e-06**	4,45e-06**	3,00e-06	2,62e-06*

*. Correlation is significant at the 0,10 level (2-tailed). **. Correlation is significant at the 0,05 level (2-tailed). ***. Correlation is significant at the 0,01 level (2-tailed).

CONCLUSIONS

In recent years, many towns and cities around the world have reflected on the future of the urban environment and on how they should manage the scarce resources available in order to improve the quality of life of their populations. There is an increasing awareness that to be competitive, the government, the business world and the population of the cities of the future will need stronger technological capabilities; they must be entrepreneurial and innovative, creative, well informed, integrated, transparent, participatory, sustainable and socially cohesive. Accordingly, many local authorities are pursuing projects in this respect in order to be considered "Smart Cities".

To measure the achievements made and to determine which cities have achieved the best results, many rankings have been published, most of which include e-participation among the areas considered strategic. However, these indices tend to pay little attention to social communications and of the use made of them by governments and by individuals.

In Spain, the IDC (2012) index, which ranks the largest Spanish cities in terms of their progress toward Smart City status, has paid equally little attention to social communication tools, and so an analysis of this strategic element would be very useful.

Examination of the Smart City rankings and the use of social networks shows that the Spanish cities that have achieved a Top 5 classification are those that make most use of social networks. However, this analysis also reveals a high degree of dispersion, with social media being used less by cities presenting a lower degree of smartness. Twitter and Facebook are the most commonly used media.

According to IDC (2012), a very similar use is made of these two social networks by each of the smart city groups, and a notable finding is that the cities making most daily postings do not always receive most comments and questions, and so the Top 5 cities do not score best in this respect. Neither are the response times for this group any better than those for the other cities.

The explanatory analysis shows that the IDC smart city ranking is related to the level of use of Facebook and Twitter, according to the parameters size, activity, visibility and interaction. Thus, with greater smartness, cities tend to make more frequent use of social networks and achieve greater impact. Furthermore, the geographic location of the city is significant with respect to the indicators of the activity, size and interaction of social networks.

Although, in general terms, the ‘smartest’ smart cities are those which obtain the best overall results in terms of social networks, further improvements are needed, especially in the field of activity and interaction with citizens via these networks.

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