Recent smart city trends: empowered citizens on the rise

Tailored public services to increase resource efficiency

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80 percent of the population currently lives in cities. Population growth and aging, climate change and pollution—all these are the de facto trending topics in our current societies and all of them contribute to the pressure on public resources availability[1]. Faced with the challenge of maintaining citizens' quality of life and living, the smarter move for governments was to combine and use the increasing availability of data and advances in research on the technology of things, and this way optimize the delivery of services. How is it called? Smart city. What is the goal? To tailor public services to increase resource efficiency.

"Smart city" is a broad concept for urban development strategies involving multiple policy areas, cross-sectorial business fields, and collaboration between different agents. Due to its very broad nature, it has been repeatedly stigmatized as a "buzzword": that is, of little meaning. But a lack of a clear definition does not always imply a lack of history or a lack of consistency. In fact, "smart city" has always been linked to an all-encompassing approach to coordinate the multiple dimensions of a city with the help of technology: from households and buildings, to infrastructure and transportation, and including all social service areas. However, the concept has evolved too. And at each stage, it has learnt from its weakness to shift towards an ever better and stronger "smart city". Join us on this journey: 1.0, 2.0, 3.0, ready?

The shift from the "I want it all" to the "I want it now" approach

Initially, "Smart city" was linked to projects like Planet IT in Portugal, Songdo in South Korea or Masdar in the United Arab Emirates. It entailed the construction of cities from scratch: high-tech newly built urban spaces invaded by data monitoring devices aiming at total sustainability with zero emissions and 100 percent green energy sources. However, these projects require massive amounts of investment: in periods of economic destabilization and declining growth rates, governments cannot maintain the same financial flow. Therefore, these projects—estimated at a cost of between €23.5 and €47 billion each[2]—saw their pace of deployment slow[3]. Haydee Sheombar, Smarter Cities business leader expert, framed it well: the smart cities strategy should emphasize less expensive but "quick-win solutions" that suit the city[4]. The approach had to shift.

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1 These, among others, are the areas in which the "Horizon 2020" strategy focuses. This is a EU program that will deploy €80 billion on research and innovation within a 7-year timeframe (2014-2020). It gives special attention to ICT programs, and the interest in developing Smart City under the framework of the Digital Agenda. European Commission (2014), "EU Research and Innovation: Tackling Societal Challenges". The EU Framework Programme for Research and Innovation horizon 2020. Available at: https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/InfoKit_UK_240214_Final.pdf

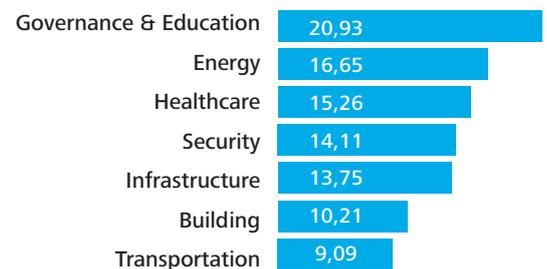2 Sassen, Saskia (December, 2012), "Urbanising technology". LSE Cities. Available at: https://lsecities.net/media/objects/articles/urbanising-technology/en-gb/

3 Turcu et al. (March, 2015). The impact of the global financial and economic crisis on European cities. UCL. Public Policy Briefings. Available at: https://www.ucl.ac.uk/public-policy/public-policy-briefings/Crisis_briefing

4 Quoted in Smart Cities in Europe, "The role of ICT", by Boyd Cohen. Post. Accessed August 2015. Available at: http://www.smartcitiesineurope.com/2011/11/the-role-of-ict/

In his article of August 2015, the urban and climate strategist Boyd Cohen highlighted the characteristics of this second connotation for smart cities, which he calls version "2.0"[5]. In contrast to the previous generation, the new strategy consisted in the partnership between city councils and big technology corporations, together with the engineering sector and assistance of business consultants, to apply ICT innovations to the already existing city infrastructures[6]. The cities and all their items were to be equipped with adequate and accessible gadgets and sensors. Smart cities 2.0 immediately caught the attention of data and technology enthusiasts, and research and academic centers, which in recent years have increasingly generated greater activity surrounding this topic[7]. In addition, this version 2.0 has received the support of the main financial actors[8]. For instance, the EU initiative in smart cities foresees a total investment of €3 trillion by the end of 2020[9]. Frost & Sullivan (hereafter as F&S) estimates a market opportunity worth US$1.5 trillion by the same year.

In the same report, F&S distinguished the main strategic sectors in which this market will expand: governance and education, energy and healthcare sectors, security and infrastructure, and building and transportation. As the graph shows, the fields that will see the most growth in the period between 2012 and 2020 are smart governance and education (21 percent each on compound annual growth rate, CAGR). These sectors are closely followed by the smart energy and healthcare sectors, accumulating 15 percent and 16 percent CAGR respectively. Security is expected to grow by 14

percent on the total market share by 2020, as is smart infrastructure. The CAGRs for smart building and smart transportation are estimated at 10 percent and 9 percent respectively[10]. Smart cities 2.0 make use of the fruitful and rich development of the internet of things (hereafter, IoT) and its more than one million possibilities[11]. IoT is of major importance for achieving successful deployment of such projects, according to experts[12]. IoT Evolution Magazine indicated that the "connected house" is "the face of the IoT"[13]. All items and devices sending data from households can be infinite and so this calls for the design of smart living solutions. In fact, Gartner estimates that by 2017, the number of connected things used in smart homes might surpass 1 billion units[14]. Examples of this are the switch towards smart metering: the European Commission has already stated its goal of replacing electricity meters by its smarter version in at least 80 percent of households in each EU Member State by 2020[15]. However, it is this constant data gathering that is indeed giving rise to most criticism.

Sector	Value
Governance & Education	20,93
Energy	16,65
Healthcare	15,26
Security	14,11
Infrastructure	13,75
Building	10,21
Transportation	9,09

5 Cohen, Boyd (August, 2015), "The 3 generations of smart cities". Fast Company. Available at: http://www.fastcoexist.com/3047795/the-3-generations-of-smart-cities

6 Paroutis, S., Bennett, M., and Heracleous, L. (2014). A strategic view on smart city technology: The case of IBM Smarter Cities during a recession. Technological Forecasting and Social Change, 89, 262-272

7   Suitable evidence is the growth in Smart City research institutes or specialized departments in the main European universities, which have multiplied over the past years. Multiple market agents can be identified through the projects presented in EU Smart Cities. From the 370 commitments being developed across the EU, in data for 2014 and among the stakeholders, 36 percent are public authorities; 26 percent Businesses; 16 percent research/academic centres; 6 percent NGOs; 2 percent private individuals; and a remaining 16 percent "other". European Innovation Partnership, "Invitation for Commitments". Smart Cities & Communities. Infographic. Available at: http://ec.europa.eu/eip/smartcities/files/eip-ifc-infographic.pdf

8 EIB, June 2014, "EIB launches first smart city investment scheme in Europe: Belgian towns to benefit from EUR 400m EIB-Belfius scheme". Retrieved July 2015 from: http://www.eib.org/infocentre/press/releases/all/2014/2014-124-premiere-europeenne-la-bei-et-belfius-debloquent-400-millions-pour-developper-des-villes-et-communes-intelligentes-et-durables-en-belgique.htm?lang=-en

9 Suitable evidence is the growth in Smart City research institutes or specialized departments in the main European universities, which have multiplied over the past years. Multiple market agents can be identified through the projects presented in EU Smart Cities, accessed August 2015. Available at: https://eu-smartcities.eu/eu-projects?search_term=&title=&field_countries_value=All&field_event_city=All&items_per_page=All

10 Frost and Sullivan, "Global Smart City Market". Presentation of the key results of the report. Available at: http://www.frost.com/prod/servlet/analyst-briefing-detail.pag?mode=open&sid=280678953

11 Literally, the Gartner Consultancy estimated in 1 million in 2015, 1.7 million in 2016 and up to 2.6 million in 2017 the number of connected things in Smart Cities. BBVA Centro de innovación (24 April 2015), "Smart Cities" will have more than one million things connected this year. Retrieved July 2015 from: http://www.centrodeinnovacionbbva.com/en/news/smart-cities-will-have-more-one-million-things-connected-year#sthash.WE2zEP6Z.dpuf

12 Zanella, A., Bui, N., Castellani, A., Vangelista, L., & Zorzi, M. (2014). Internet of things for smart cities. Internet of Things Journal, IEEE, 1(1), 22-32. Available at: http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=6740844

13 IoT Evolution (August 2015), "Where We Live: The Connected Home is the Face of the IoT". IOT Evolution Magazine. Available at: http://www.iotevolutionmagazine.com/features/articles/408102-where-we-live-connected-home-the-face-the.htm/

14 Gartner (March, 2015), "Gartner Says Smart Cities Will Use 1.1 Billion Connected Things in 2015". Newsroom. Available at: http://www.gartner.com/newsroom/id/3008917

15 Smart meters are electricity meters which allow to collect electricity usage and related information in a detailed and real-time basis. For more information on this program, see EU Commission, "Smart grids and meters". Available at: https://ec.europa.eu/energy/en/topics/markets-and-consumers/smart-grids-and-meters

Not all a bed of roses: technocracy and surveillance

Whereas the strengths of smart cities 2.0 might bring efficiency to city management and planning, some critical voices highlight the threats of this hyper-connected world. Rob Kitchin, investigator on The Programmable City project at the National Institute for Regional and Spatial Analysis, Ireland, mentions five major shortcomings of smart cities 2.0: the politics of big urban data, technocratic governance and city development, corporatization of city governance and technological lock-ins, hackable cities, and the "panoptic" city.

On the politics of big urban data, The Guardian published an article declaring "The truth about smart cities: "In the end, they will destroy democracy", in a citation of Leo Hollis, author of "Cities are good for you". Hollis criticizes constant data gathering and surveillance[16]. The fear is that citizenry would not need to express preferences, as data trends would automatically show and define the best possible policy to deploy. This reproach is linked to the potential for technocratic governance. The data to be analyzed and processed is targeting the provision of "real-time solutions"[17]. The danger is to bypass government representatives to have data analysts.

Less pessimistic views, but nonetheless critical, indicate that governments are lagging behind on two main aspects necessary to properly benefit from smart city projects: firstly, public agents are receiving the input of a new tool, whilst maintaining a traditional structure and old patterns and dynamics. Secondly, urban leaders would actually lack the required skilled staff to make the most of these technologies. Without a properly updated organization or a well-prepared workforce, the results of smart city initiatives might fall short of their actual potential[18].

Focus: Smart City projects in Europe

The EU, with the Innovation Partnership on Smart Cities and Communities initiative, has deployed smart city projects through six main action clusters: citizen focus, integrated infrastructures and processes; policy and regulations; integrated planning; sustainable districts and built environment, and sustainable urban mobility. Here are some examples:

Growsmater
Stockholm, Cologne and Barcelona
Renewal of the building stock to create low-energy districts, deployment of smart waste handling, integrated structures for ICT.

Remourban
Eskisehir, Nottingham and Valladolid
The Regeneration Model for accelerating the smart URBAN transformation focuses on the improvement and renovation of the city's existing infrastructures and buildings.

Triangulum
Eindhoven, Manchester, Stavanger
Different strategies to achieve the main goals of the program: "reduced energy consumption of buildings, increased use of renewable energies, increased utilisation of electric vehicles, deployment of intelligent energy management technology and deployment of an ICT data hub".

Pitagoras
Graz and Bilbao
The very name is indicative of its goals: sustainable urban planning with innovative and low energy thermal and power generation from residual and renewable sources. The focus of this project is to develop models for low energy city districts.
Source: EU Smart Cities

16 Poole, Steven (17 December 2014), "The truth about smart cities: "In the end, they will destroy democracy'". The Guardian. Available at: http://www.theguardian.com/cities/2014/dec/17/truth-smart-city-destroy-democracy-urban-thinkers-buzzphrase

17 As an example, one might refer to the example of CityPulse, being deployed with the support of the EC under the Digital Agenda Framework. A summary of the project can be found in "Real-Time IoT Stream Processing and Large-scale Data Analytics for Smart City Applications", retrieved from: http://cordis.europa.eu/fp7/ict/future-networks/documents/smart-cities-projects/citypulse.pdf

18 Meijer, A., and Bolívar, M. P. R. (2015). Governing the smart city: a review of the literature on smart urban governance. International Review of Administrative Sciences

And added to this criticism, is the emphasis on energy policy in the EU. Some experts maintain that prior to any "smart" solution being implemented, green energy projects have to be robustly deployed across the board[19,20].

Anthony Townsend extensively discusses the topic of hackable cities in his book "Smart Cities: Big data, civic hackers and the quest for a new utopia". In an interview with City Lab, the author anecdotally commented on problems with data privacy when discussing data privacy and hacking: "it's not hard to imagine scenarios in local government where somebody's brother gets access to something that they're not supposed to have access to"[21]. All these assessments highlighted the need to involve citizens in public decision-making. With this, the next (and current) stage of "smart cities" emerged: smart city 3.0. The position paper from Eurocities on smart cities summarizes its main characteristics: "There are no one-size-fits-all solutions: becoming smarter will mean different things to different cities. Most of all, it is crucial to involve people in the process: there can be no smart city without smart citizens"[22]. And definitely, smart cities 3.0 entail these two aspects: citizens have to join the bandwagon, but the solutions also have to fit the character of the city. Smart city projects must be personalized.

Overcoming the critiques by deploying a people-centered approach

"Smart cities 3.0", "Human smart cities"[23], "Sharing smart cities": there could be a million ways to frame the same idea, which is this empowerment of citizens under the form of ICT applications, revolutionizing the way in which we interact with our cities. To summarize this new strategy, important concepts are those of grassroots innovations; modular and cheaper solutions; crowdsourcing and crowdfunding; collaborative economy, and collective intelligence[24]. Version 3.0 is not a rejection of its peer 2.0: it is complementary to it, an add-on. The ultimate aim is to combine both, in order to gain from their different strengths and complement each other's weaknesses. But what does 3.0 bring to the previous version?

One of the main changes is the emergence of new forms of governance. Urban leaders consult civil society at different points of the decision-making process. For instance, some applications enable discussion and debate on policy and public projects between city councils and citizens. Examples of this are the "Madame Mayor, I have an idea" in Paris, which enables citizens to vote on their preferred projects; or "FixMyStreet!" in the UK, which enables citizens to report street damage to public officials by sending pictures and a location from their smartphone. There are also changes in terms of funding, as the initiation of new projects depends on the availability of investment possibilities; crowdfunding offers a potential solution. To avoid projects being blocked because of budgetary constraints, public policies are equivalently funded through money raised by citizens and investment from the public sector. In Rotterdam, for instance, at the initiative of citizens, the government and the "crowd" both assumed the cost of the Luchtsingel wooden footbridge. Additionally, there is the emphasis on training society in digital and technological skills. As regards education, there are interesting ICT apps being tested. In Barcelona, the "History Map" app aims to encourage students to become developers through constructing maps of historical routes[25].

19 Ferrara, R. (2015). The Smart City and the Green Economy in Europe: A Critical Approach. Energies, 8(6), 4724-4734.

20 However, and in light of the EU investment under the Digital Agenda framework, the flow is going in the right direction: the majority of funded projects are on the energy sector for energy efficiency. EC Digital Agenda, "EU Investments". Retrieved from: https://ec.europa.eu/digital-agenda/en/node/72869

21 Sommer, Mathis (January, 2013), "Rise and fall and eventual rise again of Smart Cities. City Lab. Accessed August 2015. Retrieved from: http://www.citylab.com/tech/2014/01/rise-and-fall-and-eventual-rise-again-smart-city/8081/

22 Eurocities (2015), "Ever smarter cities: Delivering sustainable urban solutions and quality of life for Europe". Position Paper. Available at: http://nws.eurocities.eu/MediaShell/media/EUROCITIES percent20stmt_smarter percent20cities_May percent202015_FINAL.pdf

23 Planum (2014), "The Human Smart Cities Cookbook". Journal of Urbanism, I/2014. Special Issue. Available at: http://humansmartcities.eu/wp-content/uploads/2014/06/The_Human_Smart_Cities_Cookbook_by_Planum_no.28_vol_I2014_low.pdf

24 This statement and the following paragraph with Smart City 3.0 project examples are based on the report by Sounders, T. and Baeck, P. (2015), "Rethinking smart cities from the ground up". Nesta. Available at:

25 Smart city Barcelona website. Retrieved from: http://smartcity.bcn.cat/en/mschools.html

The combination of versions 2.0 and 3.0 is also linked to the type of the data to be gathered: on the one side, data obtained through sensors as seen in smart cities 2.0. But as a complement, crowdsourced data from easy downloadable applications. As smartphones and wearable technologies grow in popularity, the lower the cost of data gathering and the greater its accuracy. Examples of this are personal sensors for air quality control, noise levels, weather, or the daily commute to work to complement traffic management projects[26], together with the above-cited examples.

Ultimately, however, it continues to be a matter of data analytics: the need for certain professional profiles among public and private agents and the spread of digital skills across all segments of civil society. Recently, in this direction, Deloitte presented best practices on big data management in smart cities. According to the report, a solution could consist in "establishing an operations center [in which] city managers are able to access data in real-time streams and city operators are able to form dynamic communities of interest around incidents"[27].

By now, these aspects seem to be the main shortcomings of this new wave of smart cities: not the generation of data, but its analysis and conversion into efficient and tailored solutions that meet citizens' needs.

Conclusion: is third time always a charm?

Smart cities are a constant data flow. However, we have learnt that data gathering is not the problem, rather its digestion is the challenge. While technology is crucial, it has a use-it-or-lose-it dimension and requires well-spread digital and analytical skills among the agents delivering the change. We need indeed fully prepared and properly trained professionals to ensure that the information is effectively managed, because the terabytes have to be converted into effective and efficient public policies. Furthermore, data privacy and data transparency are a "must" to ensure both innovations and the proper utilization of the projects being deployed. Data privacy will establish trust, and data transparency will give rise to government control and accountability.

Smart cities 3.0 build on the heritage of version 2.0. The final stage of this concept actively seeks to engage citizens to work in collaboration with private corporations and the public sector to build better cities in which to live. Citizens are not only expected to increase their use of applications to contribute to the decision-making process, but also to be part of the development of such innovative gadgets[28]. Although citizens are already becoming increasingly aware of all the potentials of living in a smart world, they should be fully integrated in the dynamics which are already in place between private and public sectors. If the aim is to design tailored solutions for day-to-day problems, and to work for a sustainable city life unhindered by a scarcity of resources, all members of society need to work collaboratively. Smart cities shall be therefore inherently linked to the efforts of citizens, businesses and governments, and their interconnections through devices, sensors, and applications.

26 Kung, K., Greco, K., Sobolevsky, S., and Ratti, C. (2014). Exploring Universal Patterns in Human Home-Work Commuting from Mobile Phone Data. PLOS One

27 Deloitte (January, 2015), "Smart cities. Big Data". Available at: http://www2.deloitte.com/content/dam/Deloitte/fpc/Documents/services/systemes-din-formation-et-technologie/deloitte_smart-cities-big-data_en_0115.pdf

28 Council, S. C. (2014). Smart Cities Readiness Guide: The Planning Manual for Building Tomorrow's Cities Today. Smart Cities Council, Redmond.