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Smart Urban Design - A Conceptual and Methodological Integration Proposal

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Abstract: Technological breakthroughs have radically changed the way people live. Gathering information has become faster, communication has grown wider and more accessible, and it is now possible to know what is happening in other parts of the world in real time. Additionally, new spatial dimensions of interaction have emerged through virtual communities. Concepts such as hyperconnectivity, Big data, and the Internet of Things have arisen from the sophisticated generation, processing, and exploitation of information. Many nouns have been qualified as "intelligent", including cellphones, televisions, automobiles, governments, houses, territories, and even cities. But how do we design an intelligent city? The development of tools that adapt urban design to this new category of cities and that allow urban decision-making to be taken into account is fundamental. This document aims to contribute to the urban city discussion and propose an adequate design method tailored to its characteristics. A first version of this work was published in the magazine "Legado" from the Autonomous University of the State of Mexico in 2019. Now, an updated version is presented, incorporating all urban planning exercises put into practice during the period 2019 - 2023.

Key words: urban design; smart city; urban data; urban planning; methodology urban

1. Introduction

Diverse initiatives led by the Inter-American Development Bank, the United Nations Organization, national governments, and civil organizations are either actively pursuing or have successfully transformed traditional cities into intelligent urban spaces. This transformation involves creating cities capable of generating data, using it to enhance relationships, solve problems, and improve effectiveness and sustainability.

In smart city, urban space is conceptualized as a network of relationships rather than a purely physical entity. It represents a system of flows established between spaces, between people, and between people and spaces. These interactions generate flows and data. Consequently, urban design focuses on establishing, modifying, or creating relationships that are sustainable, harmonious, and value-generating.

This article describes how to integrate the concept of "intelligent" into urban design, outlines an analysis process and defines actors and instruments as part of this process. The proposal is integrated based on three methodologies, the bases of urban design, the strategy of the Inter-American Development Bank for Smart Cities, and the methodology on Urban Design Centered on People, which is developed at the "Facultad del Hábitat" from Autonomous University of San Luis Potosí.

With the purpose of contributing to the discussion of the smart city, the first section makes a conceptual approach, with

the intention of providing elements that help the understanding of the term; in the second, the methodology is briefly described, and its application is exemplified; in the third, as a form of conclusion, recommendations, and advantages in the implementation of this methodology are described.

2. Why Is a City Smart?

Since the beginning of this century, initiatives to improve the operation, planning or design of the city using knowledge or information and communication technologies have multiplied, some examples are the information city, the cybernetic city, the connected city, the digital city, the knowledge city, the innovative city and now the smart city (Kitchin, 2014).

The diversity of adjectives used to describe cities has prompted specialized literature to develop a deeper understanding of each term. However, the methods for measuring these adjectives and constructing models to generate city types have progressed at a slower pace. In the case of the smart city, foundational references can be found in studies by Hall (2000), Chourabi (2012), Kitchin (2014), and Chiehyeon (2018). The development of measurement frameworks and indices for the smart city has been explored in works by Giffinger (2007) and Chen, Chiang, and Storey (2012). Meanwhile, a more comprehensive methodological approach is provided by the IDB's Emerging and Sustainable Cities Initiative (2016).

Notwithstanding the various advances in the development of the concept, it is necessary to carry out some precisions with the purpose of contributing to the discussion and going deep into the construction of indicators, methods and processes. First, a brief description of the use of data in city management is made, then the delimitation in the concept of smart city is sought, and finally some implications in the design of this type of city are listed.

2.1 From the city to the data

The intensive usage of technology and data has different spatial scales, from the virtual to the physical, from the home to the country, passing through the neighborhood, the sector, the district, the city, the metropolis, or the region; in the case of the city, it is essential for communication between people (Achaerandio, 2011). In the city, an infinite set of data and combinations are generated through protocols, which can be collected and analyzed in real time, to make decisions in a faster and more accurate way and act immediately (Kitchin, 2013).

As a result of the volume, diversity and complexity in the management and use of data, new categories of analysis have been generated such as the digital economy, the right to connectivity, Big data[1] (Kitchin, 2014), and mobility seen as MaaS[2] (Washburn & Sindhu, 2010). The correct usage of massive data supports a better understanding of urban phenomenon , the generation of knowledge and decision-making (Sevillano, 2015).

A government stewardship based on data generated "in real time" allows to enhance governance (2012); an intelligent management, for example, includes integrated systems with the administration, communication for the generation of useful information in the institutions and oriented to the solution of problems (Bélissent, 2010).

Technologies have transformed the dynamics of human behavior, altering how people perform activities and interact within urban spaces. Many activities can now be conducted remotely, shifting traditional paradigms. Now, it is possible to move fewer people rather than moving more people in less time. Technologies could once again challenge the significance of distance and boundaries, as seen with globalization, diminish the physical dimension of urban space, and revalue proximity (Nam & Pardo, 2011)

[1] It is an amount of data measured in high-speed terabytes or petabytes referenced in time and space that allows new data to be added easily (Kitchin, Getting smarter about smart cities: Improving data privacy and data security, 2014).
[2] Mobility as a Service

Thus, the generation, management, and usage of concentrated data in the city, resizes the urban analysis for the integration of the digital space and the physical one in multiple ways, also conceptualizes or qualifies concepts, and even incorporates emerging categories. With the intensive use of ICTs, the generation and usage of massive data exchanged by people and their use in knowledge make it possible for a city to be intelligent.

2.2 From smartness in the city to the smart city

The term smart city has its antecedents in the literature of the eighties of the twentieth century. Since its origin, the development of the concept has varied among countries and organizations, and in this century more specific meanings and uses have been developed (Nicos & Mora, 2018), such as the case of the solution of sustainability problems focused on energy efficiency in the reduction of carbon emissions (Achaerandio, 2011) or the usage of technology to improve urban life through intelligent transport systems or improvements in safety (Giffinger, 2007).

In 1994, more than 100 European organizations began to discuss the term smart cities associated with telematics applications such as mobility and car-free cities (Ishida, 2000). More recently, the term has been linked to the availability and capacity of telecommunication infrastructure in the city (Achaerandio, 2011).

The Inter-American Development Bank (2016) defines the smart city as the urban space that locates people at the center of development, incorporates ICT in urban administration and includes collaborative planning processes and citizen participation. Authors such as Lipman (1986), Hall (2000) and Chourabi (2012) agree that the smart city is a set of infrastructure and technological elements that the city utilizes in its operation, capable of establishing networks that physically and virtually connect people. In particular, Hall (2000) points out that the smart city is a set of interconnected structures based on advanced and integrated systems that collect data in real time with the purpose of improving city management.

In this sense, the smart city requires processes that facilitate urban transformation from the collaboration of agents at various scales (Komninos, Tsarchoupoulos, & Kakderi, 2014). In essence, it is data management, space and communication between people (Achaerandio, 2011).

In the smart city, the infrastructure generates and shares information with other subsystems through telecommunications, sensors that collect information, and robust data processing systems that order, synthesize, and interpret information; represents the cognitive capacity of the urban system (Chourabi, et al., 2012)

A smart city is understood from a social perspective by the interaction between people who actively participate in decision-making, society generates information and knowledge that allows them to act collectively in front of any change (Ishida, 2000).It is the organizational capacity and ability of a city to perceive changes in its environment and respond effectively (Liugailaite & Jucevicius, 2014).

In this sense, the smart city is made up of technological and social elements that, in integration, operate as a tool for the management of urban spaces (Giffinger, 2007). The main elements are the network, big data, knowledge, innovation, activities, and relationships.

Based on the previous definitions and as a synthesis, a smart city generates real-time data and knowledge from the activities and the usage of infrastructure, establishes connected and accessible environments, and locates people at the center of urban development, to get them involve in decision-making; initially requires a purpose, preferably sustainability (Kitchin, 2014).

It is important to specify that, although the definitions of a smart city are varied, it is still considered as an emerging category with different names and circumstances (Nam & Pardo, 2011). Thus, although precision is needed and there is no consensus on the definition of a smart city, infrastructure, the use of technology, knowledge management, and the

relationship between people are considered converging terms. The infrastructure is the base on which the network of physical and virtual relationships is established, the technology is used to generate and manage data, and knowledge is an added value in solving problems.

2.3 Some implications of the smart city

With the evolution of smart city definitions and applications, other complementary emerging categories also exist, such as digital cities, network cities, cities of knowledge, and creative cities. These are often used interchangeably, sometimes incorrectly or more as a 'fashion' than as a genuine city model (Hollands, 2008)

In this way, conceptual and instrumental implications are noted in the application of the term smart city, the first refer to the correct interpretation based on the basic characteristics that define it, and the following support the development of policies that allow its achievement.

Within the conceptual scope, the characteristics of infrastructure, intellectual capital related to social capital, and knowledge networks can be framed. Technology is considered as a democratic element; therefore, its access, social empowerment and equity must be guaranteed (Hollands, 2008).

In the instrumental implications, the centrality in people stands out. A smart city is designed to enhance the quality of life. It prioritizes improvements in individual and collective well-being, the environment, and social relations. Education and innovation centers serve as key nodes in the network (Nam & Pardo, 2011). Infrastructure necessitates securing economic resources for acquiring technology, including enabled sensors, distribution systems, supercomputers, and robust data storage systems (Washburn & Sindhu, 2010)

The integration of infrastructure, systems, the articulation of physical and digital space, the participation of people and, in general, the various components that the digital city involves in a design process.

3. Smart Urban Design (SUD)

Starting from the concepts mentioned in the previous section, based on the integration of urban design methods, people-centered design[3], and another approach from the Inter American Development Bank, a process is composed of data organized in network form, with each data representing a platform arranged in sequence. This network is based on a three-level grid (see Figure 1), where the first level groups elements that support urban projects, the second level refers to people and their daily relationships, and the third level refers to the goals pursued by the organization of the city.

Starting from the premise of intelligence based on data, and some disciplines first created technical terms, the concept of Online Analytical Processing (OLAP) or the so-called data cube has also been applied; In this mode, information can be organized and analyzed from multiple platforms. (See Figure 1)

Net, relations Reticle, three levels Cube, each side one platform

Figure 1. Conceptualization of Intelligent Urban Design (IUD). Source: Own creation

[3] For more information about this proposal, see Alva (2017)

From the six platforms considered, four are for diagnostic and two are for design. The cube allows the six platforms to be associated, and its construction is a three-dimensional assembly process that allows observing the behavior of each side. Overall, relationships can be identified and designs can be adjusted by moving cubes. In addition, similar to Rubik's Cube, each platform is assigned a color code. These six platforms are (see Figure 2):

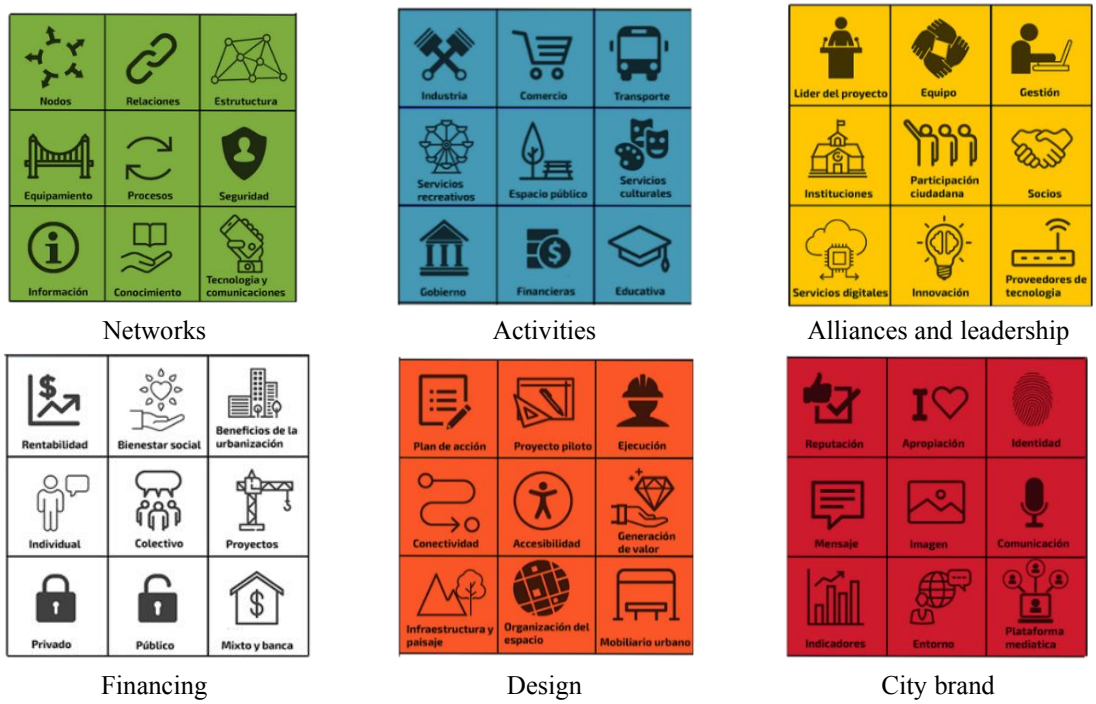

Figure 2. Intelligent Urban Design (UID) Platforms. Source: Own creation

a) Networks: The first bottom row is real-time information, technology, and telecommunications to generate knowledge. In the second row, there are the equipment, processes and security that are identified for people to carry out their activities. The third, as the end, shows linking elements, nodes located in time and place that concentrate activities and relationships of people, interactions in urban spaces and morphology of the city.

b) Activities: In the bottom row are the city's capacity to provide government, financial, and educational services; in the second row are recreation, public space, and cultural services; at the top is the city's industrial, commercial, or motor activity, that is, the activities that generate the most employment.

c) Alliances and leadership: In the first row is the diagnosis of capabilities, it is integrated with digital services, the vocation for innovation (availability of centers or clusters with the capacity to develop technology, research, and knowledge) as well as suppliers of technology. In the row of people, the level of social involvement in decision-making is identified, and in the row of purpose, the leaders of the project, both formal and informal, the interdisciplinary team and the possibility of management are recognized.

d) Financing: At the base are the sources of available and potential resources. At the center are the costs assumed by people individually, collectively or by the projects that trigger the economy. The purpose is represented by the benefits in economic, social and territorial terms.

With these four dimensions, a diagnosis is established with data that includes three levels, the basis for the development of the city, people as beneficiaries and relationships, as well as the goals or purposes sought by each dimension. The next two platforms are associated with the design, first of the space and later of the brand that allows the project to be convinced.

e) Design: This platform represents ordered spaces and criteria that support the urban design; at the base is the infrastructure, the landscape, the planning of the territory and the virtual space; in the center is the human being through criteria of connectivity, accessibility and generation of value that the project must provoke; in the row of results is presented the action plan up to the execution, it constitutes the guiding strategy or short, medium and long term route.

f) City brand: In the first row, the indicators, media environment and platforms are built; in the middle row, the communication is specified, made up of the message, the image and the slogan; finally, as a result, the consolidation of a brand is proposed, represented by the positive perception of the image, trust, appropriation and socio-cultural roots, in general terms, branding.

In this way, the assembly of the platforms for the cube allows an analysis from left to right and from bottom to top (see Figure 3). In intelligent design, considering people at the center forces us to think about relationships, activities, and processes based on data.

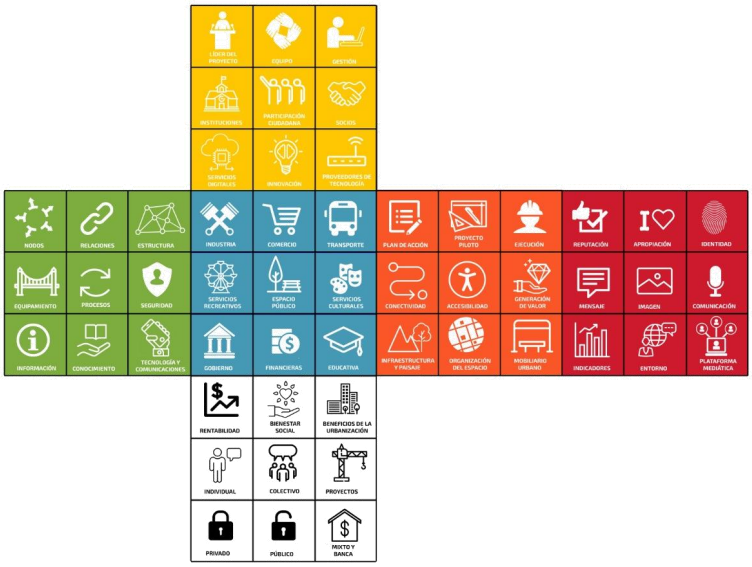

Figure 3. Integration of platforms for Intelligent Urban Design (IUD).

With these premises, the data is transformed into strategies of connectivity, accessibility, and value generation. Therefore, the platforms, the network and each box begin to rotate to group values from various platforms on a single side (see Figure 4). When analyzing the platforms transversally, the movement of the data cube associates elements with low value, or with strategic importance, placing in the center the design element that allows explaining the logic of the grouping in a right-handed sense.

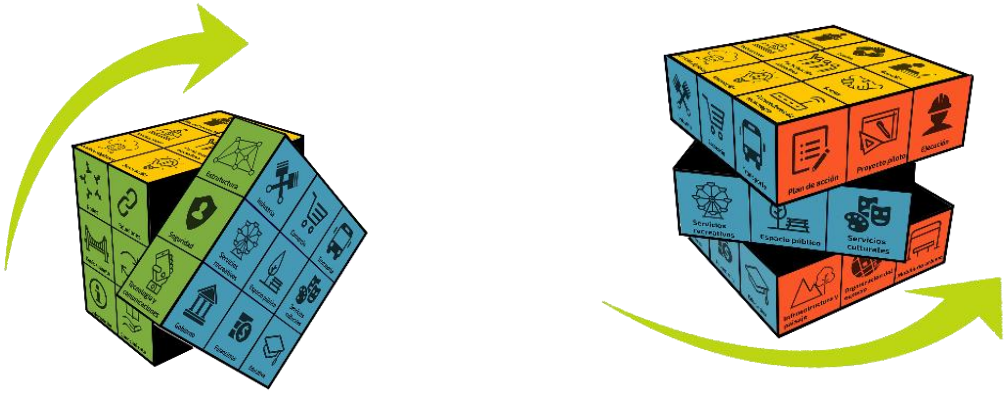

Figure 4. From strategy to data, IUD process.

This form of grouping with various elements of the platforms ordered from a design element is called "Dimension". Thus, it is possible to associate and organize a group of data under a strategic criterion that allows improving values; for example, in a hypothetical exercise, the data obtained in the diagnosis phase in the first four dimensions described, related to connectivity, are: (see Figure 5)

a) Network platform: shortage of nodes, equipment, a structure concentrated in few relationships, and lack of generation of information for decision making.

b) Platform for alliances and leadership: a low count of digital services that are necessary to integrate data and innovate.

c) Platform of activities: low inventory of commercial, recreational, and public space activities.

Figure 5. From strategy to data, IUD process.

Finally, with all the dimensions defined, the city brand platform is built. It is important to specify that the dimension can change during the design or branding process, due to a variation in the data or the organization; in such a way that the process is interactive, it is possible to observe how the indicators are modified and the identity is built. In this way, the same design can be adapted. The use of data throughout the process, its interaction and the need to make decisions are the main characteristics that make up Intelligent Urban Design.

In this way, urban design becomes intelligent for the city, using data strategically to create value or address a specific situation according to the moment and people's interests.

4. The Challenges of Smart Urban Design (SUD)

Smart Urban Design (SUD) is a proposal that seeks to transform design management through the use of data and technology. If we want to build smart cities, how do we design them? It is from this question that this methodology is born, which aims to contribute to the construction of new concepts that radically change the way we plan and design cities.

The New Urban Agenda of the United Nations Organization places people at the center, redirects the way we should build cities, and starts from the insoluble dichotomy between urban planning and design. This represents new forms of urban space management, paradigm shifts, and the use of novel techniques. In this sense, the IUD methodology provides a tool that merges emerging categories such as people-centricity and technology use.

Perhaps one of the main challenges in intelligence applied in the city and design is the quality of the infrastructure, as well as the generation and use of data. The lack of technology-based infrastructure in cities makes the generation of data impossible. Some cities start with digital government, others with open government, but there is a lack of linkage with decision-making or with the design of projects that intervene in the public space. In this way, the availability of technology to generate, process, and use specific data about relationships in public space is the main limitation of Intelligent Urban Design.

As the government commits to building new infrastructure and technology that revolutionizes decision-making and improves cities in line with our new reality, mobile apps can help offset the challenges. The development of an APP[4] in local spaces generates and processes information at a small scale, without the need for a robust infrastructure such as a supercomputer to work with information at the city level.

The IUD proposal arose precisely from an investigation that analyzed the feasibility of a smart city in San Luis Potosí, Mexico. As part of the agenda, the need to have a methodology and a mobile application was identified.

Although the limitations of IUD are recognized, it is also important to affirm that technology makes it possible to reduce barriers or face new challenges successfully, adding resilience to the city. With the COVID-19 health emergency, the use of technologies increased, and urban design was also rethought; public space implied new rules such as distance and NO permanence. Intelligence precisely implies a purpose, which allows us to know what to do at what time. Therefore, currently there are other complexities that we knew, so cities must be intelligent to be able to maintain their conditions or even improve them.

5. Conclusion, Discussion of Results

Smart urban design, an emerging concept shaped by the evolution of information and communication technologies, plays a fundamental role in enhancing the quality of life in cities. However, its response has been slow compared to the rapid changes in society. By leveraging real-time data and innovative planning and design methods, cities can accelerate their responsiveness, expand their capacity for attention, and improve decision-making tools. Urban studies must embrace artificial intelligence and develop new analytical categories and intervention methods with comprehensive and innovative approaches. While urban design acknowledges its limited theoretical foundation and operates as an understood practice, there is a pressing need for advanced work in emerging methods and tools to foster conceptual evolution and align with an increasingly dynamic reality. This research advances the integration of innovative concepts into urban design, incorporating interdisciplinary categories in its formulation.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

[1] Achaerandio, R. (2011). Analisis de las ciudades inteligentes en España. Obtenido de www.aeiciberseguridad.es: https://www.aeiciberseguridad.es/descargas/categoria6/8883484.pdf

[2] Alizadeh Tooran (2021). Global trends of smart cities. a comparative analysis of geography, city size, governance, and urban planning. *Elsevier Science Ed*. https://www.aeiciberseguridad.es/descargas/categoria6/8883484.pdf

[3] Alva, B., Narvaez, F., & Martinez, A. (2017). Diseño urbano centrado en la persona. Una propuesta para enfrentar los retos urbanos en América Latina. *Planeo*, 1-15. Obtenido de http://revistaplaneo.cl/wp-content/uploads/Arti%CC%81culo_AlvaNarvaezMartinez.pdf

[4] Atom Publishing Protocol, for its acronym in English, refers to applications for mobile devices.

[4] Bašová, S., & Štefancová, L. (Enero de 2017). Creative and Smart Public Spaces. Obtenido de www.researchgate.org: https://www.researchgate.net/publication/317167769_Creative_And_Smart_Public_Spaces

[5] Bélissent, J. (2010). Getting clever about smart cities. Obtenido de Forrester: http://193.40.244.77/iot/wp-content/uploads/2014/02/getting_clever_about_smart_cities_new_opportunities.pdf

[6] BID. (2016). La ruta hacia las Smart Cities. Banco Interamericano de Desarrollo. Obtenido de https://publications.iadb.org/bitstream/handle/11319/7743/La-ruta-hacia-las-smart-cities-Migrando-de-una-gestion-tradicional-a-la-ciudad-inteligente.pdf

[7] BID. (22 de Noviembre de 2018). Construyendo ciudades inteligentes en América Latina y el Caribe. Obtenido de Banco Interamericano de Desarrollo: https://blogs.iadb.org/ciudades-sostenibles/es/ciudadesinteligentes-smartcities-americalatina-caribe/

[8] Borja, J. (2012). Revolución urbana y derechos ciudadanos: Claves para interpretar las contradicciones de la ciudad actual. Obtenido de TESIS DOCTORAL DE JORDI BORJA : https://www.tdx.cat/bitstream/handle/10803/83360/01.JBS_1de2.pdf?sequence=1

[9] Chen, H., Chiang, R. H., & Storey, V. C. (2012). Business intelligence and analytics: from big data to big impact. *MIS Quarterly: Business Intelligence Research*, 1165-1188. Obtenido de https://pdfs.semanticscholar.org/f5fe/b79e04b2e7b61d17a6df79a44faf358e60cd.pdf

[10] Chiehyeon, L., Kim, K.-J., & Maglio, P. (2018). Smart cities with big data: reference models, challenges, and considerations. *Cities*, 86-99.

[11] Chourabi, H., Nam, T., Walker, S., Gil-Garcia, R., Mellouli, S., Nahon, K., Scholl, H. (2012). Understanding smart cities: an integrative framework. Obtenido de https://www.researchgate.net/publication/254051893_Understanding_Smart_Cities_An_Integrative_Framework

[12] Gómez, V. A., Hernandez, C., & Rivas, E. (2018). Visión General, Características y Funcionalidades de la Red Eléctrica Inteligente (Smart Grid). *Información Tecnológica*, 89-102.

[13] Fernández , V. (2016). Riesgos de la ciudad (digital) del futuro: control, guetización y desarraigo. *Revista de Investigación Social*, vol. 13, núm. 32, 15-35.

[14] Gehl, J. (2010). Ciudades para la gente. Obtenido de http://cisav.mx: http://cisav.mx/wp-content/uploads/2017/03/M4T3.-Gehl-Jan-Ciudades-para-la-gente-cap.-1.pdf

[15] Gianni , F., Mora, S., & Divitini, M. (2016). IoT for smart city learning: towards requirements for an authoring tool. Obtenido de http://ceur-ws.org: http://ceur-ws.org/Vol-1602/paper3.pdf

[16] Giffinger, R. (2007). Smart cities ranking of European medium-sized cities. Obtenido de www.smart-cities.eu: http://www.smart-cities.eu/download/smart_cities_final_report.pdf

[17] Hall, R. (https://www.osti.gov/servlets/purl/773961 de 2000). The Vision of A Smart City. Obtenido de osti.gov.

[18] Hollands, R. (2008). Will the real smart city please stand up? Obtenido de http://labos.ulg.ac.be: http://labos.ulg.ac.be/smart-city/wp-content/uploads/sites/12/2017/03/Lecture-MODULE-3-2008-Will-the-real-smart-city-please-stand-up-Hollands.pdf

[19] INEGI. (2018). Encuesta Nacional sobre Disponibilidad y Uso de Tecnologías de la Información y la Comunicación en los Hogares. Obtenido de www.inegi.org.mx: https://www.inegi.org.mx/contenidos/saladeprensa/boletines/2019/OtrTemEcon/ENDUTIH_2018.pdf

[20] Ishida, T. (2000). Understanding Digital Cities. Obtenido de Department of Social Informatics, Kyoto University: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.75.2175&rep=rep1&type=pdf

[21] Kitchin, R. (2013). The real-time city? big data and smart urbanism. Obtenido de SSRN Electronic Journal: https://www.researchgate.net/publication/314410892_The_Real-Time_City_Big_Data_and_Smart_Urbanism

[22] Kitchin, R. (2014). Getting smarter about smart cities: improving data privacy and data security. Obtenido de www.taoiseach.gov.ie: https://www.taoiseach.gov.ie/eng/Publications/Publications_2016/Smart_Cities_Report_January_2016.pdf

[23] Komninos, N. (2006). The architecture of intelligent cities. Obtenido de urenio.org: http://www.urenio.org/wp-content/uploads/2008/11/2006-The-Architecture-of-Intel-Cities-IE06.pdf

[24] Komninos, N. (2008). Intelligent cities and globalization of innovation networks. Obtenido de http://www.stellenboschheritage.co.za: http://www.stellenboschheritage.co.za/wp-content/uploads/Intelligent-Cities-and-Globalisation-of-Innovation-Networks.pdf

[25] Komninos, N., Tsarchoupoulos, P., & Kakderi, C. (2014). New services design for smart cities: a planning roadmap for user-driven innovation. Obtenido de URENIO Research: http://www.urenio.org/komninos/wp-content/uploads/2014/08/New-services-design-for-smart-cities.pdf

[26] Leydesdorff, L., & Deakin, M. (2010). The triple helix model and the meta-stabilization of urban technologies in smart cities. Obtenido de www.arxiv.org.

[27] Lipman, A., Sugarman, A., & Cushman, R. (1986). Teleports and the intelligent city. Obtenido de sugarlaw.com: http://www.sugarlaw.com/publications/teleport/teleports-all-dow-jones.pdf

[28] Liugailaite, L., & Jucevicius, R. (2014). Going to be an intelligent city. Obtenido de Elsevier: https://ac.els-cdn.com/S1877042814059515/1-s2.0-S1877042814059515-main.pdf?_tid=163b8590-130f-11e8-bb7b-00000aab0f26&acdnat=1518781796_e2bcfe5ab6d48bd33561a0054ba1bf7d

[29] Nam, T., & Pardo, T. (2011). Conceptualizing smart city with dimensions of technology, people, and institution. Obtenido de Researchgate.com: https://www.researchgate.net/publication/221585167_Conceptualizing_smart_city_with_dimensions_of_technology_people_and_institutions

[30] Nam, T., & Pardo, T. (Septiembre de 2011). Smart city as urban innovation: focusing on management, policy, and context. Obtenido de www.researchgate.com: https://www.researchgate.net/publication/221547712_Smart_city_as_urban_innovation_Focusing_on_management_policy_and_context

[31] Nicos, K., & Mora, L. (2018). Exploring the big picture of smart city. Obtenido de ResearchGate: https://www.researchgate.net/publication/319598847

[32] Poveda, J. A. (2009). Métodos de diseño basados en evidencia aplicados al diseño de un área residencial. Obtenido de Universidad Nacional de Colombia.

[33] SBB. (Marzo de 2018). Smart public space. En A. (Riedle, Smart cities: SBB contribution (págs. 14-16). *Switzerland: Real Estate Development*. Obtenido de www.sbb-realestate.ch: https://www.sbb-realestate.ch/sites/default/files/downloads/SBB_SmartCity_Positionspapier_A4_V13_EN_Web_0.pdf

[34] Sevillano, F. *(2015)*. Big data*. Economia Industrial*, 71-86.

[35] Washburn, D., & Sindhu, U. (2010). Helping CIOs understand "smart city" initiatives. Obtenido de Forrester: https://www.forrester.com/report/Helping+CIOs+Understand+Smart+City+Initiatives/-/E-RES55590