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The Road toward to Smart Cities oriented in social innovation

El camino a las Ciudades Inteligentes orientado en la innovación social

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Abstract

Introduction: Digital transformation, applied in the development of Smart Cities in Mexico, still has many questions and a way to go. This article takes an orientation from social innovation. **Objective:** To find the main similarities between the diversity of elements and concepts that smart cities and social innovation have. This analysis aims to achieve a greater understanding and reflection on these perceptions to evaluate the links between them. **Methodology:** It was of the qualitative type, based on an exploratory analysis of the literature review, as a starting point by means of a mapping according to definitions. **Results:** The conceptual similarities are presented so that in the development of smart cities the link and importance is evaluated from a perspective of social innovation, collaborative and focused on its citizens. **Conclusions:** At the time when different concepts have emerged with multiple actors involved, the use of ideas associated with urban concepts from a perspective of social innovation is of interest. To help develop public policies to achieve citizen well-being and create a positive impact.

Keywords: *Innovation; Social innovation; Smart cities; Sustainability.*

Resumen

Introducción: La transformación digital, aplicado en el desarrollo de Ciudades inteligentes en México aún tiene muchas interrogantes y camino por recorrer. Este artículo adopta una orientación desde la innovación social. **Objetivo:** Encontrar las principales similitudes entre la diversidad de elementos y conceptos que tienen las Ciudades inteligentes y la Innovación social. En este análisis se pretende lograr un mayor entendimiento y reflexión sobre estas percepciones para evaluar los vínculos entre las mismas. **Metodología:** Fue del tipo cualitativo, con base en un análisis exploratorio de la revisión de la literatura, como punto de partida por medio de un mapeo de acuerdo con definiciones. **Resultados:** Se presentan las similitudes conceptuales para que en el desarrollo de Ciudades inteligentes se evalúe el vínculo e importancia desde una perspectiva de innovación social, colaborativa y centrada en sus ciudadanos. **Conclusiones:** En la época en la que han surgido distintos conceptos con múltiples actores involucrados, es de interés el uso de ideas asociadas con los conceptos urbanos desde una perspectiva de innovación social. Para ayudar al desarrollo de políticas públicas para lograr el bienestar del ciudadano y la creación de un impacto positivo.

Palabras clave: *Innovación; Innovación social; Ciudades inteligentes; Sustentabilidad.*

Códigos JEL O35, Q55, Q56

Introduction

The world is experiencing urban growth; approximately 55% of the world's population lives in cities and this growth is expected to increase, which can lead to social, economic and environmental transformations. With good planning, cities have the potential to usher in a new era of well-being, increasing productivity, contributing to sustainable economic growth and making efficient use of available resources.

Based on the Urban Agenda (NAU) established by the United Nations Organization (UN, 2020), it is emphasized that urbanization must be planned, developed, managed and governed so that they do not generate the common problems such as; traffic congestion, garbage waste, energy consumption, environmental impact, social inclusion, dangers derived to the loss of social ties, excessive consumption and waste of water, citizen insecurity, to mention a few (Luiselli, 2019).

On the other hand, the concept of city arises from the analysis of the progress of the processes and planning of the inhabitants, which have been a complex set of distributed elements and systems, where citizens are considered the heart of urban processes (Parygin et al., 2022). The first nuclei of population growth and social evolution gave way to the development of cities. However, this concept has been defined in terms of social interactions (Hernández, 2007).

However, according to Castells (2004), planning is the intervention of the political on different social environments and/or their relations, to ensure the reproduction of the system, which has asegured the interests of the dominant social classes. Urbanization trends are dynamic and face risks coming from the limitations of governments with unequal socioeconomic models due to lack of technical capacities, information and especially resources to face it (UN, 2017).

The United Nations General Assembly (UNGA) has set out the Sustainable Development Goals (SDGs) in its 2030 agenda, Goal 11: "Make cities more inclusive, safe, resilient and sustainable" (United Nations, 2023, p. 1). On the other hand, Mexico faces challenges in terms of access to sustainable housing in balance with the environment (CONAH- CYT, 2023). The planning of a city is usually the responsibility of the public administration at different levels: local, regional or national, and requires an integrated vision of the different elements involved in its management: political, economic, social, technological, cultural, environmental and legal, and should also be seen as a means to achieve objectives.

Now, technology has been used, which has given rise to a new urban development with the objective of improving cities. These have been based on and have used Information and Communication Technologies ICT, through interconnected intelligent systems, which have been used to achieve efficient resource managements (Copaja-Alegre and Esponda-Alva, 2019). A current topic is the path to the transformation of a traditional city into a smart city, with the use of technologies has been increasingly possible. A Smart City arises from the technological revolution and transformation and

However, it also requires the participation of the societies that inhabit it.

For Panori et al. (2021), "it is the spatial manifestation of attractive digital platforms towards innovation actors" (p.1). To be able to plan a smart city requires an understanding of all the challenges and components needed to do this work. The creation of environments that allow integration and development of all people living in them, and smart services in the context of cities should be aimed at inclusion, to maximize the good living of citizens oriented in social innovations, addressing the problem from the analysis of the needs of the city, with a focus on innovation and sustainability.

The first part of the article shows the introduction to the topic. The second part exposes how technology and innovation play an important role for Smart Cities, as well as some concepts and the topic of social innovation and its relation to sustainability is presented. The third part presents the methodology used. The fourth part shows the results of the similarities between the two concepts. The fifth part presents the discussion and reflection on the research topic. Finally, the conclusions of the theoretical review are presented.

The purpose of this article has been to understand the similarity of concepts despite being different approaches, while one focuses on the application of technologies for efficient urban management, the other addresses a variety of social problems through creative and collaborative approaches. However, the focus of both has been on improving people's quality of life and finding solutions to social problems.

THEORETICAL FRAMEWORK

Moving towards inclusive and sustainable cities can be achieved with the help of technologies to achieve urban connectivity. The disruptive impact of digital technologies within cities places them within innovation systems. Transforming a traditional city into a smart city is a current issue, with the emergence of internet, digital and mobile technology is a transformation that is becoming increasingly possible.

In the search to mitigate contemporary urban challenges and difficulties over time, different definitions and models of cities have emerged (sustainable cities, healthy cities, safe cities, green cities, livable cities, soft cities, to mention a few). In this case, the concept referring to the City of the future is called Smart City in in- glés "Smart City", emerged by the International Business Machine company (IBM), as an advertising strategy, as a new potential market for technological solutions at the level of urban infrastructures (Tironi, 2019). Cities have offered different facets over time according to how human beings have configured them (Eiroa, 2002), since they have shown evolution, reflecting the historical journey, artistic impulse, utopian proposals and technological evolution, a reflection of the representation of the societies that have inhabited them (Martínez-Rivera, 2011).

It is a modern concept that arises from the planning for the development of urban centers in harmony with technological progress, which should make it possible to solve the challenges faced by today's metropolises (Rózga, 2021). For González and Luna (2019), there is a diversity of concepts, since it is an emerging model of today, from those that only use it in the use and application of information and communication technologies called by its acronym ICT, others are only based on acts linked to the reduction of carbon dioxide emissions or the efficient use of energy, others are those that provide inclusion, infrastructure and services, so it is a function of different forces and interests according to the complexity of the ecosystem of the agents that com- pon it.

In addition to all this, today we have technology and, according to Copaja-Alegre and Esponda-Alva (2019), applied to urban development models, the aim is for cities to optimize the management of their services for the sake of sustainability and improve the quality of life of the people who live there, through interconnected smart systems, based on and designed using ICTs. Pioneering authors, such as Giffinger and Haindl (2010), identify a smart city according to the needs of each city and its prospects, although they are identified according to their characteristics in terms of their smart dimensions (smart environments, smart mobility, smart governance, smart economy, smart people, smart life).

For Bouskela et al. (2016), a Smart City is an innovative urban environment that makes use of technological means and especially ICT to improve the efficiency of its operations and its decision making, have strived to meet the needs of citizens, have created a safer environment, improving services and job opportunities and the decrease of disparities, in order to improve their quality of life. According to the author Alvarado-López (2017), it is one that will be designed to enrich citizens in the field of development, in order to improve their quality of life, thanks to accessibility and social inclusion. Tironi (2019), states that they are particular imaginaries, which indicate what it is desired to achieve in the city, through the use of technology or how they should be according to the way of life and management of the city respectively.

Definitions vary, ranging from those that are sustainability-oriented to those that focus on using ICTs. Among the different concepts some have received greater attention than others (Hatuka et al., 2018). For Hatuka et al. (2018), cities around the world have used and developed strategic plans based on the diversity of concepts. In this context, the Smart City has been referred to as the city that is distinguished by the use and employment of ICT, as well as the linkage of technological tools and fundamental components of emerging technologies. Innovation and sustainability should be part of its objectives, in order to improve operational efficiency and the quality of life of its citizens, optimize the management of natural resources, and address various urban challenges.

In contrast, Hollands (2008), was one of the pioneers in criticizing the multiplicity of concepts about the Smart City, as it lacks a precise definition, is used for marketing purposes, hides different assumptions and implies several ideological contradictions. Nevertheless, it has been gaining relevance, due to globalization. Indeed, the concept itself is complex, because of

involving aspects that have been related to the development of the city, with technology mainly coming from Europe and the United States (Sikora-Fernandez, 2017).

Consequently, there has been a growing use of the concept and/or model, which has been called "smart" within cities, although smart cities in Latin America pose different challenges to globalized countries, due to the fact that there have been different points of view and classifications around this, and therefore, they have faced problems such as; lack of resources and infrastructure and lack of cooperation between the actors involved (government, private initiative and academia). In this context, the challenges and opportunities have their particularities and are directed towards national and local governments, which implement policies and initiatives within their state and municipal plans and agendas in such a way that they can compare their progress with internationally ranked cities (Amargo et al., 2021).

Indeed, in Mexico it has been a slow process, according to the Executive Power of the State of Queretaro (2021), the government needs to integrate, consolidate and implement the necessary strategies for digital development in public administrations, for the welfare of the population and its social problems. Now, the elements involved within the definitions, such as the human factor and the improvement of the quality of life are gaining ground and importance, in addition to the inherent element such as "Innovation" within the social and sustainable aspect (Szendi, 2021).

The term innovation has been explored in different literature and has been studied with different approaches. For Rogers (1982), an innovation is an idea, practice or object that a person perceives as new. If the idea seems new to the person, it is an innovation. The "newness" aspect of an innovation can be expressed in terms of knowledge, persuasion, or an adoption decision. According to Solleiro and Castañón (2016a) innovation is an innovative combination of knowledge and know-how, which must be adequate in its application to solve a problem or meet a need.

According to Chaparro (2003), innovation has been a collective event, which the actors have adopted, due to social and territorial difficulties, the availability of adequate infrastructure, the accumulation of know-how and the presence of institutions or research centers. Currently, innovation landscapes have been shaped by the way innovation systems merge with the Internet, the contribution of technologies and digital innovation environments have been related to the intelligent and collective connection between people and machines (Panori et al., 2021). Finally, in the smart city context, innovations have been understood as the creation, development and application of new ideas, products, services and processes, with the purpose of addressing and improving social challenges, the quality of life of people and contributing to the well-being of society.

In this sense, social innovation has been a tool that has addressed challenges such as poverty, inequality, poor education, inaccessible health care and many other problems faced by society. It refers to processes and outcomes that have developed a new approach, which has addressed a social need or problem (Jazmín et al., 2015). While for Szendi (2021), it "emerged as a new way of meeting social needs" (p. 242). The Economic Commission

ECLAC (2020), defined it as new forms of management, administration, tools or instruments aimed at optimizing social conditions and the lives of the population.

Parada (2017), has related it to the process of social changes in institutions, which can be modified and reformed in terms of their social designs, which would have an impact at different levels and social fields such as health care, social entrepreneurship, community markets, to mention a few. Boni et al. (2021), have focused on sustainable progress, which is adapted to local circumstances and reflects the values and interests of the communities involved. Satalkina and Steiner (2022), consolidated the evolution of the concept as the intervention directed towards structural changes within the social dimensions in different environments (technological, business, organizational), which are oriented towards the improvement of societies.

For the Organization for Economic Cooperation and Development OECD (2019), social innovation has created collaboration within societies and new social forms. Therefore, it has highlighted that stakeholders (companies, academia, governmental organizations and citizens) must be involved. These collaborations create opportunities for improving the quality of life of citizens and for sustainable development; likewise, the interaction between subjects, society and culture constitutes a fundamental component of social innovation (Jazmín et al., 2015). The key factor has been the collaboration of citizens, from defining the problem, its identification and possible alternatives, as well as implementation and follow-up (ECLAC, 2020). In this context, Social Innovation has been defined as the development and application of creative solutions to social problems, involving the community with its participation, in the identification and resolution of problems, promoting equity and inclusion with the purpose of generating a positive impact on the resolution of social challenges and improving the quality of life.

Thus, although the terms Smart City and Social Innovation refer to different concepts, they share some similarities, especially in their focus on improving people's quality of life and finding solutions to social problems, which is linked to the process of social change. By integrating these perspectives, a holistic approach is established that not only seeks to provide efficient technological solutions, but also prioritizes equity, citizen participation and positive impact on the community. Therefore, it is necessary to deepen and reflect on the subject and thus be able to address social problems through creative and collaborative approaches applied to cities. For Costales (2022), human centrality encompasses growth and the full potential of technologies; however, this holistic development of involving the human element is vital to avoid falling into technological determinism.

Social innovations within the context of Smart Cities should start with the identification of the specific needs of citizens, which will involve governmental, environmental, economic and social aspects (Jazmín et al., 2015). Linking social innovation in terms of citizen participation in the Smart City has been used in the proposals of current governors (Boni et al., 2021). However, given the need to safeguard the environment alongside territorial development and foster a correct relationship between environmental systems and sociocultural systems, inclusion and sustainability must be promoted,

because they are based on the integration of stakeholders, their urban problems and possible solutions (González and Luna, 2019).

Consequently, a sustainable urbanization should seek balance and promotion between economic growth, preservation of the environment and its natural resources and improvement of the quality of life of its inhabitants within the urban area (Cortés, 2015). Therefore, the mechanisms of sustainable development and citizen participation add value to social innovation, that cultural aspect of collaboration, energizes the inclusion of citizens and generates good results (Jazmín et al., 2015).

Sustainability is a multidimensional and very complex term, as it involves different perspectives and can be used according to stakeholders (Sadok and Welch, 2017). For Martínez-Azpeitia et al. (2020), it is related to the process of humanity and its progress as ci- vilization according to the socioeconomic development of the environment. Zarta (2018), involves aspects concerning the scarcity and depletion of natural resources, as well as the finite and limited nature of planet Earth. Sadok and Welch (2017) define that human sustainability will depend on social sustainability, and in order to survive and prosper within an organized system, it is necessary to have economic sustainability, and at the same time be related to a social environment in harmony with the physical environment and promote environmental sustainability.

Specifically, they are not exclusive approaches, they have been shown in order to understand their diversity and how the terms can be related for the planning of Smart Cities oriented to social innovations, especially in the approach towards the improvement of people's quality of life and the pursuit of solutions to social problems. In the case of Mexico, it is up to public administrations to generate public policies to deepen and encourage practices for the creation of sustainable urban societies.

METHODOLOGY

In this research, a qualitative methodology is used as a starting point for approaching the object of study by means of a mapping (Hernández-Sampieri et al., 2014), to establish a search strategy and organize the information of the theoretical framework and the literature review of the information collected. First, mapping according to the definitions of "Smart Ciu- dad", based on authors such as Alvarado-López (2017); Amargo et al. (2021); Bouskela et al. (2016); Copaja-Alegre & Esponda-Alva (2019); Eiroa (2002); Giffinger and Haindl (2010); Hollands (2008); Sikora-Fernández (2017); Tironi (2019). For "Social innovation" it was used based on the authors Boni et al. (2021); Parada (2017); Solleiro and Castañón (2016b); Szendi (2021); ECLAC (2020). It is relevant to highlight that the contextualization of the research takes the postulate of "Sustainability", for the theoretical contribution and the impact to be considered, based on authors such as Martí- nez-Azpeitia et al. (2020); Sadok and Welch (2017); Zarta (2018).

Second, an exploratory systematic review of the literature was carried out, which involved consulting scientific publications, the search strategy in the databases, by means of the words

key. Inclusion criteria were established, which included the search in English and Spanish within the exploration engines in the platforms of Goolge Académico, SciELO, Dialet, Scopus, to mention a few. The analysis and discussion of the bibliographic sources were considered from their state of the art, in order to argue the understanding and results presented.

RESULTS

The great diversity of elements that affect smart cities, as well as that of social innovations according to the different authors and their multiple definitions, the main similarities between the two concepts were found. However, these must be configured and designed with respect to the characteristics, needs and progress of the cities in question. For Zaldívar-Colado et al. (2018), there are different types of variables, however, the most relevant and important within innovation and development is the social factor, due to the fact that technological improvements have had their origin in improving the quality of life of citizens.

Now, the first and main similarity has been the focus on improving the quality of life of citizens, which has sought tangible benefits in society. The second, the use of ICTs for social welfare (health, education, financial inclusion, sustainable development, to name a few). The third, the focus on collaboration and citizen participation, promoting collaboration between different actors (governments, companies, organizations, citizens) has been valued as a means to understand the needs of the community and thus be able to design effective solutions, The fourth, sustainability and positive social impact, optimizing the use of resources and reducing the environmental footprint, can contribute to sustainability with the aim of achieving positive social change.

As mentioned, both smart city initiatives and social innovation projects must be adapted to local contexts. Solutions must be designed taking into account the specific characteristics and needs of the community or city in question. Thus, there have been different approaches to citizen participation in shaping Smart Cities in innovation environments over time. Based on Johnson et al. (2020), the approaches that local governments have developed have had different objectives, which have been related to improving efficiency, sustainability, service delivery and participation, however, these vary according to the implications of how citizens have been engaged or involved.

Another of the results found has been the work of Szendi (2021), who has mentioned that to achieve the objectives of similarities can be achieved using the Penta helix model, which is based on the cooperation of the public and private sectors, academia, civil societies, entrepreneurs and citizens. This model has been an extension of the triple helix concept, which originally referred to collaboration between government, industry and academia to foster innovation. However, two additional dimensions, civil society and environmental entities, have now been added. This model has been used in the context of social innovation, where collaboration among diverse actors has been the key to recognizing the importance of citizen participation and sustainability in the innovation process.

On the other hand, in Mexico Smart Cities and social innovations the reality has been politico-social, they have been a category within the Political Constitution of the United Mexican States, the State has considered within its public policies the areas corresponding to the benefit and improvement of citizens such as economic, health, education and security (Gonzalez and Luna, 2019). The constructions of these approaches and similarities in the path of Smart Cities oriented in social innovation, constitutes a contribution in the different alternatives to solve the different problems at the social and local level. The generation of public policies that seek to ensure citizen participation for the benefit of society and improvement of the quality of life of citizens may differ according to the localities.

In the particular case of Mexico, one of the problems it has faced is that of vehicular traffic, congestion and pollutant emissions that have impacted air quality and the mobility of citizens; the possible solution has been the implementation of a sustainable urban mobility project based on intelligent technologies and concepts of social innovation. Bautista Flores and Hoyos (2021) integrated the variables that make up the concept of smart urban cohesion, to be able to construe and describe the current state, involving the dimensions; socio-spatial (sustainable urban mobility and economy), smart (technologies), local planning and social innovation (social participation, plans and programs). Thus, the practical case that uses the technological factor to improve user mobility has been that of the Metrobus in Mexico City; its first innovation was the Global Positioning Systems (GPS), the control centers (which do not interact directly with the user), and the second was the access control and toll systems, security, card payment systems, information system and wifi.

Based on its authors Cariño and Fuentes, (2022), although the public value it has brought to the citizenry has been a complex model, not all public value references can be technologized, the use of Wi-Fi in transportation does not contribute to improving mobility, however, it has been accepted by users, so the technology has not fully matched the desires of users. Safety and connectivity with other intelligent systems are key aspects that must be addressed to achieve intelligent mobility. In the case of smart traffic lights, they represent an improvement in urban mobility and reduction of traffic accidents, which are monitored in real time and demonstrate an innovative and adaptive approach to vehicle flow management, have the ability to adjust traffic light cycles according to demand and schedule directly from traffic efficiency, thus improving mobility (Gómez et al., 2022).

The importance of considering smart mobility from a more holistic perspective is highlighted; however, it has been proposed as a long-term goal in Mexico, as part of strategic planning for sustainable urban development, in the context of smart cities to improve the quality of life of their inhabitants.

DISCUSSION

The development of the "Smart City" model or term, which has to do with the social and its functions, has led to the development of the "Smart City" model, which has to do with the social and its functions.

In the case of Mexico, with public policies, as well as social innovation. It requires its study at the local level, the research conducted in Mexico based on Smart City models have been focused on public entities (Deloitte, 2016; Rodriguez, 2021), because they are part of the actors involved, which have presented some established initiatives with technologies that have been implemented, have generated their policies at the local and federal level (Alvarado-López, 2020).

However, as has been presented, the participation of different public and private actors is required, as well as administrations, institutions and companies. These are aimed at inclusion in order to maximize the good living of citizens by addressing issues such as poverty, inequality, education, among others, and are oriented towards social innovations, in harmony with nature, with the analysis of the needs of citizens, the city, and above all with a focus on innovation and sustainability. As mentioned, both smart city initiatives and social innovation projects must be adapted to local contexts. Solutions must be designed taking into account the specific characteristics and needs of the community or city in question.

Considering the unique particularities of Latin American countries, it is recommended to establish participatory and cultural approaches, which could involve community dialogues, to understand their needs, to co-create initiatives, innovative solutions and to be able to establish strategies contributing to the sustainable development of inclusive smart cities. Another important aspect for future research would be to address economic and financial aspects of these initiatives. The implementation of advanced technology may entail costs, which are not reflected and should be considered in infrastructure investment, personnel training, impact on operational efficiencies and environmental considerations, to mention a few, for an efficient implementation.

CONCLUSIONS

The article presents an exploration of the relationship between smart cities and social innovation, highlighting its evolution and showing the different interpretations and approaches to both concepts. The intersection between Smart Cities and social innovation emerges as a comprehensive approach to address contemporary urban challenges, this transformation of traditional cities into digital environments, revealed as a strategy to improve the quality of life of citizens.

The emergence of the Smart City concept has not been a unique perception, but rather different interests and practices coexist, for this reason there is no unanimous discernment, however, it has evolved towards a more inclusive conception focused on citizen participation. Similarly, social innovation has adapted to emerging social priorities in the search for social welfare and generating a level of sustainability has become an essential component. The complexity of today's challenges requires innovations, the strategy to strengthen the inclusion of digital technologies and potentiate their development.

At the social level, citizen participation is indispensable, which is why citizen participation is key to having opportunities in matters of social interest and benefit.

In the current era, in which different concepts have emerged with multiple involu- ted actors, it is in the interest of public administrations, companies and societies to put forward their demands and strategies, so that governments can take action on participation and common interests, as innovative practices aimed at the well-being of citizens and the creation of a positive impact on the environment. Taking into account the real needs of citizens can be the starting point for selecting appropriate technologies and paths. In the specific case of Mexico, a gradual progress of adoption requires a holistic vision in order to achieve a significant impact. However, there are particular challenges and it is necessary to generate knowledge and awareness to help address the issues. It is important that public administrations establish their policies for the planning of smart cities oriented in social innovation integrating digital strategies, addressing the benefits of stakeholders.

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