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Technological, policy making and citizenship aspects in the development of smart cities

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Abstract

The paper aims to introduce how cities cope with the concepts of smart city development and implementation of its ecosystem. The concepts are presented with a systematic approach, i.e., a holistic analysis of resources about smart cities' latest technological developments and organizational approaches. Within the holistic approach, the paper connects three dimensions of social change for higher life quality and higher speed development by balancing: i.) The sustainable urban policies; ii.) An increase of speed is viable primarily through softer infrastructures as information and communication technologies switch cities into smart cities and iii.) Broadly meant citizens and other key stakeholders- whose attitudes, behaviors and action patterns must evolve to be viable. How do citizenship policies and smart cities policies structurally couple, for example, in setting the political or administrative procedures? Smart city governance implies organizational development, policy modeling, and policy-making, considering that research determines policy, determining politics. This work provides an overview of the state of the literature's art, some inputs about three-dimension governance and policy expanding citizenship into smart citizenship, and a case study for starting to apply policy assessment.

Keywords: smart city, urbanisation, socio-economic aspects, governance, public administration

Riassunto. *Aspetti tecnologici, politici e di cittadinanza nello sviluppo delle città intelligenti*

Scopo di questo lavoro è mostrare come le amministrazioni cittadine stiano affrontando i concetti di "smart city" e di implementazione dell'ecosistema. Tali concetti sono presentati attraverso un approccio sistemico, ovvero uno studio olistico sugli ultimi sviluppi tecnologici e approcci organizzativi relativi alle cosiddette città intelligenti. In tale ambito, il lavoro pone un nesso fra tre dimensioni di cambiamento sociale centrali ai fini di una migliore qualità della vita e uno sviluppo più veloce; tali dimensioni sono: i.) politiche urbane sostenibili; ii.) infrastrutture "soft" come le ICT e iii.) accoppiamento strutturale fra politiche di cittadinanza e "smart policies", ai fini, per esempio, dell'elaborazione di procedure politiche o amministrative. La governance delle "smart city" implica sviluppo organizzativo, modellizzazione delle politiche e del processo decisionale, anche considerando il fatto che la ricerca determina la politica, la quale, a sua volta, determina specifiche "policies". Questo lavoro fornisce una panoramica dello stato dell'arte della letteratura sul tema, degli input sulla governance basata su tali tre dimensioni, nonché sulle politiche di transizione da cittadinanza a cittadinanza intelligente; si proporrà inoltre un caso di studio come esempio di valutazione delle policies implementate.

Parole chiave: smart city, urbanizzazione, aspetti socio-economici, governance, pubblica amministrazione

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1. Introduction

Urban environments (hereafter referred to as cities) are considered to develop their peculiarities according to their geographical location and historical development, making them different. Thus, cities cannot be classified as a static system because it continuously changes and adapts to local and global environmental changes. For example, cities are growing at an unprecedented rate compared to rural areas. For the first time in 2007, the

global urban population exceeded the world's rural population. Thus, it is estimated that the current population of people living in urban areas is approximately 55%. The level of urbanisation worldwide is changing rapidly over time, and projections suggest that by 2050, 68% of the population will live in urban areas (United Nations, 2018). Thus, it is estimated that cities' total area world coverage will triple over the next 40 years (Ritchie and Roser, 2019).

This rapid expansion of cities requires authorities to ensure that cities are inclusive, safe, sustainable and in line with goal 11 of the United Nations Strategic Development (SDGs) plan by 2030 (Ritchie, Roser and Ortiz-Ospina, 2018). In line with contemporary discourse on urban development strategies, sustainable urbanisation must consider innovative technological solutions to formulate strategies for transforming a classic city into smart cities. Anthopoulos (2017a) provides a sophisticated mechanism that allows us to learn about the often-unintended interplay of human, environmental and socio-economic factors arising from technological solutions.

The city is understood as an urban ecosystem that originates from the community. In this context, urban development strategies focus on introducing innovative technological solutions, such as the Internet of Things (IoT), Internet of Services (IoS), artificial intelligence technologies, blockchain technologies, new sustainable materials, introducing new economic models (sharing economy, circular economy), as well as the transformation of mobility, health, government, education and social inclusion in smart systems which based on the citizen-centric technologies that lead to the continuous development and emerging the semantic characteristics of the smart city (Han and Hawken, 2018; Sepasgozar *et al*., 2019).

The Buzzword smart city was considered an “urban labelling” phenomenon in the early years of the 21st century (Komninos, 2011). Krivy (2018) points out that a smart city's concept is incompatible with the urban environment's unobtrusive and informal character. As such, it represents the corporatisation and expansion of entrepreneurship as the goal of urbanisation. It thus promotes social and urban inequalities. Another problem with the smart city concept is that it is increasingly creating a control society (in recent years, we have

witnessed the rise of the so-called surveillance economy in cities). In this article, a smart city is conceptualised as a set of peripheral smart city network practices and smart city projects' central practices. Engelbert, Zoonen and Hirzalla (2019) point out that the EU is dominated by the pursuit of "smartness" as a prestigious adjective to a city that often means obtaining grants or affordable founds for the European context from state or urban development loan agencies. The authors point out that projects tend to exclude citizens' perspectives and interests. Therefore, they suggest that politicians, urban planners and researchers, who so commendably wish to position and treat citizens as key stakeholders in smart European cities, more explicitly reflect their roles in maintaining and challenging this creative logic. As part of the preparation of a new organisational strategy, city administrations should, therefore, be aware of the importance of the development of Internet technologies in the 21st century and the processes of digitalisation and informatisation (cyberspace) of public administration (Josserand, Teo and Clegg, 2006; Paulin, 2019). Namely, when designing smart city strategies, the city must take into account the views of multi-stakeholders (municipal departments, smart city agencies, the mayor, public companies, private companies, public-private partnerships, universities, institutions, and of course, citizens) in order to ensure a bottom-up approach and user-centred approach (Castelnovo, 2019; Tomor *et al.*, 2019).

The article aims to present how cities cope with cities' digital transformation, implementation of new urban management models, and how their ecosystem is based on a holistic analysis of smart cities' resources. In doing so, we focus on the question of how to organise, e.g. government-governance structure (model) of a smart city that will meet the needs of all relevant stakeholders of the smart city and enable them to create added value (from the quality of life to shared cultural values, infrastructure, setting up projects and, of course, financial well-being) as part of their functioning within the urban ecosystems. The article's structure thus includes a chapter on the importance of ecosystems and stakeholders; the next chapter focuses on aspects of the smart city, followed by presenting the smart city's organisational and management structures.

2. Smart city as a complexity socio-technological ecosystem

Urban environments comprise complex ecosystems involving various stakeholders with specific needs and requirements, including health, energy, security, mobility and public services (Nam and Pardo, 2011). For example, cities are now considered urban ecosystems, which means that they are composed of complex systems involving various interactions and dependencies (Anthopoulos *et al*., 2016; Komninos and Mora, 2018). The systems are further influenced by the additional digital components, enabling the development of a so-called "brain" system. This component affects that the city is understood as, cyber-physical social system (Cassandras, 2016). Such an ecosystem is based on the information and communication infrastructures and urban data platform (it is expected that cities will serve 300 million European citizens with competent urban data platforms by 2025) (European Comission, 2020), which presents a central data hub. The data comes with using sensors, cameras and open data sources. The smart data platform (different European cities such as Amsterdam, Copenhagen, Munich, Vienna are implementing smart data platform) is defined as an open, secure and city-wide platform. The platform is organised as a system for collecting, processing, analysing, interpreting, storing and distributing the collected urban data on mobility, energy, urban life and masses. The task of the platform is to convert raw data into value-added information. In this way, it ensures better urban planning and quality of life in urban areas. It is expected that soon, the development will have an impact on the establishment of autonomous management, and data analysis will be based on artificial intelligence. The goal, of course, is to inform the citizens (Kumar *et al.*, 2020).

In scientific literature, two main dimensions have identified that influence the realisation of a technologically advanced urban environment. Firstly, with the rise of ecosystems, there is a need for a high level of cooperation, both between actors, which affects the formation of public-private partnerships and between cities themselves (Schaffers *et al*., 2011). Cooperation between urban centres often involves exchanging information with stakeholders in a data system for urban development purposes (Edelstam, 2016). The degree of cooperation depends on the actors' willingness to cooperate, who accept the

implementation of the common data system.

Second, smart cities are irreversibly transformed into complex ecosystems, and the role of urban governance must change. Local authorities are increasingly assuming the role of ecosystem leader, leading to conflicts and sometimes conflicting stakeholder goals (Visnjic *et al.*, 2016). Urban environments can reach their full potential when the highest level of stakeholder involvement is achieved. The key factor for local governance is, therefore, stakeholder motivation.

In the next chapter, we focus on key aspects relevant for understanding the importance of operational, organisational and management mechanisms for developing a sustainable smart city.

3. Smart city aspects

3.1 Urban aspects

Both in practice and the literature, various experts ask whether smart cities are also sustainable cities. We answer that they are and refer to the assertion that a smart city comprises four key urban aspects that are essential for achieving its sustainability (sustainable urban growth and urban economy): (i) density (building density), (ii) mobility and connections (intelligent urban mobility), (iii) mixing of purpose and function (condensation of functions and programs) and (iv) public space and participatory urbanism (involvement of the profession and the public - involvement of all actors in building a smart city). All these aspects have to be considered and presented if the city wants to achieve realisation.

Density is one of the most critical factors of a sustainable city. The density factor enables us to control the amount of development and manage the number of actors in a given space. The building density process allows for better land use, thus preserving undeveloped land

destined for the natural environment or agriculture. The density factor within a smart city can also be used concerning the actors' physical location, traffic, and public transport.

Due to the passenger car's affordability and the economy's dependence on constant economic growth, cities are developing large suburban areas, typically characterised by low building density and the absence of the intertwining of various functions. Suburbs are attractive for investment because of less complicated ownership situations (usually vast land with few owners) and easier access to the construction process. The result is large areas of suburbia, which today are increasingly turning into post-suburbia - a mixture of decentralisation and suburbia urbanisation (Keil, 2018). The process of post-suburbanisation and the development of smart cities (smart suburbs) could make a significant contribution to sustainable urban planning in the future.

Suburbia, as a phenomenon, is primarily inclined to use a passenger car and makes public transport uneconomical, thus eliminating an essential aspect of sustainable cities. Sustainable mobility today means using public transport, walking and cycling and is seen as one of the fundamental approaches to transforming cities into sustainable cities, as is the case in Copenhagen (Gehl, 2010). New smart technologies, such as car-sharing, automated driving, public on-call transportation, co-travel via mobile applications complement and upgrade this process.

Stakeholders are expected to reach most of their daily needs and services via a smart network or on foot. Mixing goods and services allows for another process in cities to be regulated - gentrification. Policies on balancing interests between different stakeholders prove to be an essential part of managing sustainable urban development. Smart city systems, with their data capture and interpretation of data, better define and understand interests.

The public space is part of the city where most of the individual actors' ideas and different views come together. Investing in public space and supporting the creative processes of democratic expression in public space thus leads to higher tolerance and mutual understanding between the various social groups. Recently we have observed an increasing presence of participatory urbanism in European cities, where people are developing a more

democratic and open approach to the development of their cities through various initiatives and tactical urbanism (bottom-up urbanism or tactical urbanism) (Lydon and Garcia, 2015). Smart systems make these processes and initiatives more transparent, accessible and visible to users. Communication between residents and decision-makers is, therefore, faster and more precise, while on the other hand, it poses a problem for those actors who do not have adequate access to technology (Molinari and Ferro, 2009; Yigitcanlar and Lee, 2014).

The smart city projects aim to understand the smart and/or sustainable infrastructure as networkers between places and people to create a more sustainable, greener, healthier and resilient future for citizens. City governance strategies must take into account global socio-economic factors, technological development and citizens' needs. Urban populations are ageing, and for this reason, local authorities must include technological solutions that affect older citizens' well-being in their investment programmes for urban technologies. These are: (i) home automation for independent living, (ii) health & well-being for functioning and (iii) communication - ICT for active participation. These technological solutions include the implementation of IoT and the Internet of Services (IoS) through everyday urban processes, the so-called "Smart Cities Initiatives" (Albino, Berardi and Dangelico, 2015). These initiatives include small, independent applications and large projects that transform all urban areas in planning and development (Lee, Phaal and Lee, 2013). The implementation of IoT and IoS enables communities to observe, understand, analyse and plan different urban life aspects. Stakeholders need to understand that they can achieve livable cities through quality management and continuous analysis of the above aspects. Stakeholders can use the Performance Indicators (KPIs) developed by the United Nations initiative United for smarts sustainable cities (U4SSC) to assess smart, sustainable cities (Belli *et al*., 2020).

3.2 Technological and socio-economic aspects

In connection with the use of technologies in the urban environment, two practical implementation concepts must be considered. The European approach to the sustainable and

technological development of the urban environment is based on creating initiatives involving the main urban actors. Such examples can be found in existing urban centres such as Amsterdam, Barcelona, Vienna, London (Bomstein *et al*., 2014). One such model for the urban development of a suburban area is the Aspern Vienna project, which will be completed in 2028. The partners (stakeholders of the city) of this project are public service companies (Wien Ernegie and Wiener Netze), Vienna 3420 (project development). Among other stakeholders, the project is based on a joint venture agreement. As part of its development, the cities are increasingly expanding into underdeveloped and non-urbanised suburbs and rural areas (Kantor, 2019). The sustainable development of cities and their transformation into smart cities enable their integration into so-called smart regions, as planned for the Vienna-Brno-Bratislava axis (Roblek, 2019). To this end, the authorities, together with the regional leadership, must develop guidelines for integrated sustainable policies aimed at improving the living conditions (building infrastructure, providing housing, kindergartens, schools and creating the conditions for the growth of entrepreneurship) of urban and rural residents, while strengthening the links between urban and rural areas based on their existing economic, social and environmental relations (Lawton, 2018).

Another approach has been developed by multinational companies like IBM, Cisco Systems and Siemens AG. They approached the idea of building new high-tech city centres. In recent years, urban centres such as Songdo (Korea), Masdar (UAE) or the PlanIT valley (Portugal) have emerged. The researchers have split this concept into two. Thus, opponents of the concept emphasise that it does not take into account actual knowledge of how cities function and represent "empty" spaces that do not take into account complex values, unplanned scenarios and mixed uses of urban space (Cugurullo, 2016; Shwayri, 2013). On the other hand, we find advocates who consider developing intelligent technologies in urban environments to be essential for empowering citizens, assuming that the technology adapts to their needs (Kitchin, 2015; Vanolo, 2014).

In recent decades, industrialisation and urbanisation in Asia, South America and Africa have accelerated. Especially in Asia, South America and Asia, more and more people

migrate to the middle class due to economic growth. Therefore, accelerated urbanisation is attracting more and more people from rural areas, as these often offer better opportunities for living, working and studying. However, urbanisation has also created problems that are still unresolved and are rapidly undermining the benefits it once brought, such as increasing pollution, traffic congestion, waste and crime. For these reasons, one can argue against the desire to develop new large metropolitan areas. One such example is a Chinese project for new capital in Sri Lanka called Port City. By way of exception, most of these projects are ecologically and socially unacceptable because they significantly impact the destruction of the human habitat (Safi, 2018).

With the development of technologically driven urban networks, the role of local authorities is changing rapidly. Traditional roles and functions of local government are shifting to the so-called "Local Governance of Public Networks" (Span *et al*., 2012). Local authorities face the challenge of perfecting smart cities as an environment for innovation, empowerment and the involvement of their citizens, businesses and other stakeholders (Schwarz-Herion, 2020).

As urbanisation increases worldwide, more and more cities participate in developing and establishing urban technologies in different parts of the centres and for different purposes. However, technologically advanced and innovative urban environments perceive human capital as the engine of urban growth rather than merely assessing technological infrastructure (Albino, Berardi and Dangelico, 2015; Lee, Phaal and Lee, 2013). Cities are generally considered technologically advanced when communication infrastructures such as transport and ICT, together with investments in social and human capital, promote sustainable economic growth. As a result, participatory urban management improves the quality of life and makes more efficient use of natural resources (Caragliu, Del Bo and Nijkamp, 2011; Nilssen, 2019). Participatory leadership and citizen participation are becoming key concepts in many technologically advanced environments (Meijer and Bolivar, 2016). So-called innovative and technologically advanced urban projects focus primarily on solving societal problems by developing efficient energy systems and other natural resources (Berrone, Ricart and Carrasco, 2016).

3.3 Political and public administration aspects

The decision to transform the city into a smart city is highly political. Therefore, the city administration must prepare political priorities and strategies, considering both the financial capacity and the complexity of the problem. In doing so, the city administration must take into account that digitisation as an information technology that drives the functioning of the urban ecosystem into cyberspace (Paulin, 2019), it must replace Weber's existing bureaucratic model with a post-bureaucratic model that represents the direction of development of organisations that strive for horizontal forms of organisation (Höpfl, 2006; Kira and Forslin, 2008; Laffin, 2018). Post-bureaucracy is involved in processes of internal and external organisational change. Central internal change is aimed at the functional decentralisation of management structures. Horizontal coordination enables the increased use of project work and other forms of co-management. Civil servants are expected to develop the ability to organise themselves in carrying out operational tasks and project cooperation (Miles *et al.*, 1997). An important political and economic factor is also to ensure the establishment of public-private partnerships. Post-bureaucratic models are still based on the so-called ideal type of the Weber model because the old rationalisation mechanisms are combined with the new principles of networking and democracy. The hierarchy itself cannot be removed entirely from a complex organisation such as the city administration. Post-bureaucracy, therefore, does not mean the end of the dominant Weber model, but the organisation and its leadership take democratic mechanisms into account in the post-bureaucratic model and is known as a democratised bureaucracy (Riggs, 1997).

It is essential by developing smart governance strategies to remember that one of the fundamental characteristics of public administration, which clearly distinguishes it from the private sector, is its public relations work. In the private sector, companies are perceived by the public as potential customers or clients. In the public sector, stakeholders include citizens, citizens' groups, businesses, non-governmental organisations, interest groups, political parties, public institutions, and other public organisation forms (Holzer and Charbonneau, 2008, p. 9). In the context of the urban management of a smart city, a public

official's increasing role thus gains the task of serving citizens and the community by helping citizens articulate and fulfil their common goals. Thus, a public servant's role is not to control the company or steer it in new directions. In political administration and public administration, this responsibility extends beyond the direct decision-makers to the citizen.

Bourgon (2007) tried to close the dichotomy of public administration between political and administrative spheres and bring them together in a familiar learning environment where citizens can better perceive policy-making and decision-making to adapt the social capacity enables a dynamic balance in society. The researchers support these changes in public administration and facilitate citizens' participation in decision-making in public affairs, especially at the local government level, making the smart city a highly appropriate implementation environment (Nabatchi, 2012).

A combination of innovative practices to improve public service delivery and citizen involvement in the policy process is being developed. The first phase involves participation and, in the second phase, the concept of responsible and transparent decision-making in the development and implementation of public policies and concrete public projects while introducing digital technologies. Urban data systems as an interface for smart governance enable the political city administration to build a smart governance system that is understood as a framework for the democratic political governance of a smart city (Anand and Navio-Marco, 2018; Barns, 2018). Different authors (Bolivar, 2018; Castelnovo, Misuraca and Savoldelli, 2016) therefore conclude that smart city government, provided that it implements policies effectively, provides a framework for a public administration tool that promotes public trust in government institutions at all levels of an organisation. Smart governance plays a critical role in participating in initiatives in a city where processes of complex dialogue take place between government (providers), citizens (demand) and other stakeholders (Pereira *et al*., 2018). Open innovation, therefore, plays a crucial role in this process. Its implementation in city administration's digital processes allows the transformation of a customer-centred perspective into a community-centred «perspective that incorporates the community's social capital» (Petrou and Daskalopoulou, 2013, p. 52). This process also influences the transformation of leadership in the technologically

advanced development of the urban environment. Depending on the degree of transformation of "smart city governance" in each city, it is assessed on a scale ranging from institutional preservation to institutional transformation (Meijer and Bolivar, 2016; Florida, 2010). It can be said that the digitisation of the public apparatus contributes to political decision-making and thus contributes to the emergence of an ethic in this context (Yolles, 2019).

Political systems (democratic or not) must be viable, and they need value and stability. The value represents the public good, while stability is enriched by substantial evidence of that good. In a smart city, its administration can enrich value and stability through processes that increase economic transparency and prevent corruption in the public sector. These processes include data openness, transparency, accountability and evidence of effective management. Corruption affects efficiency, and both factors are responsible for the loss of credibility and trust among voters. Schildkraut (2011) believes that the effectiveness and trust of citizens together make political leadership possible. A loss of trust can lead to political instability. It is worth mentioning the importance of cyberspace, which plays an increasingly important role in restructuring the public administration's bureaucratic system. Cyberspace offers opportunities to translate individual preferences into collective decision-making and provides a mechanism for direct democracy, initially at the level of smart cities (bottom-top approach). In this case, cybernetic space will probably become a place of co-governance in the future.

The decentralisation of city administration and its responsibilities does not mean that the authority has withdrawn from regulating the system. In practice, it means that processes are regulated indirectly. In this case, the actors regulate their activities themselves (Giddens, 2009). The next step is self-regulation, in which technology enables the unmediated creation, storage, retrieval and modification of information that determines the eligibility of legal entities in a society (Paulin, 2019).

4. The infrastructure organisation for the performance of smart city governance

Governance structures in smart cities present an important driving force for their development. However, this practice area has not yet been sufficiently researched (Neves, de Castro Neto and Aparicio, 2020). It is essential that smart urban management, seen as a complex process, involves all the key players. Moreover, they are also influenced by different phases of the process and at different government levels (Borghys *et al*., 2020). Based on stakeholders' importance within a smart city, we can say that stakeholders in the urban ecosystem have individual needs and reasons. Therefore, conditions need to be developed within the urban ecosystem that allows stakeholders to create added value (Maraña, Labaka and Sarriegi, 2020). In other words, we are talking about an urban ecosystem of opportunities that enable value creation (De Valck *et al*., 2019). In this context, ecosystem governance is the link (e.g. financial resources, knowledge, talent, leadership, supportive infrastructure, transparency) needed to seize these opportunities and turn them into value. The course itself will depend on the characteristics of each urban ecosystem model (Stam, 2015). Cities such as Amsterdam, Barcelona, Vienna, Milan and Turin are committed to economic development, the adoption of sustainable approaches, and, consequently, an approach that aims to improve citizens' quality of life.

In contrast, cities in the United States (New York, San Francisco) and Asia (i.e. Hangzhou Hong Kong, Shenzhen, Seoul, Singapore, Songdo) strive to develop and implement smart urban solutions and approaches. Thus, they are primarily concerned with the technology-centred approach to designing a smart city that primarily supports the industry. Besides, sustainable solutions are to be offered that enable the citizens' life quality. Korean Songdo presents a case of the “high tech utopia”. The city where computers are built into its streets and condos to control traffic and let neighbours hold video chats is still less thant half built and is considered a “ghost town”. (Benedikt, 2016; Petit and White, 2018; Shwayri, 2013).

Based on European cities' analysis, especially Amsterdam and Vienna (Bomstein *et al*., 2014; Fitzgerald, 2016), observations are made within this urban governance model. The urban governance model is reflected in the organising committee, composed of the head of

the city administration, the heads of the city administration sectors, the heads of the public enterprises and public services that oversee this political administration. External consultants advise this body. However, the urban planning department, internal and external stakeholders (according to the city administration) and the public agency manage the projects at the operational level. The active part is managed by the head of the city planning department. Vienna's example shows that the city planning department plays a vital role in developing smart city strategies. The smart city public agency's main task is to support the task force and cooperate with internal and external stakeholders to prepare and implement projects. When preparing projects, European cities have recently focused on the so-called green city concept (Barcelona, Lisbon, Dublin, Vienna, Milan). Their strategy is networked all sectors (stakeholders) active in the smart city areas as an urban ecosystem where they can develop, produce and use "smart" open innovation with the critical objective of energy efficiency and climate protection.

The smart city administration can create a two-pronged organisational chart for managing a comprehensive project. The first level is political and is headed by the mayor of the city. The politicians' task is to develop a political agenda (strategy) to set priorities and strategies to enable further development. A smart city strategy's main objectives are integrating energy, mobility, urban planning, and management. The primary purpose of linking these areas is to ensure the implementation of the urban ecosystem society's environmental and social aspects and introduce a participatory approach to decision-making on crucial urban planning orientations and policies (Anthopoulos, 2017b).

The second level is operational and involves both the municipal (public) administration and external regional partners in regional development and other joint projects (e.g. mobility). A "Smart City" initiative is organised within the cities, involving the municipal public administration and public enterprises on the one hand and private enterprises and civil society. The city's citizens' initiative is to establish constructive cooperation between all key players in the smart city. We will use Vienna's example to show how the individual initiatives work; in 2014, they launched an initiative called the Digital city Wien. This initiative aims to establish Vienna as a central ICT hub in the wider region and, to this end,

to ensure its strategic positioning and promote it regionally and internationally. The stakeholders involved focused on the development of data security projects, digital literacy projects and the establishment of digital literacy popularisation programs (educational app, an app for older people for social inclusion), the provision of services for the inhabitants of the ecosystem (e.g. e-health, public transport app, construction initiative, Women in IT, refugee initiative, industry and the Vienna digital platform; Digital city Wien, 2020). To implement "smart city" projects, the city administration must establish management mechanisms that balance the various stakeholders' needs and objectives. The city administration works with stakeholders and project owners within the management framework, from preparing the joint strategy to its implementation in practice. More practical examples show a bottom-up project approach (from an individual, initiative, institution or organisation to the city administration). Moreover, the establishment of a quadruple-helix governance system contributes to a more effective stakeholder response to the development of technological, participatory projects, sustainable and environmental adjustments within the urban ecosystem, which also contribute to cost savings, added value, return on investment (Caragliu and Del Bo, 2019; Tomor *et al.*, 2019).

The smart urban management infrastructure organisation depends on the city administration's strategic orientation and the main actors. The development of sustainable, natural and smart cities is underway, and smart management models that address sustainable urban development issues and the urban environment and democratic participation will emerge in the future.

5. Conclusion

The theoretical article focuses on the smart city's importance as a complex mechanism based on a technological and engineering-led approach. The consequences of the technological approach of development are visible in social and economical, and environmental fields. The fourth industrial revolution has brought about the emergence of

computerisation, the consequences of which are visible in the emergence of computerised entities that can be created, controlled and transformed within cyberspace. The purpose of smart urban projects is to understand smart and/or sustainable infrastructure as a network between cities and people to create a more sustainable, healthy and resilient future for citizens. City strategies must, therefore, address global socio-economic factors, technological development and citizens' needs.

The paper's main aim is to present the latest technological developments and socio-economical approaches in smarter cities. In research, we proceed with a systematic approach to the technological changes in the smart city ecosystem. Thus, we anticipate that the consequences of informatisation technological solutions on smart urban management. The Paper is also briefly focused on the importance of sustainable smart city development. The last part of the paper highlights the smart city governance's organisational and management structures' theoretical and practical view.

The main limitation of the paper is that it is based on the literature review. In the future, it will be necessary to prepare the research in some cities to find out the citizens' opinions about their cities' approaches, policies, and strategies and determine how residents perceive a smart city.

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