

SMART CITY AS AN ECOSYSTEM OF INNOVATION AND ENTREPRENEURSHIP:
WHAT OPEN INNOVATION MEANS FOR CITIES

İNOVASYON VE GİRİŞİMCİLİK EKOSİSTEMİNDE AKILLI ŞEHİR: ŞEHİRLER
İÇİN AÇIK İNOVASYON NE ANLAMA GELİYOR

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Özet

Kentleşmedeki büyüme, şehirleri, şehir sakinlerinin artan taleplerini karşılamaya zorlamaktadır. 2050 itibariyle şehir nüfusunun toplam nüfusun %68,4'ü olması beklendiğinden, şehirler mevcut fiziksel altyapılarını optimize etmek için bilgi iletişim teknolojilerini kullanarak bu zorluğu gidermeye başlamışlardır. Bu kavram akıllı şehirler olarak adlandırılmaktadır ve teknolojiyi kullanmaktan daha fazlasını gerektirmektedir; zira şehir yönetimlerinin çabaları giderek artan sorunların hızına tek başına ayak uydurmak için yetersiz kalmaktadır. Bu nedenle akıllı şehir olmak, yenilikçi ve girişimci bir zihniyeti ve şehirdeki tüm paydaşların iş birliğini gerektirmektedir. Bu çalışmada bir akıllı şehir tanımı önerilmekte, açık inovasyon modelinin akıllı şehirlere nasıl uygulanabileceği ve bu modelin şehir yönetimi tarafından nasıl yönetilebileceği incelenmektedir. Açık inovasyon araştırmalarını derinleştirmeyi hedefleyen akademisyenler ve modeli uygulamak isteyen uygulayıcılar için bu çalışmanın bir başlangıç noktası olması öngörülmektedir.

Anahtar Kelimeler: Açık İnovasyon, Girişimcilik, Akıllı Şehir

Jel Sınıflandırması: M13, O30

Abstract

The urbanization growth is pressing cities to meet the growing demands of the city residents. As urban population is expected to be 68.4% of the total population as of 2050, cities have started to address this challenge using Information Communication Technologies to optimize their current physical infrastructure. This notion is called smart cities and it is more than using the technology; because city governments' efforts alone are not enough to keep up with the pace of ever-increasing issues. Therefore, being a smart city requires an innovative and entrepreneurial mindset and collaboration of all the stakeholders in the city. In this paper, a smart city definition is proposed in order to examine how open innovation model can be applied to smart cities and how this model can be governed by the city management. This can be a starting point for academicians who aim to deepen the research in open innovation and for practitioners who wants to apply the model.

Keywords: Open Innovation, Entrepreneurship, Smart City

Jel Codes: M31, O30

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1. INTRODUCTION

In 2007, world's urban population had slightly exceeded the rural population for the first time in history. As of 2019, our earth hosts 7.674 billion people, 55% of who live in urban areas (The World Bank, 2021) that cover only 2% of earth's landmass (Nam & Pardo, 2011). United Nations (2021) foresee that the urban population rate will be 68.4% as of 2050. The global urbanization megatrend (Richter et al., 2015) is putting increasing pressure on the physical infrastructures necessary for the city to survive as a livable place. The challenges are mostly observed in domains such as mobility, environment, security, and safety (Yun & Lee, 2020). As the history shows us, humanity have always used technologies to overcome these kinds of problems they had faced (Fikirli & Çetin, 2017). Cities are no exception: The notion of smart city has been evolved to find ways to solve complex city problems that are generated by rapid urbanization. Smart city approach envisions the use of Information Communication Technologies (ICT) to optimize the current physical infrastructure and resources for city residents' increasing demands.

However, the city managements lack necessary competencies (Ferraris et al., 2020b) to create smart services that require an innovative and entrepreneurial mindset (Damanpour & Schneider, 2009). Therefore, they must choose the role of facilitating the city stakeholders' collective efforts of creating innovation through entrepreneurship. This facilitation is basically the governance of the smart city. Researchers mostly focused on the technological aspect of smart cities rather than its governance (Nam & Pardo, 2011), notwithstanding the literature on smart cities have grown for more than three decades in academia (Hollands, 2008).

In this context, how cities approach governance to increase innovation and entrepreneurship is examined in this study. It also presents an up-to-date picture of the ever-evolving literature on the subject. Moreover, the as-is situation of open innovation approach and why it is important for smart cities are discussed.

The article is comprised of 4 main sections. The Introduction puts forward the rationale for the study. The second section discusses the smart city concept and proposes a definition. The third section presents how innovation and entrepreneurship are interrelated with smart cities and how they must be approached in terms of governance. The fourth section follows up with a discussion and conclusion of the outcomes of the study against its objectives.

2. SMART CITY CONCEPT

Although the smart city concept has become popular during the last decade (Dameri & Rosenthal-Sabroux, 2014), its roots go back much further (Taewoo & Pardo, 2011; Komninos, 2007). The smart city notion has been studied for more than three decades in academia (Scornavacca et al., 2020). The starting point of the concept is the massive pressure that the cities are under, of meeting the needs and solving the problems augmented by rapid urbanization (Vanolo, 2013) using the physical infrastructure available. To overcome these challenges, the idea of using technology has become popular among all the stakeholders of the cities (Dameri, 2013). The idea has especially emerged from the fact that cities have been using ICT increasingly (Schaffers, et al., 2011). The smart city concept has emerged to deal with increasing challenges by getting more benefit out of the fixed capacity of the physical infrastructure using ICT. In this sense, a smart city uses ICT to monitor, integrate, and control its physical infrastructure, optimize its capacity and the resources it uses (Hall, 2000), and develop new services to improve quality of urban life (Brocke et al., 2009).

Therefore, an ICT infrastructure is the core of a smart city (Graham & Marvin, 2001) and a prerequisite to name a city “smart” (Paskaleva, 2011). A smart city is comprised of digital technologies and Internet of Things (IoT) (Su et al., 2011) of which the connectivity is provided by ICT infrastructure. While the emphasis on technology mostly belongs to digital city and intelligent city concepts, many articles in smart city field also focus on the technology side of smart cities (Nam & Pardo, 2011). However, the smart city is more than just the technology (Leydesdorff & Deakin, 2011), it is also comprised of the infrastructure and the people (Ferraris et al., 2020a) who are at the center of those two. Therefore, it is an overarching concept that incorporates technology and infrastructure with why and how they are critical for people. Smart cities have several common aspects, although there is still no agreement on a smart city definition and what its benefits are (Deakin & Al Waer, 2011; Kummithaa & Crutzen, 2017) due to a variety of smart city applications that differ among cities based on their identity and resources (Letaifa, 2015).

The first aspect found in smart city definitions is “living”. Northstream (2010) points out that the purpose of using technologies is to enhance the living experience. Quality of life, well-being of citizens, security, and safety are also addressed in this context (Hall, et al., 2000; Leberecht & Vanderbeck, 2014).

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The second aspect is “economy”, as innovative smart city initiatives developed by entrepreneurs are expected to create new economy and new businesses (Hollands, 2008; Vanolo, 2013).

The third one is “society”, which is mostly used together with economy, therefore referred as “socio-economic”. Many definitions include how smart cities provide socio-economic benefits using ICT (Kourtit & Nijkamp, 2012).

The fourth aspect is “optimization”. In most definitions, a city is considered to be smart if it can optimize its resources and physical infrastructure therefore improve their productivity with the help of intelligent technologies (Caragliu et al., 2011).

“Inclusiveness” is another common concept found in smart city definitions (Hollands, 2008; Dameri, 2013). It stands for the participation of citizens in designing and managing of the city (Kummithaa & Crutzen, 2017). This perspective foresees independent city residents who can make their own decisions about the city they live in and have the awareness to do so (OECD/International Telecommunication Union, 2011). In this sense, it is a critical part of the smart city’s governance, which is also referred frequently in smart city definitions (Ferraris et al., 2020b).

Governance involves the smart city ecosystem that is comprised of industry, citizens, and the government (Yun & Lee, 2020) to enhance entrepreneurship in the city resulting in innovative smart city initiatives (Dameri & Rosenthal-Sabroux, 2014) developed based on the smart city vision (Wilson, 1992; Giffinger & Gudrun, 2010). All these aspects are assumed to be delivered in a sustainable manner in most of the smart city definitions (Heeks, 2002; Bakıcı et al., 2012), taking care of the environment by reducing CO₂ emissions and using the natural resources in a greenly manner (Kourtit & Nijkamp, 2012). Lastly, the development of human capital to build the smart city is widely included in the smart city definitions (Shapiro, 2003; Florida, 2004)

All of these aspects included in smart city definitions are classified into six verticals that stand on the ICT horizontal in the literature: smart mobility; smart environment; smart people; smart living, smart energy, and smart governance (Zygiaris, 2013). Therefore, a smart city definition should include all these aspects. The definition suggested by this study is as follows: “A city is smart when individual and institutional inhabitants of the city become entrepreneurs and an inclusive ecosystem develops innovative city services using ICT with the objective of sustainable socio-economic growth and high quality of life, being mindful of the limits of the natural resources and the physical infrastructure.”

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This definition includes all the stakeholders including the citizens. Entrepreneurship and innovation are also emphasized in the definition. Moreover, ICT and the physical infrastructure that form the backbone of the smart city is covered by this definition. There is a clear objective that puts life and people at the center. Lastly, ecosystem, hence the governance is underlined.

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3.1. Open Innovation in Smart Cities

Smart city, like other high-tech industries, is about innovation and entrepreneurship (Hsiao et al., 2013). Innovation can be defined as making incremental or radical improvements in products, processes, services, and business models (OECD, 2011; Del Rio et al., 2010; Hellström, 2007; Rogers, 1998; Aslan et al., 2016) whereas entrepreneurship can be explained as starting up new organizations to create new values in business, public, academic, or social contexts (Gedeon, 2010) through innovation (Santoro et al., 2019), therefore helping the economy grow (Audretsch et al., 2005). Cities use innovation approaches and include its communities and ICT infrastructure to sustain economic and urban growth and remain competitive.

From an innovation perspective, a smart city can be defined as an ICT-enabled city innovation focused on city infrastructure and processes (Nam & Pardo, 2011) to solve urban problems (Caragliu et al., 2011). In that sense, smart city is a complex ecosystem of entrepreneurship and innovation (Isenberg, 2010) that builds itself (Usai et al., 2018). Smart city entrepreneurs innovate city services and business models that solve citizens' problems through Smart City Projects (SCPs) (Schaffers, et al., 2011). ICT has a critical role in building the smart city (Kummithaa & Crutzen, 2017) and it is complementary to physical infrastructure to form a cyber-physical environment for humans who are at the center of all smart city innovations (Kummithaa & Crutzen, 2017).

Open innovation is an approach that has been gaining traction in the field of smart cities. It is a method promoted by Chesbrough (2003) and it is simply explained as using and collaborating with external human resources as well as internal ones (Chesbrough et al., 2006). Recent studies reveal that open innovation positively affects innovation and entrepreneurship due to the benefits of the mentioned collaboration (Ferraris et al., 2020b). It has already been popular in private sector (Biscotti et al., 2018) and it has been gaining attention by governments lately (Georghiou et al., 2014) in the context of smart cities where stakeholder participation is

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prioritized in the process of city service development (Cohen et al., 2016). The triggering reason for governments to be open to the idea of open innovation is that the public sector lacks necessary competencies for innovation and entrepreneurship (Damanpour & Schneider, 2009). However, the most important aspect of this approach is that it assumes participation of actual users (Schaffers, et al., 2011) who are inclined to innovation as the technology is diffusing into social life. In other words, it is about co-creation of effective city services with the city service beneficiaries. A permeable boundary is created with the city management and the city residents where contact happens to diffuse ideas inwards and outwards.

Living labs are an example of open innovation contact points where different smart city services can be piloted (Paskaleva, 2011). They are the physical spaces that bring city residents as contributors and innovators (Wise & Høgenhaven, 2008) in the process of service design (Mitchell, 2005). By the help of living labs, cities unleash the creative and innovative potential of the entire city (Sauer, 2012), bringing smart city entrepreneurs and users together at the early stage of the city service development process (Schaffers, et al., 2011). Living labs is similar to science and technology parks in the sense that they bring entrepreneurs together in a concentrated setting (Sauer, 2012).

Triple Helix, developed by Etzkowitz & Leydesdorff (2000), is a similar approach to innovation in multistakeholder ecosystems. It explains how innovation occurs with the interaction of three helices: public sector, university, and the private sector (Ferraris et al., 2020a). Although it assumes stakeholder ecosystem involvement in innovation and entrepreneurship, its focus is on the dynamics between the institutions; the citizens seem to be included indirectly from the perspective of the public sector and their role in the government of the civil society (Leydesdorff & Deakin, 2011).

To sum up, open innovation is basically a response to solve the problem of limited innovative talent and mindset in governmental institutions. The aim is to create innovative city services more efficiently and quickly by bringing together the entrepreneurs, the city residents, and other related stakeholders in the city. By developing this ecosystem, an army of people trying to solve the problems of the city can be created. A successful governance of this multistakeholder ecosystem, which will be discussed in the following section of the study, is critical to achieve the innovative end entrepreneurial smart city vision.

3.2 Governance of Open Innovation Ecosystem in Smart Cities

The aim of the stakeholder participation for innovation is to address complex problems that can only be solved by involvement of different parties (Corus & Ozanne, 2012). Most of the smart city initiatives' claim is to solve these complex and multisectoral problems of the city. To accomplish that, creative and open-minded people from several public and private stakeholders, their relationship networks, and citizens (Yun & Lee, 2020) collaborate to develop city services under the uncertainty of development and commercialization success (Sandulli et al., 2017).

Getting together all the stakeholders requires a democratic innovation platform (Hajer & Wagenaar, 2003; Eisenmann et al., 2009) that is expected to be established, governed, and facilitated by the city management (Meijer et al., 2016). The ultimate goal is to be an entrepreneurial ecosystem (Brischiani, 2017) that hosts investors, entrepreneurs, legal systems, universities, and the innovative and entrepreneur culture that tolerates failures (Ferraris et al., 2020b). In simple terms, smart city governance is the enablement of city resident participation, stakeholder co-operation (Castelnuovo et al., 2016), and management of different interest of the parties involved (Rodríguez-Bolívar, 2015). According to Schiavone et al. (2020), stakeholders can be categorized based on their roles as: entrepreneurs, government, framers (technology providers, markets, supply chain), and constituents (citizens, investors, labor).

The synchronization needed among smart people to make the city smarter through innovation (Schiavone et al., 2020) requires a smart approach to governance using ICT. City as a platform (Grech, 2015) or the platform city (Belissent, 2011) concept is a response to address this challenge. It assumes that the smart city provides a collaborative digital platform rising above the big data collected from the city and shared with the city stakeholders (Paskaleva, 2009). Because the big data means new business opportunities (Richter et al., 2015), it can be provided to all the stakeholders of the city in the form of a city service or just as-is, so that the stakeholders can generate new city services using the data. This open data approach to service development accelerates the development of mobile city applications (Deakin, 2014) at a pace that any single institution cannot reach alone. It can be said that the city as a platform works as an entrepreneurship promoter (Parramatta City Council, 2015) by offering the data especially to the technology startups of the city. To sum up, a city becomes a platform city when it is able to integrate applications and data from different verticals (Yun & Lee, 2020) such as traffic management, garbage management, sharing the applications and the data with the rest of the city.

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Through open innovation and similar approaches, smart cities encourage entrepreneurship: The smarter the city, the higher the entrepreneurial activities and technology level (Barba-Sánchez et al., 2019). The innovative atmosphere incubates entrepreneurship that positively impacts the city economy. Cities can choose to accelerate the entrepreneurship by acting as clusters for innovative entrepreneurs (Feld, 2020) to boost coordination among them. They can become startup cities like Berlin and Helsinki (Richter et al., 2015) and provide infrastructure for technology startups, just like science and technology parks and incubation centers do to increase the rate of knowledge transfer rate from universities and entrepreneurs (Kılıç, 2020). In conclusion, they aim to be an attractive destination for business (Zygiaris, 2013).

Looking at the examples of smart city governance; Barcelona aims to increase synergy between all the public and private stakeholders of the city, including the citizens (Ferrer, 2017). Birmingham has a smart city commission to manage the city ecosystem, helps them adopt the smart city agenda, and encourages them to participate in developing smart city services (Birmingham Smart City Commission, 2012; Digital Birmingham, 2014). Dublin engages with entrepreneurs, citizens, academia, and business to address city challenges (Dublin City Council, 2016). Singapore focuses on a digital platform to engage companies and citizens for innovation and creating economic value (Smart Nation Singapore, 2017). Berlin aims to be the center of innovation as a city for smart technologies (Senate Department for Urban Development and the Environment, 2015). Denver has established a smart city team with members from several strategic sectors and work on sharing city assets and data with the city (The City and County of Denver, 2016). Amsterdam has established an innovation ecosystem composed of private sector, public sector, and living labs (Zygiaris, 2013).

Taken together, cities are trying to get “smarter” by fostering open innovation by governing the stakeholder ecosystem in a number of ways. Some focus on citizen participation while others focus on the participation of other city stakeholders. Some provide innovation centers while others aim to become the innovation center as a city. Some focus on technological platforms to share the city data with the city so that the entire city can work on developing smart city services, some focus on facilitating private – public partnership. All in all, these efforts are made to create an environment of innovation and entrepreneurship in the city so that the city can make itself smart, rather than the city government tries to achieve smartness with its limited resources.

CONCLUSIONS AND FUTURE RESEARCH

A smart city definition cannot rule out concepts such as stakeholders including the city residents, ICT, infrastructure, innovation, entrepreneurship, governance, and its goals and vision. Therefore, this study proposes a definition that covers all the necessary components of a smart city: “A city is smart when individual and institutional inhabitants of the city become entrepreneurs and an inclusive ecosystem develops innovative city services using ICT with the objective of sustainable socio-economic growth and high quality of life, being mindful of the limits of the natural resources and the physical infrastructure.”

The roles of the stakeholders are challenged in the academia regularly (Kummithaa & Crutzen, 2017) and this study suggests the city management’s role as a as a regulator and a facilitator having an understanding of the technologies involved. This suggestion is made especially due to the public sector’s lack of necessary capabilities in terms of innovation and technology. Besides, the sustainability of a smart city is critical and this can be achieved by the collaboration of all the stakeholders of the city, not the government alone.

Furthermore, smart cities need to focus more on entrepreneurship both in academic and practical contexts. The development of smart city services at a rate the urban issues arise is only possible if the private sector is included, hence the entrepreneurship mindset. Because the technology entrepreneurship and innovation are based on big data, it is critical that the city becomes a platform that shares the data it generates with its sensors and cameras with the technology startups of the city. This leads to a massive crowd trying to solve city’s problems, instead of a small department struggling at the municipality.

Cities implement open innovation to foster an environment of entrepreneurship and innovation to become smart cities that solve complex challenges created by rapid urbanization. Very few studies have focused on how governments and city managements utilize it in the smart city context (Cohen et al., 2016), albeit open innovation is an approach that has been used by the private sector for a long time (Stanko et al., 2017). In that sense, this study is a contribution to the open innovation literature in smart cities context. Secondly, it attempts to come up with a clear and practical definition as the current definitions vary in a wide range and the term is misused and misapplied by the cities increasingly (Richter et al., 2015).

This study has several implications for practitioners. Firstly, this study can be the first step to design a smart city governance of the entrepreneurship and innovation ecosystem. While it is unclear how cities achieve this goal (Kummithaa & Crutzen, 2017), the philosophy shared in

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this article can be of help. Secondly, a clear and practical definition is the first step to define a smart city vision. Our definition proposition could be used as a starting point for smart city vision development. Third, city managements can plan their human resources according to the requirements of an innovative and entrepreneurial environment. Lastly, cities can develop their data strategy in a way that fosters entrepreneurship and feeds technology startups.

Further work needs to be carried out to have a deeper understanding of what innovation means for cities and how to apply the open innovation model. It is not expected that a best practice can be applied to everywhere; a model in one city may not work as it does in another city (Meijer, 2015). Therefore, it is crucial to identify how and why application of open innovation models differ from one city to another. In addition, analyzing the current applications of open innovation models will help academicians and practitioners get a deeper insight on which components work best in different settings. Another important matter to resolve for further studies is building the right architecture of the technological smart city platform that collects data from the city and shares it back with the city. Without this platform, it is almost impossible to foster innovation and entrepreneurship in cities.

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