

## THE ROLE OF SOCIAL CAPITAL IN THE DEVELOPMENT OF SMART CITIES

Aleksandra KUZIOR<sup>1\*</sup>, Bartosz SOBOTKA<sup>2</sup>

<sup>1</sup> Silesian University of Technology, Poland; aleksandra.kuzior@polsl.pl, ORCID: 0000-0001-9764-5320

<sup>2</sup> Syntea S.A., Poland; bartosz.sobotka@syntea.pl, ORCID: 0000-0002-0393-3645

\* Correspondence author

**Abstract:** The article addresses issues related to the development of Smart Cities and Smart Sustainable Cities. The authors draw attention to the important role of social capital, emphasising the participation of citizens in the holistic management of modern Smart City. This approach allows one to show the development of cities in a wide context of sustainable development. The authors refer, inter alia, to Agenda 21, The Future We Want, and international programmes, such as the Sustainable Cities Programme of Habitat (UNEP) or Healthy Cities Programme of the WHO. The authors indicate that social capital is an element integrating particular parts of the urban system. They also indicate that the development of modern technologies will lead to the formation of a new type of society 4.0., advancing along with the development of industry 4.0 and artificial intelligence. In order to properly use the opportunities related to the development of modern technologies, society should be properly prepared for using their functionalities.

**Keywords:** Smart City, social capital, holistic city management, artificial intelligence.

### 1. Introduction

Beyond doubt, the concept of a Smart City is associated primarily with modern technologies. It fits into the contemporary picture of economic reality, i.e. the fourth industrial revolution and shapes the new paradigm in the economy related to the optimisation processes conditioning competitiveness (Pająk, Kamińska, Kvilinskyi, 2016). The idea of a Smart City consists predominantly in automation and robotisation of all sectors of the economy, aided by Big Data and the connectivity afforded by the Internet of Things. Reports with projections of the future labour market present a vision where most professions we know today will be pushed out of the picture, and humans will be replaced by automation and robots (Frey and Osborne, 2013, p. 4). Moreover, one of the scenarios for the development of artificial intelligence articulated by Chief Futurist of the German IT giant SAP, Kai Goerlich, is that machines will

take over power, as in the cult-status movie, Steven Spielberg's Terminator (Kowanda, 2017). Therefore, a question arises about the role of people and social capital in the context of the development of modern technologies. Another question concerns a new mode of urban development, i.e. the development of Smart Cities with their sustainable characteristics. This question may have two dimensions. The first one concerns how urban residents will support pro-development processes based on modern technologies and actively use such technologies. The second dimension, however, concerns the negative consequences of the development of modern technologies – to a larger extent in the context of the development of social capital than in the context of security.

## **2. The Concept of a Smart City**

The concept of a Smart City is based on the assumption that resources should be used more efficiently, i.e. in an innovative, creative or intelligent way. Moreover, a simplified definition of the idea of a Smart City is that its inhabitants actively participate in the development of the city, thus becoming not only beneficiaries of municipal initiatives, but also their originators. There are many definitions of the Smart City concept, most of which emphasise the use of technologies and their functionalities. One of the best known definitions is the open definition presented by W. Mitchell, which assumes that subsequent layers of development will accompany the process of urban development and its “smart dimension”. A Smart City is a new dimension of the city (Mitchell uses the word intelligence to describe this dimension), which results from a combination of increasingly effective digital telecommunication networks (compared to human nervous systems), ubiquitous intelligence (compared to the human brain), sensors and markers (compared to human sensory organs) and software (compared to knowledge and cognitive competence). An important feature of Smart Cities is also that this new urban form does not exist in isolation from other existing urban systems (dimensions/intelligence), as it adds a smart dimension to the existing network of overlapping connections, such as mechanical and electrical systems in buildings, systems embedded in household appliances (the Internet of Things), transport systems, electricity grids, water supply, sewage and urban security systems (Mitchell, 2007, p. 5). It is forecasted that the increase in the number of investment projects in Smart City technologies, in particular in information technologies and systems related to rapid urbanisation and digitisation of urban infrastructure, will last for many years (Lakhno, Malyukov, Bochulia, Hipters, Kwilinski, Tomashevskaja, 2018).

Preliminary experimental implementations of this concept have so far focused on investments in technology and infrastructure to facilitate taking advantage of smart solutions. However, humans have been left out of the picture – although the so-called urban intelligence

relies on the skills, creativity and knowledge of the city's inhabitants. Therefore, social capital seems to be the key to a full understanding the concept of a Smart City and its application.

Consequently, it is important that the definition of a Smart City should place a stronger emphasise on the social dimension, as in the works of. N. Komninos. In his view, a Smart City is an area (municipality, county, cluster, city, city-region) consisting of the following four key elements:

- an active population which implements knowledge-based and knowledge-intensive activities or a cluster of such activities;
- effective knowledge-forging entities, institutions and procedures which also facilitate further knowledge acquisition, adaptation and development;
- extensive broadband infrastructure, digital spaces, e-services and on-line knowledge management tools;
- innovation potential (Komninos, 2008).

It must be emphasised at this point that the definition quoted above also aligns well with the concept of sustainable development. Literature on the subject offers the concept of Smart Sustainable Cities (SSC), which develop through modern technologies and contribute to meeting the current needs of city populations, while also taking into account the developmental needs of future generations (Höjer, Wangel, 2014).

Although in one of the fundamental documents establishing the concept of sustainable development, Agenda 21 (1992), there is no direct reference to the so-called Smart Sustainable Cities or SSC (such a concept was not yet in operation at the time when Agenda 21 was drafted), the document clearly presents the vision of urban development. The authors of Agenda 21 predicted that at the turn of 20th and 21st centuries, the majority of the world's population would live in cities. Consequently, they recognised the fact that urbanisation processes should be properly planned, as even contemporary urban development is troubled by many symptoms of an environmental and even humanitarian crisis. In 1992, the emphasis was placed on appropriate management of the city's resources in order not only to preserve, but also to develop the ability to maintain productivity and improve the quality of life of the inhabitants (Agenda 21; 7.13). Agenda 21 also recommended that countries should support the development of the private sector and implement pilot programmes for the collection, analysis, dissemination and management of urban data (Agenda 21; 7.17). As we can see, those elements, defined already at the beginning of the 1990s, overlap with the elements necessary for the functioning of Smart Cities. The idea of sustainable cities was to be implemented thanks to the support of international programmes, such as the Sustainable Cities Programme of UN Habitat and UNEP or the Healthy Cities Programme by the World Health Organisation. Agenda 21 also pointed out that the governance of urban processes should involve local communities and foster an equal dialogue between all the stakeholders involved in urban development: from the public sector, the private sector and society at large. It also stressed the importance of the contribution of local communities to shaping environmental awareness and the recognition of the need to

protect the natural environment, participation of local communities in the identification of social needs in order to offer better public services, e.g. in the field of efficient functioning of urban infrastructure, improvement of the functioning of public facilities, etc. Healthy and sustainable urban development is possible thanks to a comprehensive approach to planning, taking into account all of the above-mentioned aspects, as well as the development of environmentally friendly and culturally sensitive tourism. Agenda 21 also recommends participation in international “sustainable city networks” to exchange experiences and share good practices (Agenda 21; 7.20).

In order to develop sustainable and intelligent cities, it is necessary to assign human resources (managers, technicians, administrators) and strengthen the potential of the social and community stakeholders.

It is certain that smart cities could not exist or develop without their greatest asset: their inhabitants.

This has also been recognised by M. Angelidou, who emphasises the social dimension of Smart Cities and defines the following four main objectives of a Smart City:

- Human capital development: strengthening the position of the local residents (aware, educated and participatory); strengthening the intellectual capital and knowledge development;
- Development of the social capital: sustainable social development and digital inclusion;
- Behavioural change – development of a sense of agency and meaning (i.e. the feeling that all the residents are co-owners of the city and who are jointly responsible for the place where they live);
- Social dimension: implementing technology that matches the needs, skills and interests of the users, while respecting their diversity and individuality (Angelidou, 2014, p. 101).

Without residents and their social capital, cities die, depopulate, disappear or go bankrupt. Examples of such cities in Poland include Kłomino and Pstrąże, perhaps because of their complicated and tragic history and the impact of World War II and the post-war years. Another tragic story is that of the American city of Detroit, which declared its bankruptcy in 2013 – even though it had been the hub of the automotive industry, where three American car corporates flourished and had their headquarters (Ford Motor Company, General Motors and Chrysler).

### **3. The role of social capital in the creation of Smart Cities**

First of all, it should be noted that social capital, unlike human capital, has a collective character, because it stems from a community of interpersonal relations, not merely the sum of all individuals within the community. In principle, social capital refers to a given community

as a group of people with their attitudes and behaviours. It is fundamental for a civil society that it is self-aware of the needs of its members and strives to meet those needs out of genuine interest, as well as having a feeling of ownership and responsibility for the community.

It is assumed that a low level of social capital results in weak bonds between people, which means that few people know one another, and even if they know one another, they do not trust one another. The consequence of this is a lack of joint or individual initiatives aimed at improving the life of the community. On the other hand, a high level of social capital can be observed when people have and forge good relations with other members of the community, when they trust one another and collectively undertake actions aimed at improving their living conditions. In economic terms, a high level of social capital translates into easier negotiations, lower transaction costs, a decrease in corruption, dissemination of knowledge, development of civic institutions (NGOs) to foster scrutiny of public authorities and better prospects for long-term investments (Fukuyama, 2003, p. 169; Fukuyama, 1997).

The concept of social capital was present in literature as early as in the 1960s. This notion was coined because there was a need to refer to the situations which required civic activism, as in the case of the American journalist Jane Jacobs and her book “The Death and Life of Great American Cities” (Jacobs, 1961, p. 138).

The role of social capital in the creation of Smart Cities can be considered by looking at its functions listed in the report entitled Social Diagnosis, Conditions and Quality of Life of Poles from 2015, i.e.:

- 1) Social inclusion and solidarity – combating exclusion and discrimination.
- 2) Complementing and relieving inefficient state institutions.
- 3) Control and *accountability of the government*.
- 4) Control of the private sector.
- 5) Developing local communities and protecting local culture from commercialisation (Czapiński, Panek, 2015, p. 351).

Re. 1. With the development of modern technologies, social exclusion and discrimination have become an increasingly pressing issue. On the one hand, they may take the form of e-exclusion, i.e. the failure of a part of the society to keep up with technological changes and the inability to take advantage of new solutions. On the other hand, the development of virtual reality and the blurring of the boundaries between the cyber world and reality results in serious social problems for the young generations of Z and Y, whose representatives are often unable to comfortably adapt to traditional interpersonal relations. The panacea for these phenomena accompanying the creation of Smart Cities should be social integration and solidarity, both constituting a catalyst for the negative phenomena triggered by the development of modern technologies.

Re. 2. On the one hand, the universality of access to information and databases concerning communities (e.g. data on administrative services), and on the other hand, the possibility for local residents to add to that pool of data (co-creation of data sources) may yield mutual benefits

for both the authorities and the citizens. As a result, public institutions become more efficient and can develop and improve their functioning in the context of a Smart City.

Re. 3. Furthermore, thanks to access to information in the 21st century, citizens can better uphold the rule of law implemented by public institutions through a wide range of control activities, thus forcing authorities to become accountable. Transparency of public administration is the basis for a relationship of trust between citizen and local authorities. If it is in place, it can generate further initiatives related to the creation of a friendly environment for the residents (a Smart City).

Re 4. Scrutiny of the private sector by the local residents resulting from universal access to information and access to information about competitors minimise the risk of unfair practices that can be detrimental to the citizen as a consumer. What is more, such scrutiny and access to information guarantee an appropriate market balance and fair competition.

Re 5. The existence of strong social bonds makes it possible to protect the local culture from the threats of commercialisation, which may have negative social, environmental or economic consequences. They can also contribute to the creation of a common heritage in the axiological dimension, providing a framework for the development of future generations.

Use of the functions of social capital listed above is described in literature as an alternative scenario for the development of modern cities, called the Smart City Hack scenario. The name derives from the social movement promoting an alternative to the technological scenario (as in Spielberg's movie). The alternative scenario is based on the assumption that there will be grassroots activities by civic groups which will provide citizens with access to data and pass on the required competences for the use of the data. In this scenario, it would be possible for citizens to co-decide on the use of broadly understood urban data, as opposed to the scenario where the beneficiaries of the data are narrow groups of specialists (e.g. city officials or business people) (Gubiński, 2018).

#### **4. The importance of social innovation for the development of Smart Cities**

A Smart City arguably equals the city of the future and is a result of the development of technological innovations – this is the notion we are slowly getting used to. What we saw as a novelty or technological innovation yesterday becomes an everyday solution today. The social dimension of Smart City development would not be possible without innovation in this area, too. Innovation has a social dimension, above all because the existing mechanisms for solving social problems have not produced satisfactory results. Table 1 presents the most frequent areas of social innovation.

**Table 1.***The most common areas where social innovation occurs*

Development of new products, services and programmes	Satisfactory social needs, innovation in the public sector and provision of public services by social enterprises and civil society organisations; provision of public services and other means of redistribution thanks to budgetary savings in the welfare state.
Social transformation	The role of civil society in the process of social change and the role of social economy and social entrepreneurs in the implementation of economic growth and social integration; the role of business in social change – corporate social responsibility and the role of enterprises in conducting the next wave of innovation and productivity by focusing on “social” areas, such as education or health care.
Organisation management model	Building business strategies including changes in human, institutional and social capital that lead to improved organisational efficiency and competitiveness; organisational restructuring, modernisation of industrial relations and improvement of human resources management; non-profit management.
Social entrepreneurship	Development of new and innovative ways overcoming social challenges through the involvement of “socially sensitive” entrepreneurs.
<i>Governance</i> model	Strengthening the position and capacity of social institutions (improvement of mutual relations between various social actors, improvement of skills, competences, social capital among social life actors involved in the development and implementation of social and economic programmes and strategies.

Source: Own compilation based on: Kwaśnicki, W. (2015). Innowacje społeczne – nowy paradygmat czy kolejny etap w rozwoju kreatywności człowieka (Social Innovation – a new paradigm or another stage in the development of human creativity?). In W. Misztala, G. Chimiak and A. Kościński (eds.), *Obywatelskość wobec kryzysu: uśpieni czy innowatorzy?* Warszawa, 14.

Social innovations consist of an innovative use of existing resources, which contribute to solving social problems relevant for the community (Pelka, 2012, p. 2). When analysing the above definition, four aspects should be taken into account:

- the phenomenon has a dynamic dimension and concerns specific actions,
- the activities are carried out by the community,
- it concerns a social problem that is important from the point of view of the given community,
- it does not require the input of any additional resources.

Moreover, a very important feature of social innovations in the context of atomisation of society and the general disappearance of social bonds is their integrative function of strengthening and building interpersonal relations. This is very important, above all, in the context of changes in the attitudes of the young generation of citizens, who find themselves more often in the virtual world than in the traditional, which is based on authentic human relations.

## 5. Summary

The Smart City concept is closely linked to the development of modern technologies. The progress it brings with it changes the reality around us. These changes happen quickly.

A natural consequence of this process is the need for a highly adaptable society. Without shaping attitudes of openness and the ability to acquire new competences, both technological and social, not only will it be impossible for the inhabitants to take full advantage of modern solutions, but it may also lead to atrophy of social bonds and the ensuing disappearance of social capital, which is the basis for the development of every city. Such a prospect is not optimistic when we look at the projections of growth of the planet's population: according to estimates, the number of people on earth will grow to 9 billion by 2050, and two thirds of them will live in cities. Social capital is a factor which integrates the particular components of the urban system that should be managed in a holistic way, as indicated by the authors of the outcome document of the RIO+20 Summit, "The future we want". (2012, p. 35). A holistic approach to urban management must take into account this fundamental human factor, as well as the relationship of trust and responsibility which determines survival and development of cities. Smart Cities, however, require new competencies from urban communities. These competencies are related to the development of new technologies and the fourth industrial revolution. Society 4.0, as it is referred to in literature (Kiepas, 2017; Kuzior, 2017), must meet the new challenges posed by modern Smart City technologies. It is predicted that, as in the previous types of societies, Smart City societies will not be able to avoid social stratification. Therefore, Smart Cities should incorporate mechanisms and tools that will prevent social exclusion, in accordance with the Europe 2020 strategy, which postulates smart, sustainable and inclusive development. Importantly, society 4.0 should have access to formal, informal and alternative education, e.g. in the field of ICT. Information and communication competences, as well as technological savviness, are necessary to use the services of innovative organisations and institutions of Smart Cities. The better prepared the society for these new challenges, the greater the demand for innovative products and services. However, we can also observe two intrinsically different processes generated by modern technologies and their impact on the development of society 4.0. These are based on the notions of information society and knowledge society. On the one hand, society 4.0 will function on the basis of a culture of real virtuality. On the other hand, a characteristic feature of society 4.0 will be the polarisation resulting from the division into "makers" and "users" of IT/ICT services. This division which will dominate all sectors of the economy and social life. Those on the margins of social and economic life will be the ones who, due to their "technological illiteracy", are excluded from both groups, i.e. they will be neither "makers" or "users" of new technology. The positive take on the "social margin" is that it may effectively protect itself from the risk of infantilisation – or at least it will not be exposed to infantilisation to the same extent as the users who may lose their ability to think independently, creatively and prudently, as a result of thoughtless use of Industrial 4.0 products and services, as well as Artificial Intelligence (IT and AI) technology. Technology users will probably be intellectually idle, which may consequently lead to biological and psychological changes, a regression of human intellect and a regression of the distinctive features of the human species, such as: consciousness and awareness, free will,

morality, creativity, abstract thinking, symbolic thinking and the ability to cooperate. A further consequence may be complete dependence of natural intelligence on artificial intelligence, resulting in acquired helplessness. A possible system error or an “algorithm virus” may lead to irreversible negative consequences for individuals, societies and economies. The danger of manipulation of information and data may also increase, as well as the danger of blurring the differences between the real world and the virtual world, which may significantly affect individuals (Kuzior, 2017, p. 37). It is difficult to assess whether this picture of the development of society 4.0 is still a futurist’s vision, or rather already a reality of the present day, of which we are not yet aware, but which already exists, also in the form of Smart Cities with their innovative IT tools and AI algorithms. Are humans and their communities threatened by a computer-driven mechatronic apocalypse? Should catastrophic visions of technological development limit the development of modern IT and AI tools? The answer to both questions should be “no”. It can be assumed that the apocalypse can be avoided by inscribing ethical values into algorithms and by educating people and communities in the spirit of humanistic values. IT and AI technologies should be developed with a view to improving the quality of life of people and societies, as well as implementing social innovations aimed at counteracting technological exclusion. Concurrently, people ought to be equipped with the necessary competences needed to skilfully use the available technological and AI solutions – they need to be taught to be selective, critical and ethical at the same time. Although fears related to the development of artificial intelligence have been voiced by even the greatest minds of modern science (for example the recently deceased, world-famous theoretical physicist Stephen Hawking), it should be noted that technological inventions and innovative IT solutions have always generated two potentials: they either serve the people, improving their quality of life, or they have the potential to annihilate people. For the time being, it is in the hands of humans to decide on the right (good) or wrong use of technological and technical solutions. Will this continue to be the case, or will AI take over the decision-making functions? We do not know at present, and although the projections for the future in this respect are not always optimistic, efforts must be made to educate people as human beings with the virtue of prudence or practical intellect (*phronesis*) that is necessary to take up reasonable and ethical actions. In antiquity, Aristotle considered this virtue as one of the fundamental features of the human character (Kuzior, Zozul’ak, 2019). This virtue should characterise all entities involved in Smart Cities and their development: city authorities, technical experts, administrators, as well as social capital.

## References

1. Angelidou, M. (2015). *Smart cities: A conjuncture of four forces*. Cities.
2. Arystoteles (2002). *Etyka nikomachejska; Etyka wielka; Etyka eudemejska; O cnotach i wadach*. Warszawa: PWN.
3. Czapiński, J. and Panek, T. (2015). *Diagnoza społeczna. Warunki i jakość życia Polaków*.
4. Frey, C. and Osborne, M. *The future of employment. How sustainable are jobs to computerisation?* Oxford Martin School.
5. Fukuyama, F. (1997). *Zaufanie. Kapitał społeczny a droga do dobrobytu*. Warszawa-Wrocław: PWN.
6. Fukuyama, F. (2003). Kapitał społeczny. In L.E. Harrison, S.P. Huntington (Eds.), *Kultura ma znaczenie*. Kraków: Zysk i S-ka.
7. Gubański, K. (2018) Smart city – sformatowany produkt czy narzędzie demokratyzacji? Dwa scenariusze rozwoju współczesnych polityk miejskich. *Studia Socjologiczne*, 1(228).
8. Höjer, M. and Wange, J. (2014). Smart Sustainable Cities: Definition and Challenges. In L.M. Hilty and B. Aebischer (Eds.), *ICT Innovations for Sustainability. Advances in Intelligent Systems and Computing*, 310. Zurich: Springer International Publishing.
9. Jacobs, J. (1961). *The Death and Life of Great American Cities*. New York Random House.
10. Kiepas, A. (2017). *Filozofia techniki w dobie nowych mediów*. Katowice: Wydawnictwo Uniwersytetu Śląskiego.
11. Komninos, N. (2008). *Intelligent Cities and Globalisation of Innovation Networks*. London-New York: Routledge.
12. Kowanda, C. *Futurolog Kai Goerlich o roli człowieka w świecie maszyn. Oswoić robota*. Retrieved from <https://www.polityka.pl/tygodnikpolityka/rynek/1724546,1,futurolog-kai-goerlich-o-roli-czlowieka-w-swiecie-maszyn.read> ISSN 0039–3371; DOI: 10.24425/119088, March 14, 2019.
13. Kuzior, A. (2017). Problem bezrobocia technologicznego w perspektywie rozwoju Przemysłu 4.0. *Etyka Biznesu i Zrównoważony Rozwój. Interdyscyplinarne Studia Teoretyczno-Empiryczne*, 4, p. 31-38. Retrieved from: <https://www.polsl.pl/organizacje/SCEBIZR/Documents/Kuzior%20Aleksandra%20-%20Etyka%204%202017.pdf>.
14. Kuzior, A. and Zozul'ak, J. (2019). Adaptation of the Idea of Phronesis in Contemporary Approach to Innovation. *Management Systems in Production Engineering*, 27, 2, p. 84-88.
15. Kwaśnicki, W. (2015). Innowacje społeczne – nowy paradygmat czy kolejny etap w rozwoju kreatywności człowieka? In W. Misztala, G. Chimiak and A. Kościński (Eds.), *Obywatelskość wobec kryzysu: uśpieni czy innowatorzy?* Warszawa.
16. Lakhno, V., Malyukov, V., Bochulia, T., Hipters, Z., Kwilinski, A. and Tomashevskaya, O. (2018). Model of Managing of the Procedure of Mutual Financial Investing in Information

- Technologies and Smart City Systems. *International Journal of Civil Engineering and Technology*, 9(8), 1802-1812.
17. Mitchell, J. (2007). Intelligent cities. UOC Papers. Iss. 5. UOC: 200. Retrieved from <http://www.uoc.edu/uocpapers/5/dt/eng/mitchell.pdf>, December 27, 2018.
  18. Pająk, K., Kamińska, B., and Kvilinskyi, O. (2016). Modern Trends of Financial Sector Development under the Virtual Regionalization Conditions. *Financial and Credit Activity: Problems of Theory and Practice*, 2(21), 204-217.
  19. Pełka, W. (2012). Rola “Banków czasu” w rozwoju wspólnot lokalnych. *Polityka Społeczna*, 3.
  20. The future we want. Outcome document of the United Nations Conference on Sustainable Development (2012). Rio de Janeiro.