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Doctoral School in Administrative Sciences**

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**NATIONAL UNIVERSITY OF
POLITICAL STUDIES AND PUBLIC ADMINISTRATION**

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**SOCIAL INNOVATION AND THE
DEVELOPMENT OF SMART CITIES**

- SUMMARY -

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INTRODUCTION

0.1. General considerations

Recently, in the specialty literature there is a concern regarding the social innovation concept, this type of innovation being useful in order to achieve the main objective of the public administration, namely to meet the needs and requirements of citizens, thus contributing to the process of developing smart cities. Social innovation is useful mainly to more actively involve citizens in their relationship with the public sector and also to deliver, in a faster, cheaper and easier way, the services provided to each citizen by the public administration.

This type of innovation is mainly representative in the technological field, in which innovations simplify and improve both the lives of civil servants and citizens who benefit from the services provided by public administration, but also in areas based on knowledge management, knowledge leading, implicitly, to the innovation process.

In Romania, social innovation is a field still insufficiently studied, which leads to a stagnation in the evolutionary process of the public sector and its relationship with citizens, thus appearing problems in society as a whole. These problems can be solved through innovative methods and visions on the future of public administration and, implicitly, the development of smart cities.

As current generations are already used, from a fairly young age, to use information and communication technology both for socialization and for undertaking various activities of the daily living, the process of changing the public space nature is a continuous one, which must adapt to the new requirements and needs of citizens.

Technology is an element of major importance in terms of social development, but it is not enough to achieve a better society. As developments take place in the digital environment regarding the way citizens live together, technology needs to be introduced into a new social, economic and political framework¹.

¹ Lopfe, F., Vontobel, W. (2013), *Rich multinationals, poor citizens. Exorbitant profits – the immoral solution of big companies*, Globo Publishing House, Bucharest, p. 207.

Thus, one of the great challenges of the current states of the world becomes the transformation of their own cities into the so-called “smart cities”. To this end, the models of social and economic development must be modified to suit the new needs of today’s societies, here referring mainly to social inclusion² and, implicitly, to citizens life quality.

In this context, both of the promotion of the cities and societies development process and of the social inclusion of citizens, the world states governments should play an active role. Thus, investments in the education and technology fields, which are largely made by governments, represent important tools for distinguishing between developed and least developed countries, this distinction not being limited only to the resources available to those states, but also to the level of social knowledge³.

We can thus understand that the three pillars of an effective development strategy are represented by governments, labor markets and individuals in a state. Another key player of major importance is the community, which is formed by citizens, between whom there are collaborative relationships, being beneficiaries of support from governments or certain non-governmental organizations⁴.

The doctoral research starts from the premise that, in order to create and lead to the efficiency of a more productive public sector and, implicitly, to improve both the relationship between it and citizens, and to improve the citizens life quality and thus develop smart cities, a reinvention of that public sector is needed. Social innovation is, in this context, a fundamental factor, the study seeking to provide an overview of the ways in which the specific issue of social innovation can be integrated into the complex context of the smart city.

It can be seen, from reading the paper, that the practical applicability of social innovation takes place on a large scale, especially at the local level, given that this concept is present in smart cities.

The reason for choosing this topic is therefore to show the need, timeliness and applicability of social innovation in the public sector of smart cities, in order to make the reader

² Bencardino, M., Greco, I. (2014), *Smart communities. Social innovation at the service of the smart cities*, TeMA – Journal of Land Use, Mobility and Environment, special edition: INPUT 2014 – Smart City: planning for energy, transportation and sustainability of the urban system, Napoli, p. 39.

³ Stiglitz, J. E. (2008), *Globalization and Its Discontents*, Polirom Publishing House, Iasi, p. 39.

⁴ *Idem*, 57.

better understand these concepts that are in a process of development and continuous change. To highlight the usefulness of this study, we chose to give various examples through which the reader, if not a specialist in this field, will be able to get a vision on social innovation applied by public institutions present in different smart cities.

The objectives of this paper are classified into three complementary levels, as follows:

Table 0.1. Objectives of the paper

GENERAL OBJECTIVES	SPECIFIC OBJECTIVES
1. Understand and describe social innovation in the public sector	1.1. Describe the social innovation concept; 1.2. Highlight the changes that have taken place regarding social innovation in the public sector; 1.3. Achieve a conceptual model of social innovation in the public sector.
2. Understand and describe the premises of social innovation for community development	2.1. Describe the e-administration concept; 2.2. Describe the process of integrating information and communication technology in the public administration; 2.3. Describe the performance-based management, knowledge management and innovative marketing concepts.
3. Understand and explain the smart city concept in the social complexity	3.1. Describe the smart city concept; 3.2. Describe the global urbanization concept; 3.3. Describe the Internet of Things concept and its role in the smart cities development; 3.4. Describe the social cities concept.

The working hypotheses related to this research wanted to show that the more the state institutions are involved in the process of social innovation, the better life quality of the citizens of a state, thus contributing to the development of smart cities.

At the same time, it must be mentioned that, through the studies carried out for the doctoral research, the aim is to achieve the final objective of the paper, namely to conceptualize an application through which social innovation contributes to the development of smart cities. This highlights once again the importance of conducting this research and establishing it as a

guide for the better functioning of the public sector, while leading to streamlining the process of developing smart cities through social innovation.

The results of this research will show that social innovation is more important than just helping to streamline the public sector, it being also a tool through which it can be contributed to the development of smart cities, thus addressing the challenges that today's society is raising. To this end, it will be demonstrated that among the premises of social innovation, which contributes to the development of communities, there are: e-administration, performance-based management, knowledge management and innovation marketing.

In addition to these results, the paper aims to answer the question: "Can social innovation contribute to the development of smart cities through an application that contributes to the improvement of citizens life quality?". In this way, the purpose of the scientific research will be fulfilled, namely to conceptualize an application through which social innovation will contribute to the development of smart cities.

The doctoral thesis will itself have an innovative character, being among the few research papers in Romania that deal with the relationship between social innovation and the development of smart cities. Moreover, it should be mentioned that, in relation to previous research, in this detailed paper, the concepts in question will be divided into all the elements that compose them, elements that have been analyzed individually through research conducted during doctoral studies.

At the same time, it should be mentioned that the research will also develop in detail relatively new concepts for Romania, which today are of great interest for a wide range of actors, topics such as *smart cities* and *Internet of Things*. These concepts will help us better understand how to integrate the specific issues of social innovation in the complex context of smart city development. Moreover, they can lead to an increase in the level of transparency and, implicitly, of citizens trust in the state institutions, at the same time involving more actively especially the young generations in the decision-making process that can lead to solving social problems.

The purpose of this paper is to highlight the importance of the attention that the public institutions of the Romanian state, as well as of the states of the world should pay in order to be able to keep up with the fast pace of the information society development. These entities need to adapt both the activities they undertake and the skills they have, reinventing themselves, if

necessary, so that they can achieve their objectives, effective communication with citizens being one of their priorities. They must be able to meet the needs of public service beneficiaries.

0.2. Research methodology

In order to have a broader view on this paper, we consider necessary to mention the fact that the research methodology used is both of bibliographic nature – therefore we chose to study the works of authors specializing in this field, from Romania and abroad, and of empirical nature – constituted by the conceptualization of an application for integrating social innovation in the context of smart cities.

In order to fulfill the purpose of the doctoral research, this paper will be structured on clearly delimited chapters, so as to provide a better understanding of the implications that the connection between social innovation and the development of smart cities have.

The paper is structured in four chapters, the last chapter being, in fact, a case study.

The first part of the paper will have theoretical foundations, describing concepts and theories on the topic and, more precisely, on the components of the concept of social innovation and the integration of this issue in the complex context of the smart city, reference studies coming from specialists of a number of three schools of thought, namely: the European school, the American school and the Asian school. Following the research undertaken so far, we can mention that the European school is richly found in the specialty literature and, at the same time, it is the closest to the values acquired by the author during the studies carried out so far. The values presented by the other two schools are also notable, so they will too be intensively studied in the paper.

Thus, the first chapter contains a presentation of social innovation in the public sector, both conceptually and in terms of the concept evolution and the environment in which it is stated, in the sixth subchapter being described the objectives of innovation in the public sector, among the most important being the following: increasing the cost efficiency and profitability of public services provided, improving the relationship between the public sector and citizens, increasing the quality and access to public services and improving citizens life quality.

The second chapter aims to illustrate in detail the premises of social innovation for community development. In this context, we opted to detail the constituent elements of social innovation necessary for community development, therefore we talked about e-administration and its components. At the same time, we considered important to mention the implementation of performance-based management, knowledge management and innovative marketing. The fifth subchapter of this chapter of the paper is a research that links the two concepts discussed – innovation and community development, presenting a statistical analysis of the correlation between them. This correlation is based on international studies focused on these factors, taking into account the indicators used to measure the two concepts in different member states of the European Union over a period of more than five years.

In the next chapter – the third chapter, we presented the smart city in the social complexity. Thus, in addition to detailing the concept of smart city, we also mentioned elements such as: global urbanization, Internet of Things and its role in the development of smart cities and we also talked about smart city models based on social innovation, these being called “social cities”. As in the case of the previous chapter, in the end of this chapter we also presented the results of the correlation between innovation and the intelligence of a city, the statistical analysis being, again, performed by comparing specific indicators of the two concepts in different European countries.

The final chapter is the practical part of this paper, presenting the elements needed to conceptualize an application through which social innovation is integrated in the context of smart cities. For this purpose, it was analysed the applicability of the social innovation concept in Romania with the purpose of developing smart cities, e-administration having an important role here.

For creating the fourth chapter, it was chosen the use of a quantitative method, therefore the sociological survey based on the questionnaire was used. The questionnaire was transmitted to the officials from the IT departments of certain public institutions in Romania, aiming to find out the number of computers used in each of those institutions, the applications or programs used to carry out specific activities and the computing power not consumed by these equipments.

This study aimed to highlight the level of public institutions involvement in the process of social innovation, which contributes to the development of smart cities. At the same time, the aim was to understand their approach to future projects destined for this purpose.

The conceptualization of such an application will be of major importance for the research completion, which will be a guide of international good practices and successful examples for a better functioning of the public sector in Romania, presenting elements necessary for the development of smart cities through social innovation.

CHAPTER I

– Social innovation in the public sector –

1.1. Defining the concept of social innovation⁵

Social innovation is considered a fundamental concept for the study of economic development and social cohesion policies, constituting a term that has been in the public debate process for several years already. However, the concept became even better known when the European Commission began to focus on it, defining innovation as “a process of social change that can produce desired results in terms of improving economic competitiveness, environmental sustainability and social solidarity⁶”.

The first researcher to use this concept in the literature is considered to be James B. Taylor, who defined social innovation as a new way of achieving certain things necessary to meet a social need⁷.

At the same time, social innovation is understood by the Canadian National Agency CRISIS (Research Group on Social Innovation in Enterprises and Trade Unions) as representing “new approaches, practices or interventions, along with all newly created products, all new services to improve a situation or solve a social problem that takes place at the level of institutions, organizations, communities”⁸.

The content and purpose of this concept focus on the continuous processes of development and diversification⁹. Social innovation is aimed at stimulating individuals to create and apply new ideas and solutions so that the society can cope with the many challenges it

⁵ This part of the paper is based on the article: Tîrziu, A.M. (2016), *Social innovation a beneficial vision on the public sector. Case study: social innovation in the public universities from Italy*, vol. 3 of the Conference “Smart Cities”, Pro Universitaria Publishing House, Bucharest, pp. 233-250 (with the necessary changes and updates).

⁶ European Commission (2010), *Europe 2020. A European strategy for smart, green and inclusive growth*, communication of the Commission, Brussels, Eur-Lex website, <http://eur-lex.europa.eu/legal-content/RO/TXT/HTML/?uri=CELEX:52010DC2020&from=IT>, accessed in January 2017.

⁷ Taylor, J.B. (1970), *Introducing social innovation*, Journal of Applied Behavioral Science, vol 6, no. 1, pp. 69-77.

⁸ Neagu, G. (2009), *Innovation in education*, Quality of life – Journal of social policies, vol. 20, no. 1-2, Romanian Academy Publishing House, p. 111.

⁹ Matei, A., Săvulescu, C., Antonovici, C.G. (2016), *Education for social innovation. FAL model and transfer of best practices*, Proceedings of EDULEARN16 Conference, vol. 8, no. 1, Barcelona, p. 2378.

faces¹⁰. We can thus understand that it focuses on improving the life quality of both individuals and communities, whether they act as consumers or producers¹¹ of public services¹².

1.2. Types of social innovation¹³

One of the elements that divides social innovation into the categories listed below is the nature of the solution found to solve social problems or needs, as well as the type of product that results from this process¹⁴:

- a) **product innovations**: these innovations aim to create and develop a physical product;
- b) **service innovations**: these contribute to certain changes in existing services or to the creation of various new services;
- c) **process innovations**: these are constituted as new processes related to production or to the organizational nature.

Another classification of social innovations is made taking into account the extent and impact they have on society, being the following types¹⁵:

- a) **incremental innovations**: those that represent the continuation of certain improvements;
- b) **radical innovations**: those that mark changes with different interruption periods;
- c) **systemic innovations**: those that refer to changes that take place in systems of technological, managerial and organizational nature.

Another element that contributes to the classification of social innovations is the solution novelty, thus proposing the following types¹⁶:

¹⁰ Mulgan, J. (2009), *The art of public strategy*, Oxford: Oxford University Press, cited by Matei, A., Săvulescu, C., Antonovici, C. (2015), *Social Innovation in the Local Public Sector: A Cross-Regional Approach for Romania*, Theoretical and Applied Economics, vol. 22, no. 4(605), p. 8.

¹¹ OECD, *LEED Forum on Social Innovations*, <http://www.oecd.org/fr/cfe/leed/forum-social-innovations.htm>, accessed in May 2017.

¹² Matei, A., Tîrziu, A.M. (2017), *Collaborative learning as a tool for social innovation*, Proceedings of EDULEARN17 Conference, vol. 9, published by IATED Academy, Barcelona, p. 7033.

¹³ This part of the paper is based on the article: Tîrziu, A.M. (2016), *Social innovation a beneficial vision on the public sector. Case study: social innovation in the public universities from Italy*, vol. 3 of the Conference "Smart Cities", Pro Universitaria Publishing House, Bucharest, pp. 233-250 (with the necessary changes and updates).

¹⁴ National Endowment for Science, Technology and Arts – NESTA (2007), *Innovation in response to social challenges*, Policy Briefing, cited by Matei, A. (2009), *Social innovation – a thematic map*, Social Innovation Journal, no. 2 (July-December), published by the Quality of Life Research Institute, p. 91.

¹⁵ *Idem*, p. 92.

- a) **new innovations:** those that propose new types of product or service;
- b) **partially new innovations:** innovations that already exist in a field, represented by technologies or ways of acting, which are adapted for a completely different field, for the creation of different products or services or even for the achievement of different objectives.

At the same time, the beneficiaries of these changes also determine certain categories of innovations, such as¹⁷:

- a) **innovations addressed to the members of a society:** these persons are direct beneficiaries of the impact that the respective innovations have;
- b) **innovations addressed to specific social groups and categories:** the beneficiaries of these innovations have a common characteristic or problem;
- c) **innovations addressed to local communities:** these are addressed to people who are in close geographical areas;
- d) **innovations addressed to individual users:** this type of innovations is addressed to people who are willing to adopt those innovations, who can afford the costs of adoption and who, by using them, produce certain effects on either groups or communities of which they are a part.

In addition to these elements, we consider it important to mention the elements related to improving both the life quality of beneficiaries in areas such as: health, education, civic participation, social connections, environment, personal security, subjective well-being and their material condition regarding the access to economic resources, employment and professional life, household etc.¹⁸.

¹⁶ Matei, A. (2009), *Social innovation – a thematic map*, Social Innovation Journal, no. 2 (July-December), published by the Quality of Life Research Institute, p. 92.

¹⁷ Matei, A. (2009), *op. cit.*, p. 92.

¹⁸ OECD (2017), *How's Life? 2017: Measuring Well-being*, OECD Publishing, Paris, pp. 22-23.

1.3. Social innovation from the public sector perspective¹⁹

In the public sector, the concept of innovation is still far from being a uniformly recognized topic, as a societal or organizational phenomenon, but policy makers and administrators have begun to pay more attention to it in recent years²⁰.

Improving the quality and the types of services provided to communities, which include individual citizens, social groups and businesses, is one of the main opportunities resulting from the process of innovation in the public sector²¹.

In this context, the private sector focuses on products, markets, money and profits, as opposed to the importance given to the services, the social, the process and the beneficiaries of services in the public sector. Thus, we find, in both mentioned sectors, two fundamentally different innovation outbreaks, this also revealing differences in approach, content, objectives and in the way in which they are implemented. Statements about the innovation equivalence of the two sectors thus become slightly limited, with a tendency to simplify some or all of the implementation processes, and the same is true for the objectives and models of disseminating innovation. In both sectors, but especially in the public sector, such simplification could be counterproductive, as opposed to a correct and effective identification of political priorities and opportunities²².

Although there are differences between the private and public sectors, practices regarding the innovation process are not mutually exclusive, bringing benefits and additions. In the context of the public sector, the innovation process can take place through the priority dissemination of ideas to improve public sector performance through actions such as the integration of new technological systems or the management of public information. At the same time, the private sector can benefit from innovation in the public sector, this assistance being met in the form of creating or supporting certain conditions that allow the stimulation of the innovative generation,

¹⁹ This part of the paper is based on the article: Tîrziu, A.M. (2016), *Social innovation a beneficial vision on the public sector. Case study: social innovation in the public universities from Italy*, vol. 3 of the Conference “Smart Cities”, Pro Universitaria Publishing House, Bucharest, pp. 233-250 (with the necessary changes and updates).

²⁰ Applied Research and Communications (ARC) Fund (2013), *Innovation in the Public Sector. State-of-the-Art Report*, part of the project CCIC (Complex Challenges Innovative Cities), Sofia, pp. 5-9.

²¹ Walker, R. M. (2006), *Innovation Type and Diffusion: an Empirical Analysis of Local Government*, Public Administration, vol. 84, no. 2, pp. 311–335.

²² Applied Research and Communications (ARC) Fund (2013), *op. cit.*, pp. 18-19.

more precisely through targeted programming, new or old regulations that have been modified, mediation, funds designated for specific purposes in the field in question etc.²³.

The table below shows the main differences and similarities between the public and private sectors when it comes to innovation.

Table 1.1. Public sector innovation versus private sector innovation

PUBLIC SECTOR	PRIVATE SECTOR
Service innovation	Product innovation
Process innovation	Process innovation
Organizational innovation	Organizational innovation
Communication innovation	Marketing innovation

Adapted after: Hollanders, H. et al. (2013), *European Public Sector Innovation. Scoreboard 2013 – A pilot exercise*, Enterprise & Industry Magazine, Brussels, p. 9.

We can see that in both the public and the private sectors there is process innovation²⁴ and the one of organizational nature, the differences regarding innovation in the two sectors consisting in the process of service innovation and communication innovation in the public sector versus product and marketing innovation in the private sector. In the following lines, these types of innovation will be explained.

In 2008, Paul Windrum conducted a classification of public sector innovation that included the following categories²⁵:

- **service innovation** → which refers to the introduction of a new service or the quality improvement of existing service;

²³ *Ibidem*.

²⁴ Product innovation, represented by represented stages of initiation, development, implementation, dissemination and adoption of innovations. To be seen Săvulescu, C. (2015), *Innovative governance – The impact of information technology*, Economic Publishing House, Bucharest, pp. 24-27.

²⁵ Windrum, P. (2008), *Innovation and entrepreneurship in public services*, in Windrum, P., Koch, P. (eds.) (2008), *Innovation in Public Sector Services: Entrepreneurship, Creativity and Management*, Edward Elgar Publishing, UK, pp. 8-10.

- **service provision process innovation** → being represented by new methods or some modified methods of public service provision;
- **administrative and organizational innovation** → which consists of changes in organizational structures and routines;
- **conceptual innovation** → the development of new points of view and the challenge of already existing hypotheses;
- **political innovation** → consisting of changes in thinking or behavioral intentions;
- **systemic innovation** → represented by new or improved ways of interacting with other organizations and other sources of knowledge.

The Oslo Manual assigned a general definition of innovation, which can also be used for the public sector context, saying that it represents the implementation of a new or significantly improved service, a method of communication, a new or better developed process or an organizational method²⁶.

1.4. Objectives of innovation in the public sector²⁷

Regarding the objectives of the innovation process in the public sector, some major trends can be observed, which will be presented in this section of the paper.

Thus, one of the main objectives of public sector innovation is considered to be the element of **increasing the cost efficiency and cost-effectiveness of the provided public services**. The first aspect of this objective, namely increasing efficiency, is largely understood as the provision, at no additional cost, of more high-quality services to citizens, while simplifying administrative procedures. The objective discussed is mainly of local and regional authorities that have the role of providing public services to the citizens, they being responsible for the efficiency of the expenditures that are made in the public sector²⁸.

²⁶ OECD/Eurostat (2018), *Oslo Manual 2018: Guidelines for collecting, reporting and using data on innovation*, 4th edition, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Luxembourg, p. 20.

²⁷ This part of the paper is based on the article: Tîrziu, A.M. (2016), *Social innovation a beneficial vision on the public sector. Case study: social innovation in the public universities from Italy*, vol. 3 of the Conference “Smart Cities”, Pro Universitaria Publishing House, Bucharest, pp. 233-250 (with the necessary changes and updates).

²⁸ Applied Research and Communications (ARC) Fund (2013), *op. cit.*, pp. 31-32.

Another major benefit is the goal of **improving public-citizen relations**, which can lead to innovation. Therefore, the action to strengthen the channels through which citizens can provide their feedback contributes to improving public services so that they are more compatible with public needs and expectations²⁹.

The above-mentioned objectives contribute to the achievement of a major goal of innovation in the public sector, namely to **increase the quality and access to public services** provided by local or regional authorities, achieving this goal leading to an **increased life quality of citizens**, this representing the ultimate goal of the public service. It is thus highlighted that innovation in the public sector is a means of facilitating different public policies and can be recognized in policy models and in several policy areas³⁰.

²⁹ Applied Research and Communications (ARC) Fund (2013), *op. cit.*, pp. 31-32.

³⁰ *Ibidem*.

CHAPTER II

– Premises of social innovation for community development –

2.1. Development of e-administration

Developed countries differ from the least developed not only by the resources at their disposal, but also by the element of knowledge³¹ - thus arriving to the so-called „information society”. This type of modern society is increasingly based on the use of information and communication technology in all areas of activity, skills in this direction being also one of the great challenges of today’s society³².

The state governments of the world must be actively involved in promoting the development of communities and protecting the citizens of those communities. Therefore, increasing investment in education and technology, which largely comes from the government, is a necessary and important action³³.

E-administration refers to the implementation and use of information and communication technology (ICT) in the public administration, this process taking place from an *intra-office* and an *inter-office* perspective. The first refers to the transformation of the traditional office into a modern one, therefore paper processes become electronic processes, and the second perspective is that which refers to the relationships that public institutions have with external actors, using new methods of communication with citizens³⁴.

2.1.1. Defining the concept of e-administration

The activity of organizing and enforcing the law is carried out through the public administration system, addressing all citizens of a state, the laws being applicable throughout the

³¹ Stiglitz, J.E. (2008), *Globalization and Its Discontents*, Polirom Publishing House, Iasi, p. 39.

³² Baltac, V. (2011), *Information technologies: basics*, Andreco Educational Publishing House, Euroaptitudini, Bucharest, p. 8.

³³ Stiglitz, J.E. (2008), *op. cit.*, p. 39.

³⁴ Olivares, J.A. (DocPath CEO) (2013), *How e-Administration facilitates direct communication with the public*, <https://www.docpath.com/art-eadministracion-administracion-electronica/>, accessed in September 2017.

territory of that state³⁵. In other words, the administration can be understood as consisting in an activity of efficiently using the resources that it has at its disposal – namely human, financial and material – to obtain maximum results, but with minimal efforts³⁶.

In recent years, the states of the world have begun to take steps to comply with the transformations that new technologies produce. Thus, the organizational culture of public institutions began to move towards a citizen-oriented one and the provision of efficient public services, allowing the possibility of an intensive exchange of information between all actors involved in the process, both internal and external³⁷.

Information and communication technology has a key role to play in this context, it being seen as a tool through which democracy is implemented and the education systems and the services that the public sector provides are developed. The state must therefore provide access to technology, free of charge and without discrimination, to individuals who make or have the possibility to make use of information in the digital version³⁸.

We thus understand that the electronic administration or e-administration is an indispensable concept in the public administration transformation and evolution process. This concept can be defined as a set of mechanisms through which the processes that take place on paper, in a traditional type of office, are transformed into some of electronic nature, the main objective of e-administration being to create a „paperless” office³⁹, therefore digital.

2.1.2. Challenges of ICT integration in the public administration

The use of digital technologies brings benefits to the business sector, to individuals, and to the public sector. We can therefore understand that information and communication

³⁵ Dincă, D.V. (2016), *The place of public administrator in the Romanian administrative system*, in Manda, C.C., Nicolescu, C.E., Rădulescu, C.R. (coord.), *Current issues of the EU's political and legal space*, supplement of the Romanian Journal of European Law, vol. 3 of the International Conference SRDE (Romanian Society of European Law), 3rd edition, October 27, 2016, Wolters Kluwer Romania Publishing House, Bucharest, p. 149.

³⁶ Bălan, E. (2008), *Administrative institutions*, C.H. Beck Publishing House, Bucharest, p. 21.

³⁷ Matei, A., Iancu, D.C. (2009), *E-Administration as a Way of Increasing the Managerial Capacity in Public Sector*, Annual Conference NISPAcee (The Network of Institutes and Schools of Public Administration in Central and Eastern Europe) “State and Administration in a Changing World”, 17th edition, May 14-16, 2009, Budva, p. 2.

³⁸ *Idem*, p. 3.

³⁹ eMunicipality, <http://www.emunicipality.com/e-government-and-electronic-administration-why/>, accessed in September 2017.

technology has major effects on development from a social and economic point of view, thus producing an impact on public administration and society as a whole⁴⁰.

The **digital divide** can be a problem in this context. The term refers to the gap between different individuals, businesses, households and geographical areas at various levels of socio-economic development, in terms of the opportunities they have to access the information and communication technology and to use the Internet to carry out numerous activities⁴¹.

The **universal access** is another concept related to the development aspect and, although digital development policies should be based on this aspect, there are still diverse conceptions regarding the scope and nature of this element. The issue in question depends, to a large extent, on the policy environment of developing countries and the willingness of developed countries to invest in this regard⁴².

Individuals access to the Internet infrastructure can help bridge the digital divide, and in the case of developing countries there are two key issues regarding this aspect. The first is access to Internet thoroughfare⁴³, based mainly on connecting continents via submarine fiber optic cables. The second aspect is connectivity which, in rural areas, is more difficult to obtain. However, the situation can change through mobile telephony and wireless communication⁴⁴.

In order for the public system to benefit from a healthy development, it is necessary to develop its technological component, but for this to be possible, the actors involved in the process (civil servants, citizens and employees in the business environment) must be trained in

⁴⁰ Kurbalija, J. (2016), *An introduction to Internet Governance*, 7th edition, published by DiploFoundation, p. 175.

⁴¹ OECD (2001), *Bridging the digital divide*, <https://www.oecd.org/site/schoolingfortomorrowknowledgebase/themes/ict/bridgingthedigitaldivide.htm>, accessed in September 2017, cited by Kudo, H. (2017), *To have, or not to have: That is not the question! Digital divide as a myth, or the cognitive limitation to understanding information*, in Hansen, H., Muller-Torok, R., Nemeslaki, A., Pichler, J., Prosser, A., Scola, D. (eds.) (2017), *Digital divide in the Danube Region: Is it still significant in explaining ICT adoption in eDemocracy and eGovernment?*, Proceedings of the Central and Eastern European e|Dem and e|Gov Days 2017, Budapest, published by the Austrian Computer Society, p. 57.

⁴² Kurbalija, J. (2016), *op. cit.*, p. 177.

⁴³ "Group of communication lines used for the transmission of information from different sources to one or more receivers", definition available on DEX online, <https://dexonline.ro/definitie/magistrala>, accessed in September 2017.

⁴⁴ Kurbalija, J. (2016), *op. cit.*, pp. 178-179.

an appropriate manner⁴⁵ so that they can acquire the **skills and competencies** needed for **effective access**.

In terms of **political and institutional aspects**, it is important to create an environment conducive to the use of technology in the public administration, which implies the progressive demonopolization of the telecommunications market. At the same time, it is necessary to implement laws specific to the aspect regarding the Internet and the increase of Internet access among the population, without discrimination of religious, political nature etc.⁴⁶.

Efficiency and motivation in e-administration depend on the **capabilities** of individuals, organizations and nations. We can therefore understand that these represent the abilities of previously mentioned actors to „define and solve problems, make informed choices, order their priorities, plan their futures, and to implement programmes and projects to sustain them⁴⁷“.

In order to increase the potential and to benefit from opportunities, capacity development must take place in the direction of four major dimensions, namely⁴⁸:

- **individual competencies**: acquisition and creation of capacities, abilities and know-how, independent use and personal reflection;
- **organizational development**: improving value-oriented performance (efficiency, effectiveness), adapting to change;
- **system development**: development of normative parameters and of the relationship that is established between actors;
- **network development**: strengthening the relationship between actors, orientation towards specific goals, informality.

⁴⁵ Vrabie, C. (2014), *IT elements for public administration*, 2nd edition, revised and added, vol. 2, Pro Universitaria Publishing House, Bucharest, p. 5.

⁴⁶ Kurbalija, J. (2016), *op. cit.*, pp. 178-181.

⁴⁷ Swiss Agency for Development and Cooperation (2006), *Glossary Knowledge Management and Capacity Development*, https://www.eda.admin.ch/dam/deza/en/documents/publikationen/glossar/157990-glossar-wissensmanagement_EN.pdf, accessed in September 2017.

⁴⁸ Swiss Agency for Development and Cooperation (2006), *Capacity Development in SDC*, pp. 6-7, https://www.eda.admin.ch/content/dam/deza/en/documents/die-deza/strategie/202114-capacity-development-sdc_EN.pdf, accessed in September 2017.

2.1.3. E-administration as a platform for e-government

The development and implementation of e-administration as a platform for e-government can be achieved through open source tools. In this way, citizens are given the opportunity to access public information, while ensuring the transparency and accountability of the public sector authorities⁴⁹.

This is an application that allows the relationship between government and citizens (G2C), government and other government agencies (G2G), government and the business environment (G2B) and between the business environment and citizens (B2C), respectively the whole business environment (B2B). It thus contributes to the integration of both vertical and horizontal governance hierarchy, from state to village level. Such a platform aims to create and make accessible the entire geographical and political distribution of government and organizations, while performing the distribution, from a functional point of view, of the activities carried out by the government, following to integrate the two in a unity. In this way, it contributes to the creation of various departments and appropriate positions for civil servants who, working efficiently in those departments, also deal with the mapping of citizens⁵⁰.

2.1.4. Community development through e-participation⁵¹

E-participation is considered an essential element for the functioning of a quality e-democracy⁵² and, implicitly, of an e-administration – this being a fundamental constituent element of e-democracy. Moreover, e-participation helps people get involved in politics and the policy-making process, making this type of process easier to understand and access through the use of electronic means⁵³.

⁴⁹ GAP (Governance Assessment Portal), <http://www.gaportal.org/country-initiatives/e-administration-an-e-platform-for-e-governance>, accessed in September 2017.

⁵⁰ *Idem*.

⁵¹ This part of the paper is based on the article: Vrabie, C.I., Tîrziu, A.M. (2016), *E-participation – a Key Factor in Developing Smart Cities*, EIRP Proceedings, vol. 11, Danubius University Press, Galați, pp. 135-140 (with the necessary changes and updates).

⁵² *eCitizen II – Towards citizen-centered eGovernment in European cities and regions*, interregional project led by The Baltic Institute of Finland, <http://eparticipation.eu/information/e-participation/>, accessed in September 2017.

⁵³ European Commission (2014), <https://ec.europa.eu/digital-single-market/eparticipation>, accessed in September 2017.

In 2014, the United Nations conducted a survey to find out the level at which member state governments use electronic means in their relationship with citizens. In the third chapter of that study, the three fundamental elements of the e-participation framework are highlighted, namely⁵⁴:

- a) **e-information** → allowing participation by providing public information to citizens and their access to information without or upon request;
- b) **e-consultation** → involvement of citizens in contributions and deliberations on public policies and services;
- c) **e-decision-making** → empowering citizens by co-designing the policy option and co-producing service components and delivery methods.

As part of e-administration, e-participation can lead to the creation and/or development of smart communities and cities, its main advantages being those described below⁵⁵:

- a) greater transparency of the government;
- b) more emphasis on citizen needs;
- c) increasing citizen involvement;
- d) improved government response.

In order to have a smart city, where democracy is at the heart of all government activities, these four pillars of e-participation need to be improved, so that both government policies and the legislative decision-making process will be properly developed, participation enabling individuals to live and thrive in connected democratic communities⁵⁶, with information being shared at a significantly lower cost and in an easier and faster way⁵⁷.

⁵⁴ UN Public Administration and Development Management – Department of Economic and Social Affairs, *United Nations E-Government Survey 2014. E-government for the future we want*, pp. 61-73, https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2014-Survey/E-Gov_Complete_Survey-2014.pdf, accessed in September 2017.

⁵⁵ Erkul, R. E. (Regional National Plan Manager at Microsoft Middle East and Africa) (2014), *The 4 pillars of e-participation*, available on the Microsoft website, http://www.microsoft.com/en-us/government/blogs/the-4-pillars-of-e-participation/default.aspx?WT.z_evt=WebClick#fbid=4h79i-WKLih, accessed in September 2017.

⁵⁶ *Idem*.

⁵⁷ Matei, A., Săvulescu, C. (2014), *Enhancing the capacity for innovation of public administration. An exploratory study on e-Governance, ICT, knowledge management in Romania*, Theoretical and Applied Economics, vol. 21, no. 11(600), pp. 8-9.

2.2. Correlation between innovation and community development

This section of the paper aims to present a research that links the concepts of innovation and the development of communities, representing a statistical analysis of the correlation between them, based on international studies focused on these two factors, referring to common indicators that are used in order to measure the use of the two concepts in different states of the world.

As for we can see similarities between the indicators used to determine the degree of performance in terms of innovation and those used to determine the degree of community development, we will continue to focus on elements such as GDP per capita, education and sustainability in order to achieve a correlation between innovation and community development for the period that the international databases make available through official websites, the period between 2012 and 2018. Thus, we chose to focus on studying one state of all four categories in which they were divided according to the performance obtained in terms of their innovation capacity in the *European Innovation Scoreboard 2020* study, these states being: Sweden (innovative leader), Belgium (strong innovator), Cyprus (moderate innovator) and Romania (modest innovator).

Table 2.1. Correlation between innovation and community development

INNOVATION INDICATORS	COMMUNITY DEVELOPMENT INDICATORS
R&D expenditure in the public sector	GDP/capita
Public-private co-publications	Education
Private co-funding of public R&D expenditures	Overcrowding rate in cities

Correlation information:

- **Countries:** Sweden, Belgium, Cyprus and Romania;
- **Period of time:** 2012-2018;

- **Sources:** European Commission, World Bank, United Nations Development Programme, Eurostat;
- **Condition:** investment in innovation leads to community development (positive correlation/direct proportionality relationship);
- **Results:**
 - in more developed countries, GDP/capita is directly proportional to investment in public sector research and development;
 - the level of education has an impact on publications made through partnerships between public and private entities;
 - the overcrowding rate in cities has a direct proportional impact on private co-financing of research and development expenditure in the public sector.

CHAPTER III

– The smart city in the social complexity –

3.1. The smart city and its dimensions

Specialists in the field have found a more complex definition, saying that “a city can be defined as ‘smart’ when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action and engagement”⁵⁸.

Smart cities focus on improving the life quality of citizens, which is facilitated through the use of digital technologies. Smart cities are also beneficial in achieving the main goal of public administration, which is to meet the needs and requirements of citizens.

The ranking of cities is based on ten dimensions which are considered to be fundamental in order to determine their level of efficiency⁵⁹:

- 1) **governance** – in this context, the citizen is the point of contact for solving the current challenges facing cities;
- 2) **public management** – for this dimension, actions to improve the efficiency of the city administration are important;
- 3) **urban planning** – plans for local development and the design of green areas and public spaces are taken into account in order to improve territorial viability and smart growth;
- 4) **technology** – the development of this dimension makes it possible for cities to be sustainable for a longer period of time, to broaden their horizons in terms of the competitive advantages of their production system and to improve the quality of jobs;

⁵⁸ Caragliu, A., Del Bo, C., Nijkamp, P. (2009), *Smart Cities in Europe*, Serie Research Memoranda 0048 (VU University Amsterdam, Faculty of Economics, Business Administration and Econometrics), cited by URBACT (2015), *Smart specialisation, triple helix, open innovation and smart cities. Going beyond the jargon*, <http://urbact.eu/smart-specialisation-triple-helix-open-innovation-and-smart-cities-going-beyond-jargon>, accessed in January 2017.

⁵⁹ Ricart, J. E., Berrone, P., Carrasco, C., Ricart, R. (2014), *Which Are the World's "Smartest" Cities?*, IESE insight, University of Navarra, Madrid, <http://www.ieseinsight.com/doc.aspx?id=1582>, accessed in January 2017.

- 5) **environment** – through the construction of green buildings and the use of alternative energy, efficient water management and the implementation of public policies that focus on counteracting the effects of climate change, ecological sustainability will be improved;
- 6) **international outreach** – expanding this dimension involves improving the city's brand, which takes place through actions such as developing strategic tourism plans, attracting foreign investment and intensifying the city's global presence;
- 7) **social cohesion** – the concern for this dimension must be accompanied by an analysis of the level of immigration, community development, care for the elderly, inequality, efficiency of the health system, public safety etc .;
- 8) **mobility and transportation** – some of the great challenges of the future are the development of cities, which are often large, and the facilitation of individuals access to public administration services;
- 9) **human capital** – cities must have as their main objective the improvement of their human capital;
- 10) **economy** – in order for cities to develop this dimension, they must create industrial plans for strategic development, develop initiatives to stimulate innovation and entrepreneurship etc.

These dimensions are meant to highlight the importance of an overview of urban management, in which it is necessary to have control over the following elements: the delay period of the impact of public policies, the influence of the national context, the fact that there is no single model of success and the discrepancy between the reputation of cities and their realities⁶⁰.

⁶⁰ Ricart, J. E., Berrone, P., Carrasco, C., Ricart, R. (2014), *Which Are the World's "Smartest" Cities?*, IESE insight, University of Navarra, Madrid, <http://www.ieseinsight.com/doc.aspx?id=1582>, accessed in January 2017.

3.2. Global urbanization and the cities of the future⁶¹

According to the World Health Organization, global urbanization is a process that changes the social and environmental framework on each continent, therefore the population in rural areas migrates to urban areas, leading to a natural urban population growth⁶².

In this context, we can mention that in 2019 the urban population constituted 55.7% of the planet's population, reaching 56.2% in 2020 (until the completion of this part of the work), being thus almost 4 billion and a half people who currently live in urban areas⁶³. The percentage of urban population globally is expected to increase to 68% by 2050, which means that the urban population will almost double in size. The Organization for Economic Co-operation and Development (OECD) has calculated that by 2100, the urban population will increase to 9 billion, thus about 85% of the global population will live in cities⁶⁴.

We can thus observe that the urban population is growing at a rapid and continuous pace, therefore, the quality of global and local ecosystems and the urban environment play a fundamental role in the urban processes of sustainable development and management⁶⁵.

In finding successful solutions to urban challenges, there are several fundamental approaches that can be taken, such as: partnerships with stakeholders, urban development strategies, local cooperation, cities as ecosystems and city leaders as economic managers⁶⁶.

The European Union is also focused on this issue, helping member states by engaging in partnerships and creating initiatives for sustainable urban development. We can mention here the new *European Urban Initiative*, created to support cities to innovate, access information,

⁶¹ This part of the paper is based on the article: Tîrziu, A.M. (2020), *Urbanization and cities of the future*, International Journal for Innovation Education and Research, vol. 8, no. 3, pp. 235-245 (with the necessary changes and updates).

⁶² World Health Organization (WHO), <https://www.who.int/globalchange/ecosystems/urbanization/en/>, accessed in January 2020.

⁶³ Worldometer (2020), <https://www.worldometers.info/world-population/>, accessed in January 2020.

⁶⁴ OECD (2015), *The Metropolitan Century. Understanding urbanisation and its consequences. Policy Highlights*, OECD Publishing, Paris, p. 1.

⁶⁵ World Health Organization (WHO), <https://www.who.int/globalchange/ecosystems/urbanization/en/>, accessed in January 2020.

⁶⁶ Asian Development Bank (2019), *Creating livable cities: regional perspectives*, co-published by the African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank, Manila.

understand politics, while providing support for the creation and strengthening of networks and capacities⁶⁷.

3.3. General aspects of social cities

In smart cities, technologies have two functions. The first function refers to the fact that they transform cities into service and infrastructure systems that are characterized by highly efficient management processes. The second function is that through which technologies offer customized versions of the urban ecosystem, using universal search and reporting devices⁶⁸.

The role of social cities is to explore how digital technologies allow citizens to co-create viable and development-friendly cities, this being called *civic empowerment*. Thus, individuals have the opportunity to participate in the process of shaping the urban environment in which they live, establish interconnected relationships with state authorities and other people, while collaborating to find solutions to common urban problems⁶⁹.

Smart cities based on social innovation have been grouped into different models⁷⁰:

- ***the open city*** – gives priority to the transparency of its work, so the communication of its activities takes place through the online publication of all documents, the live transmission of board meetings, the free access of individuals to documents etc.;
- ***the wiki city***⁷¹ (*owned*) – in this type of city, communication is intended to encourage citizens to get involved in public affairs management, thus making citizens an active part in the decision-making process on issues affecting the city;
- ***the cloud city (platform)*** – technology becomes a tool for citizens to communicate, software through which ideas, experiences, skills and initiatives are connected;

⁶⁷ European Commission (2019), *Explanatory Memo: European Urban Initiative – Post 2020*, Publications Office of the European Union, Luxembourg.

⁶⁸ Hollands, R.G. (2008), *Will the real smart city please stand up? Intelligent, progressive or entrepreneurial?*, City, vol. 12, no. 3, pp. 303-320.

⁶⁹ De Lange, M., De Waal, M., (2013), *Owning the city: New media and citizen engagement in urban*, First Monday, vol. 18, no. 11, <http://firstmonday.org/ojs/index.php/fm/article/view/4954/3786>, accessed in January 2017.

⁷⁰ Bencardino, M., Greco, I. (2014), *Smart communities. Social innovation at the service of the smart cities*, TeMA – Journal of Land Use, Mobility and Environment, special edition: INPUT 2014 – Smart City: planning for energy, transportation and sustainability of the urban system, Napoli, pp. 46-47.

⁷¹ A wiki is a website that allows collaborative modification of its content and structure directly from the web browser.

- *the creative city* – this is the city where communication comes from the citizen in the form of artistic productions, offering favorable conditions for the regeneration of urban areas;
- *the resilient city* – this city model is associated with the idea of intelligence that can cause the transformation of events that are not beneficial for the development of the city.

3.4. Correlation between innovation and the intelligence of a city

In 2019 IMD World Competitiveness Center has created, in collaboration with Singapore University of Technology and Design (SUTD), the *Smart City Index (SCI)*, a comprehensive report for which the performance of 102 cities of the world was evaluated. The purpose of this report was to find out what citizens think about the efforts being made to transform the cities in which they live into smart ones⁷².

In that report, the top 10 smartest cities in the world in 2019 were: Singapore, Zurich, Oslo, Geneva, Copenhagen, Auckland, Taipei, Helsinki, Bilbao and Dusseldorf. The capital of Romania, Bucharest, was ranked 85th.

This section of the paper aims to present itself as a research that links the concepts of social innovation and intelligence of a city, representing a statistical analysis of the correlation between them, based on international studies focused on these two factors, referring to common indicators that are used to measure the use of the two concepts in different states of the world.

As the global statistics showing the situation of different smart cities are incomplete and often have missing values for certain periods of time, we have decided that it is more realistic to make these comparisons at the state level, so we will present the correlation between social innovation and the intelligence of the states of which the cities presented previously in this section are part, so we will present the values obtained, for the two aspects, by: Norway, Denmark, Finland and Romania in the period between 2012 and 2019.

⁷² IMD (2019), *IMD and SUTD's unique ranking shows importance of citizens' needs in policymaking*, [https://www.imd.org/smart-city-observatory/smart-city-index/#:~:text=The%20only%20global%20index%20of,all%20parts%20of%20the%20world.](https://www.imd.org/smart-city-observatory/smart-city-index/#:~:text=The%20only%20global%20index%20of,all%20parts%20of%20the%20world.,), accessed in March 2020.

Table 3.1. Correlation between innovation and the intelligence of a city

INNOVATION INDICATORS	SMART CITY INDICATORS
Population aged 25-34 with tertiary education	Individuals using the Internet for interaction with public authorities
Internet access	E-government activities of individuals via websites – submitting completed forms (last 12 months)
Oppurtunity-driven entrepreneurship	Digital inclusion – the percentage of persons that have used the Internet in the last 3 months (at least once a week)

Correlation information:

- **Countries:** Norway, Denmark, Finland and Romania;
- **Period of time:** 2012-2019;
- **Sources:** European Commission, Eurostat;
- **Condition:** investment in innovation leads to the development of smart cities (positive correlation / direct proportionality relationship);
- **Results:**
 - in most countries there is a positive correlation between the population aged 25 to 34 and the use of the Internet to interact with state authorities;
 - the correlation between the Internet access and e-government activities through websites may seem obvious, but there is a double implication in this case: it is true that if there is no Internet connection, no online action can be taken, but Internet access does not necessarily involve virtual interaction with public authorities. However, the correlation is positive for all four states studied;
 - mostly positive correlation between opportunity-based entrepreneurship and digital inclusion.

CHAPTER IV

– Application for integrating social innovation in the smart city context –

The study wants to show that there is significant unused processing power by computers already purchased by the Romanian public administration. In general, this computing power can be used by an application with a decentralized architecture that would run virtually on all units in the public institutions.

The empirical part of the thesis consists in conceptualizing an application for integrating social innovation in the smart city context. Basically, it is an application that would run on computers already existing in the public institutions, this application using some of the computing power not used by the processors of that equipment, making calculations and statistics related to one of the most important medical problems which society is currently facing. Thus, the proposed application focuses on the particular case of coronavirus (SARS-CoV-2), a type of coronavirus that appeared in December 2019 in Wuhan, China.

Technology is an element of major importance, whether it is applications that collect various data on the spread of the virus or the creation of 3D printed ventilators for hospitals⁷³. At the same time, the part of technology focused on the concept of artificial intelligence is used to research the new coronavirus, develop effective drugs and vaccines to combat it, manage services and resources in medical centers and analyze data needed to support public policy decisions that must be implemented in order to manage the current pandemic crisis⁷⁴.

Artificial intelligence is one of the young branches of modern technology and the research and development work in this regard is consistent in all parts of the globe. This new field promises significant developments in medicine⁷⁵, so it is of social importance and will help the evolution of mankind. Thus, the platform, which represents the implementation of the application, provides the technological basis for the use of more efficient methods of solving

⁷³ Banco Bilbao Vizcaya Argentaria (BBVA) (2020), *The innovation ecosystem, united against coronavirus*, <https://www.bbva.com/en/the-innovation-ecosystem-united-against-coronavirus/>, accessed in June 2020.

⁷⁴ Banco Bilbao Vizcaya Argentaria (BBVA) (2020), *How Artificial Intelligence can help fight COVID-19*, <https://www.bbva.com/en/how-artificial-intelligence-can-help-fight-covid-19/>, accessed in June 2020.

⁷⁵ Amisha, Malik, P., Pathania, M., Rathaur, V.K. (2019), *Overview of artificial intelligence in medicine*, *Journal of Family Medicine and Primary Care*, vol. 8, no. 7, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6691444/>, accessed in June 2020.

social problems. The proposed application would fulfill, through its implementation, an important step in preparing for technological advancement from a social perspective: the integration of the latest technologies in the public system, by having an integrated platform at national level, even in public institutions. This aspect is the innovative component of the application.

The algorithms used for machine learning and artificial intelligence help to establish diagnoses and make personalized treatment plans⁷⁶. The concrete description of the algorithms of the proposed application is outside the scope of this paper. Thus, an overview of the application will be presented.

This application aims to help medical centers in Romania that treat patients diagnosed with SARS-CoV-2 and find an effective vaccine against this virus. Without the help of modern technology, history has shown us that the development of effective treatments for newly discovered diseases would take years, even decades⁷⁷. With the inclusion of intelligent diagnostics and automated research algorithms, human effort is receiving significant support. Basically, the application would meet, for health and research centers, various processing requests, which may include automated analysis of medical data for rapid diagnosis or intelligent prediction of the effectiveness of personalized treatment plans⁷⁸.

The case study described supports the feasibility of the proposed application and the fact that its architecture has the major advantage of increased processing capability. The processing power referred to in this paper is measured in GHz and represents the CPU clock rate per second. This is one of the two relevant measures of computing power specific to processing units, the second being the maximum number of basic instructions achievable in a CPU clock cycle (IPC). This second measure is more difficult to find and, for this reason, was excluded from the study. The result of the case study is favorable and indicates that the computing power potential available for the application is more than significant: only from 10 public institutions included in

⁷⁶ Banco Bilbao Vizcaya Argentaria (BBVA) (2020), *How Artificial Intelligence can help fight COVID-19*, <https://www.bbva.com/en/how-artificial-intelligence-can-help-fight-covid-19/>, accessed in June 2020.

⁷⁷ Colarossi, N. (2020), *How long it took to develop 12 other vaccines in history*, <https://www.businessinsider.com/how-long-it-took-to-develop-other-vaccines-in-history-2020-7>, accessed in July 2020.

⁷⁸ Vaishya, R., Javaid, M., Khan, I.H., Haleem, A. (2020), *Artificial Intelligence (AI) applications for COVID-19 pandemic*, *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, vol. 14, no. 4, pp. 337-339.

the study, the potential computing power would be 4 times higher than the power of one of the most powerful processors on the market today⁷⁹.

The questionnaire prepared for this case study aimed to find out how much computing power is available and unused by public institutions in Romania, therefore taking into account the IT equipment already purchased. This questionnaire was sent to the Romanian public institutions representative for the objective pursued by the case study. Thus, the institutions selected as stakeholders of this research went through three stages of selection.

The first stage consisted in choosing some state institutions physically located in some of the smart cities of Romania, namely: Bucharest, Alba Iulia, Cluj-Napoca and Brasov, these being development areas focused on innovation.

The second stage of the selection of representative institutions for this research was represented by the existence, within those institutions, of an IT department as we sought to find out the informed opinion of civil servants who have knowledge in this field.

The third stage of the institution selection process was the fulfillment of the conditions for using the Windows operating system on the computers of those institutions. We chose the ones that use only the Windows operating system because, for its specific applications (from the Office suite or the pre-installed ones), the average CPU usage values could be determined experimentally.

Thus, out of a number of 40 institutions targeted in the first stage, 10 representative institutions were selected for this research, which met the necessary criteria to be considered public administration stakeholders in this case study.

The questionnaire included a number of 23 questions, of which we will present only the answers to the key questions for this case study.

The information collection period was between February and June 2019, so the results of this research are relevant for 2019.

Regarding the questionnaire conducted for this research, it should be noted that it is an exploratory one, so it was created in order to reveal the trends and opinions useful for conducting this research and for understanding the usefulness of such an application.

⁷⁹ AMD, <https://www.amd.com/en/products/ryzen-threadripper>, accessed in June 2020.

Specialists are looking for answers to the various current problems of society, but sometimes it can be difficult to find a path. In order to find the right direction to establish feasible solutions, they could benefit from the help provided by several computerized actions. For example, in the case of natural disasters such as floods, long-term prediction would have a major advantage in reducing the negative effects they produce. Prediction systems of this type require a lot of computational power and automatic analysis, difficult to obtain in a centralized architecture. Thus, by using the proposed application, therefore by dividing the processing tasks across its entire network, the computing processes would become decentralized.

We will present, in the following lines, the answers received to question 22 of the questionnaire, used for some of the calculations of this research. At the same time, we would like to mention that, in the 10 representative institutions for this study, there are a number of 1020 PCs and 217 laptops, sufficient equipment to support a possible installation of an application such as the one proposed. At the same time, it is important to find out whether or not those equipments have unconsumed computing power, a result that we will find out at the end of this chapter.

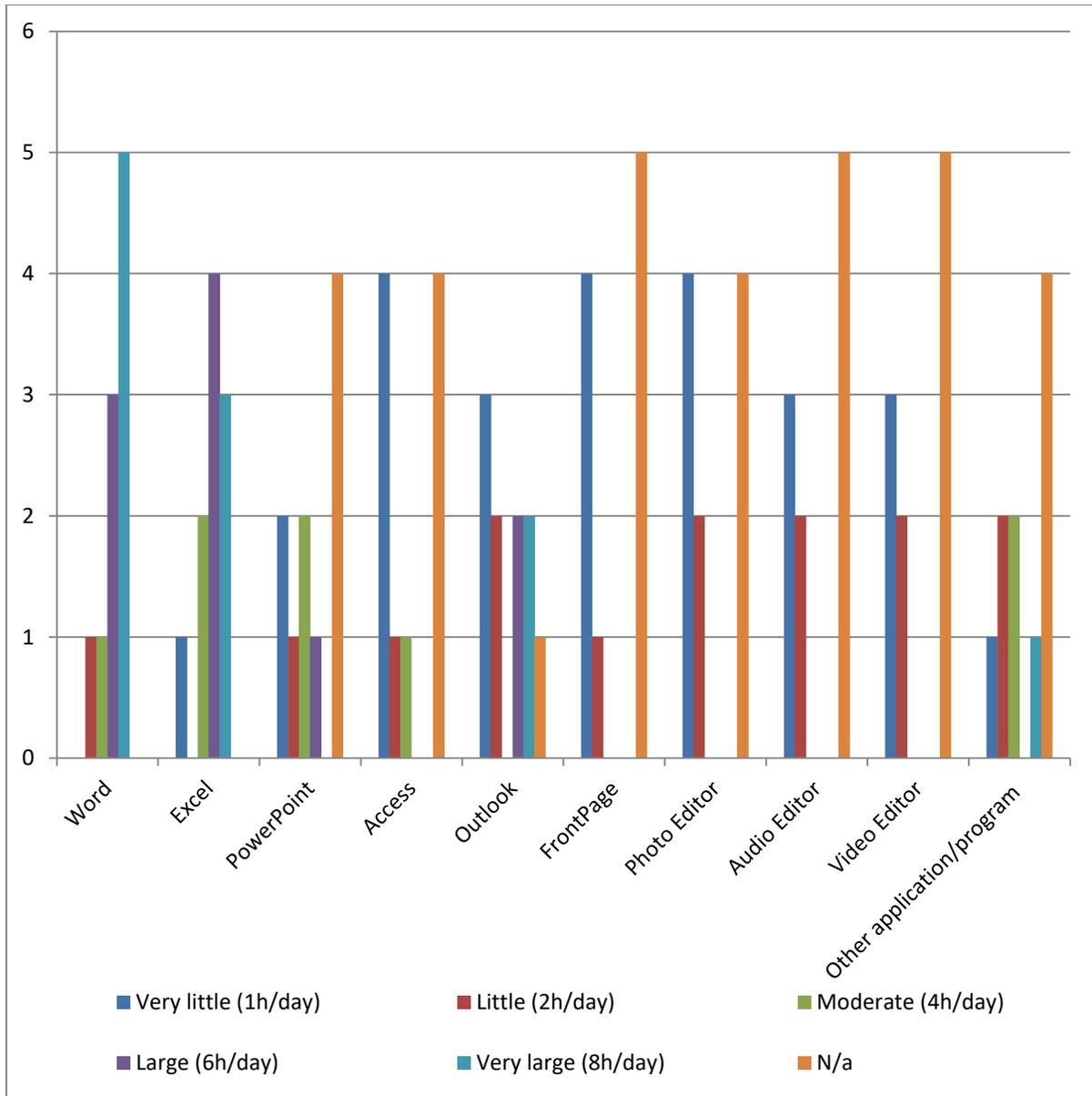


Figure 4.1. Components of the Microsoft Office package used to perform institution-specific activities

With this question, we wanted to find out which are the applications and/or programs of the Microsoft Office package that the civil servants of the responding institutions use in order to carry out the activities specific to the institution in which they work.

Thus, we found out that the most used elements of the Office package are Word (which in 5 of the responding institutions is used to a very large extent – 8 hours a day), Excel (in 4 of

the institutions it is also used to a large extent – 6 hours a day) and Outlook (in 2 institutions being used 8 hours a day). The other applications are also used in some institutions, but to a smaller extent, as can be seen in the chart above.

In the case of this question, the lack of an answer for a certain element (n/a) means that certain applications are not used within certain institutions. At the same time, there were answers in which the use of applications or programs other than those in the questionnaire was mentioned, among which were elements such as: D-Smart, ReviSal⁸⁰, PCA - Integraph⁸¹, Echofin⁸², various legislative software etc.

In the following lines we will present the steps through which we found the unused computing power within the 10 representative institutions for this research.

The experimental part of determining the average values of CPU usage by the applications in the Microsoft Office package, mentioned in question Q22, was performed by intensive use of these applications, resulting in an average percentage of CPU capacity used within one minute. The experiment was performed on two computers with total processing frequencies of 5 GHz (2 cores) and 6.8 GHz (4 cores). The percentages were extracted from the Resource Monitor interface, accessible in the Task Manager utility, and were transformed into absolute values (GHz) by reporting to the total processing frequencies of the respective computers. The resulted values for applications in the Office suite are as follows:

- 1) Word: 0.45 GHz;
- 2) Excel: 0.41 GHz;
- 3) PowerPoint: 0.5 GHz;
- 4) Access: 0.25 GHz;
- 5) Outlook: 0.54 GHz;
- 6) FrontPage: 0.2 GHz;
- 7) Photo Editor: 0.25 GHz;
- 8) Audio Editor: 0.2 GHz;

⁸⁰ General register of employees – includes all individual employment contracts in progress.

⁸¹ The Annual Coordinating Program (PCA) of Bucharest City Hall was developed with a geospatial solution developed by Integraph Computer Services, this solution generating the first G-2-G service with geospatial content in the Romanian public administration at the local level. See more information on the website Intergraph Computer Services, <http://www.ingr.ro/upload/resurse/Profil%20de%20solutie%20ePCA.pdf>, accessed in June 2020.

⁸² Communication platform for teams undertaking financial activities.

9) Video Editor: 0.55 GHz.

Regarding other applications or programs used by public institutions participating in the study, as access to them is restricted or consumption is highly variable, we decided to establish a CPU consumption of 50% of the processing power of computers in each institution. The latter is an excessive consumption, but which maintains the relevance of the results.

The final result of the study is a sum of processing frequencies considered unused by the existing computers in the analyzed institutions. This result can be considered the nominal frequency of a virtual processor made up by the simultaneous use of all those computers. We considered this sum as a homogeneous mixture, because the nominal frequencies represent an absolute property, of CPU clocks per time unit.

The calculation procedure is one that has been repeated for each institution. In a first stage, we calculated, for each institution, the weighted average of the nominal frequencies corresponding to each computer model reported by the respondents. To do this, we have followed 4 steps that we will describe below:

- **Step 1:** we summed up all the existing computers in the institution, obtaining a first result;
- **Step 2:** for each computer model, we obtained its share in the institution from the total number of computers, reporting the number of pieces in that model to the result from step 1;
- **Step 3:** for each computer model, we multiplied the weight obtained in step 2 with the frequency reported by the respondent;
- **Step 4:** summing all the results from step 3, we obtained the weighted average of the nominal frequencies corresponding to each computer model.

In the second stage we assigned weights to the average frequencies obtained in the experimental part, depending on the hours reported to question Q22 as follows:

- for the value 1, which in the questionnaire represents less than one hour of use of the respective application per day (very low usage), we set the weight 1, meaning one hour per day of CPU usage;

- for the value 2, which in the questionnaire represents over an hour, but also less than 3 hours per day of application use (low usage), we set the weight of 2, meaning 2 hours per day of CPU usage;
- for the value 3, which represents a moderate use of the respective application (more than 3 hours, but less than 5 hours per day), we set the weight 4, meaning 4 hours per day of CPU usage;
- for the value 4, which represents a high usage of the respective application (over 5 hours, but less than 7 hours per day), we set the weight to 6, meaning 6 hours per day of CPU usage;
- for the value 5, which represents a very high usage of the application (more than 7 hours per day), we set the weight 8, representing 8 hours per day of CPU usage.

In the context of variable usage hours for each application, this process simplifies calculations to find out existing and unused processing power. Thus, the remaining steps to reach the final result are:

- **Step 5:** multiplying the average frequency of processing units in an institution, resulted at step 4, with the maximum weight of use – 8, we obtained the maximum (weighted) computing power;
- **Step 6:** for each application of the Office package, mentioned in question Q22, we multiplied the number of hours reported by the institution with the average experimental frequency calculated for the applications in the Office package (the values were mentioned above);
- **Step 7:** summing up all the results obtained at step 6, we obtained the total weighted consumption of the applications;
- **Step 8:** subtracting the calculated computing power, resulted at step 7, from the result obtained at step 5, we obtained the total unused power;
- **Step 9:** multiplying the total number of computers of the institution, resulted at step 1, with the result from step 8 (total power not consumed) and dividing it by 8 (maximum weight), we obtained the total potential processing frequency for the application proposed.

Thus, following the calculations performed for the steps mentioned above, we obtained a total processing frequency, which could be available for the proposed application, of **1205.11 GHz**, meaning an average of **120.511 GHz** for each institution. This processing frequency, not used by the studied institutions, would be used by the application to perform calculations and simulations that would support the treatment of the new coronavirus and even determine the effectiveness of a vaccine against it. Currently, the coronavirus crisis is a major social problem, and the proposed application also lends itself to supporting this problem, but the concept of the application is not limited to this particular purpose. Its applicability can range from obtaining more accurate long-term weather forecasts, to supporting research and even medicine.

To compare the result of a virtual processor with a nominal frequency of 1205.11 GHz with the top physical alternatives at the moment, we have prepared the following table:

Table 4.1. Specifications of top processors

PROCESSOR MODEL	CPU FREQUENCY	CORE NUMBER	TOTAL FREQUENCY
Intel® Core™ i9 10980XE Extreme Edition	3 GHz	18	54 GHz
Intel® Core™ i9 10900K	3.7 GHz	10	37 GHz
AMD Ryzen™ Threadripper™ 3990X	2.9 GHz	64	185.6 GHz

Source: Intel, <https://www.intel.com/content/www/us/en/products/processors/core/x-series/i9-10980xe.html>, <https://www.intel.com/content/www/us/en/products/processors/core/i9-processors/i9-10900k.html>, accessed in June 2020; AMD, <https://www.amd.com/en/products/cpu/amd-ryzen-threadripper-3990x>, accessed in June 2020.

In the table above we can see three of the most powerful processors on the market today. As mentioned above, one of the institutions in the questionnaire has, on average, a computing power of 120.511 GHz, close to and even above the power of the processors mentioned in the table, which demonstrates that those institutions, and not only them, would have the opportunity to install the application proposed by this case study.

CONCLUSIONS

During the realization of this paper, we have witnessed many upheavals regarding the two concepts discussed, namely social innovation and the development of smart cities. These concepts have undergone, since their emergence, a series of transformations, by changing various paradigms or even creating new ones, all of which take place in order to adapt the older principles to the new trends that today's society imposes.

Through this paper we came to the conclusion that one of the main challenges facing both today's society and the public institutions is the continuous change process of the technologies used.

Today's world enjoys information and communication technology, which is one of the modern tools that contribute to the process of implementing democracy and developing the services provided by the public administration. States must therefore ensure access to all citizens who use digital information, free of charge, on the basis of the equality and non-discrimination principles⁸³.

Through the use of information and communication technology, public administrations can become more efficient, carrying out more transparent activities to help citizens increase their confidence in state institutions, thus contributing to the development of smart communities and cities.

Information and communication technology can therefore be useful for transforming constructive e-administration practices and therefore collaboration between state institutions and citizens. In order to strengthen such a constructive structure, state institutions must encourage the constant use of technology for the purpose of remote governance. Although there is no strict cause-and-effect relationship in which technology is the reason for these practices, we can see that e-government methods have helped to simplify them. So e-government methods have helped citizens and public institutions to interact despite geographical distances. At the same time, they managed to facilitate the finding of alternative sources of public information, citizens being able

⁸³ Matei, A., Iancu, D.C. (2009), *E-Administration as a Way of Increasing the Managerial Capacity in Public Sector*, Annual Conference NISPAcee (The Network of Institutes and Schools of Public Administration in Central and Eastern Europe) "State and Administration in a Changing World", 17th edition, May 14-16, 2009, Budva, p. 3.

to communicate more easily with the authorities through various online methods, such as e-mail, discussion forums etc.

These e-government methods facilitate alternative practices of collaboration, interaction between citizens and institutions, as well as individual finding of information of public interest. It is interesting to note, however, that individuals use technology in different ways only when it meets their needs, requirements and interests. They may also decide not to use it in a very high percentage.

In order to overcome the challenges arising from the use of e-government methods or the implementation of new ones, there is a need for openness and transparency related to the problems to be analyzed and the solutions to be found and put into practice to improve the life quality of citizens.

The public sector has a fundamental role to play in stimulating the creation of innovations and the use of information and communication technology in order to develop new projects and, implicitly, to increase productivity. At the same time, it must contribute to stimulating the creation of public value, to increasing the efficiency in the relationship between citizens and state institutions, thus responding to current social challenges⁸⁴.

This practice of social innovation can be implemented by developing creative minds that do not get caught in the margins of pre-established patterns⁸⁵. Fundamental elements, in this context, are experiments. In this way, participants can be given the opportunity to test an innovation for a certain period of time, through this test being able to highlight the unexpected effects that a certain innovation can have. It is also necessary to take into account the prompt analysis of the participants in those experiments as their experiences and the knowledge they have gathered over time can highlight the elements to be considered in the process of designing a social innovation⁸⁶.

However, although digital technologies are an important aid to the proper functioning of the processes of social innovation and smart city development, the fundamental element in any

⁸⁴ Matei, A., Săvulescu, C., Antonovici, C. (2015), *Social Innovation in the Local Public Sector: A Cross-Regional Approach for Romania*, Theoretical and Applied Economics, vol. 22, no. 4(605), p. 6.

⁸⁵ Tîrziu, A.M., Vrabie, C.I. (2016), *NET Generation. Thinking outside the box by using online learning methods*, New Trends and Issues Proceedings on Humanities and Social Sciences, no. 8, SPROC, Paris, pp. 41-47.

⁸⁶ Westley, F. et al. (2015), *Social Innovation Lab Guide*, The Rockefeller Foundation, pp. 1-100.

interpersonal relationship, namely human resources, must not be forgotten. We understand, therefore, that the interaction between people must not be suppressed, but rather a balance must be found between the use of the new technologies at their disposal and the traditional methods by which certain actions are carried out⁸⁷.

It is equally important how much individuals want to adapt to these new trends and acquire the necessary skills. This will of theirs must exist so that the whole process of developing smart cities is properly supported.

Therefore, we have observed that the objectives pursued by this paper were achieved, during the paper meeting other objectives that were not mentioned in the introduction. By reading this paper, we consider that the reader has managed to understand the concept of social innovation and its evolution in the public sector, as well as the concept of communities and smart cities development.

Thus, by achieving the objectives, it was possible to demonstrate that social innovation, urban development and public administration itself are constantly changing, both by highlighting the many transformations they have gone through and by mentioning various real examples from the global level.

Both social innovation and the development of smart cities are undergoing these changes for two reasons. First of all, these two concepts are influenced by today's society so it must be possible to adapt to the new requirements and needs that citizens have. At the same time, they undergo transformations in order to prevent certain situations that may require their partial or even total change. The reasons why these concepts go through various transformations were relevant for the elaboration of this paper, the subject of special interest in this context can be illustrated by the question "For who does the public administration reinvent itself?", the answer obviously being represented by the citizens of each state aspiring to the title of smart state.

The working hypotheses of this paper were confirmed, both by describing the concepts of social innovation and development of smart cities, and their components and by mentioning the various examples that we considered useful for this paper. Research has therefore shown that, as

⁸⁷ Tîrziu, A.M. (2016), *Social innovation a beneficial vision on the public sector. Case study: social innovation in the public universities from Italy*, vol. 3 of the Conference "Smart Cities", Pro Universitaria Publishing House, Bucharest, pp. 233-250.

public institutions become more involved in the social innovation process, the life quality of a state's citizens also improves, contributing to the development of smart cities.

The application proposed in the fourth chapter of the paper is intended to help find a solution to one of the most serious medical problems in the world today. It introduces a new way for public administration to support citizens, while using hardware resources already available but not used by public institutions. Thus, the application, through its implementation, would take part in increasing the performance of smart cities, being at the same time an innovation with a strong social impact.

The quantitative study carried out on a series of institutions in Romania aimed to determine a certain minimum of processing power available and unused by them. This minimum is guaranteed by the fact that the whole calculation process was built considering the intensive use of the applications in the Microsoft Office package mentioned in the questionnaire and of the unknown applications. Even in these conditions, the result reveals a real opportunity to integrate the proposed application in public institutions in Romania, demonstrating that, on average, these institutions have a significant potential of resources usable for this purpose. As this integration would not require the modification of existing structures or major investments in processing equipment, and the benefits would be the improvement of citizens health and research processes at national level, the implementation of this application is presented as a process without concrete impediments.

In conclusion, we believe that this research has succeeded in answering the question: "Can social innovation contribute to the development of smart cities through an application that contributes to the improvement of citizens life quality?", the answer being an affirmative one.

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65. Worldometer (2020), <https://www.worldometers.info/world-population/>, accessed in January 2020.

ANNEX 1

QUESTIONNAIRE TEMPLATE

SNSPA. Doctoral School in Administrative Sciences

Questionnaire on the percentage of computing power used by public institutions in Romania

This questionnaire aims to find out the number of computers used in public institutions of Romania and the applications used to carry out activities. The research is carried out in public institutions in Romania and has a scientific purpose. You have been chosen to answer this questionnaire as you are part of the institution's IT department. The validity of this study depends on your honesty.

The name of the institution you belong to will be mentioned in the study to ensure its transparency and accuracy. We also mention that personal data (name, surname, e-mail address) will not be used in the study, being necessary only to certify the authenticity of the questionnaires.

Insert an „x” in the box that corresponds to your opinion. Choose a single answer option unless otherwise specified.

Thank you for your collaboration!

ID questionnaire _____ (to be completed by the researcher)

Q1. Name and surname: _____

Q2. Gender:

- 1. M
- 2. F

Q3. The name of the public institution you belong to and the city in which it is located:

Q4. Position held within the IT department of the institution:

- 1. Department head
- 2. Administrator
- 3. Another department member

Q5. Do you think that there is a link between the correct use of the computer, the stimulation of innovation and a good functioning regarding the relationship between the institution and its officials? Hatch the box corresponding to your answer.

1. Very small	2. Small	3. Neutral opinion	4. Big	5. Very big
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Q6. Specify what type of computer the institution you belong to uses. Hatch the associated box.

Q7. Specifies the model of computers used, their number and the total frequency of computer processors in GHz⁸⁸. Fill in the appropriate boxes where appropriate.

Model 1	No.	Processor frequency (GHz)	Model 2	No.	Processor frequency (GHz)	Model 3	No.	Processor frequency (GHz)
1. PC								
2. Laptop								
3. Tablet								
4. Other type of computer (mention):								

⁸⁸ If there are multi-core processors, display the product result between the number of cores and their frequency.

Q8. To what extent do you use the institutional computer for the activities listed below? Hatch the box corresponding to your answer.	Very little	Little	Moderate	Large	Very large
1. Creating materials	1	2	3	4	5
2. Use of online resources (sources, platforms etc.)	1	2	3	4	5
3. Online communication within the institution	1	2	3	4	5
4. Other activity (mention):	1	2	3	4	5

Q9. In order to acquire the skills necessary to use the computer, the civil servants of the institution attended specific courses or training programs?

- 1. Yes
- 2. No

Q10. If the answer to the previous question is no, please move on to the next question (Q11). If you answered yes to the previous question, please specify the type of courses or training programs:

- 1. Accredited, short or medium duration (less than 60 hours)
- 2. Accredited, long-term (between 61 and 100 hours)
- 3. Uncredited, short-lived (less than 20 hours)
- 4. Uncredited, medium duration (between 21 and 40 hours)

Q11. Do you think that participating in a computer training program would help stimulate the creativity and innovation of the institution's civil servants? Hatch the box corresponding to your answer.

1. Total disagreement	2. Disagreement	3. Neutral opinion	4. Agreement	5. Total agreement
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Q12. In your opinion, participating in a training program to stimulate innovation and technology transfer in the institution is a way to increase the performance quality of the institution's civil servants?

1. Total disagreement	2. Disagreement	3. Neutral opinion	4. Agreement	5. Total agreement
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Q13. Do you believe that the institution you belong to should develop the technologies used for digital communication to stimulate creativity and innovation?

1. Total disagreement	2. Disagreement	3. Neutral opinion	4. Agreement	5. Total agreement
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Q14. Are new digital communication technologies used for socially-innovative purposes within the institution you belong to?

1. Total disagreement	2. Disagreement	3. Neutral opinion	4. Agreement	5. Total agreement
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Q15. The institution you belong to has an innovation and technology transfer department?

- 1. Yes
- 2. No

Q16. Does the institution of which you are part of develop innovation and technology transfer programs?

- 1. Yes
- 2. No

Q17. Are there created and/or developed research projects within the institution?

1. Very few	2. Few	3. Neutral opinion	4. Many	5. Very many
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Q18. Can the services provided by the institution be applied in areas complementary to the main field for which they were designed?

1. Very little	2. Little	3. Neutral opinion	4. Much	5. Very much
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Q19. Do the services provided by the institution have social impact?

1. Very little	2. Little	3. Neutral opinion	4. Big	5. Very big
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Q20. Does the institution you belong to organize and participate in local, national and/or international actions to stimulate social innovation and the development of smart cities?

1. Very little	2. Little	3. Neutral opinion	4. Much	5. Very much
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Q21. Please specify which operating system is running on the PCs of the institution you belong to:

- 1. Windows
- 2. Linux
- 3. Other operating system (please specify): _____

Q22. If your institution uses the Microsoft Office suite, please specify the extent to which public servants use certain applications and/or programs to perform institution-specific activities. Hatch the box corresponding to your answer.

	Very little (< 1h/day)	Little (> 1h, <3h/day)	Moderate (>3h, <5h/day)	Large (>5h, <7h/day)	Very large (>7h/day)
1. Word	1	2	3	4	5
2. Excel	1	2	3	4	5
3. PowerPoint	1	2	3	4	5
4. Access	1	2	3	4	5
5. Outlook	1	2	3	4	5
6. FrontPage	1	2	3	4	5
7. Photo Editor	1	2	3	4	5

8. Audio Editor	1	2	3	4	5
9. Video Editor	1	2	3	4	5
10. Other application/program (mention):	1	2	3	4	5

Optional

Q23. If you would like to receive the results of the study, please provide us with your e-mail address: _____

Thank you!

ANNEX 2

LIST OF INSTITUTIONS CONSIDERED FOR THE STUDY

PUBLIC INSTITUTION NAME
County Agency for Employment Alba
General Directorate of Social Assistance and Child Protection Alba
Brasov Philharmonic
Bucharest Streets Administration - General Council of Bucharest
Bucharest Authority for Animal Surveillance and Protection
Bucharest Center for Seniors
Bucharest City Hall of District 1
Cluj County Agency for Payments and Social Inspection
Cluj County Council
Cluj Court of Appeal