THE SMART CITY CONCEPT – FOCUSING ON THE PERCEPTION OF CLUJ-NAPOCA RESIDENTS

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ABSTRACT

The Smart City concept became a key aspect in the development of municipalities. This study underlines the major components of a Smart City and presents in a comprehensive way what strategies are to be used, by putting in the spotlight one of the best examples of a city which implemented this framework: Cluj-Napoca. With contributors from the academic to the business sector, and including the citizens and their needs, this city in Romania managed to implement projects which helped it to become first in rankings of business openness, safety and quality of life. The conclusions present the significant impact of the Smart City concept, and the focus authorities should have for the involvement of citizens in the strategic decisions and long term vision of the municipality development.

1. INTRODUCTION

A smart city development strategy applies different technologies and several digitalization levels to save the consumption of resources, improve people's quality of life and increase the economy competitiveness of regions through sustainable policies. This concept involves the implementation of effective intelligent solutions for infrastructure, energy, housing, services, and security, based on integrated sensor technology, connectivity, and data analysis. (Gassmann, Böhm & Palmié, 2019)

The definitions and characteristics of a smart city vary, but common to most of them is the dependence on ICTs (Information and Communication Technologies). Digitalization and technology are the substrates that underpin multitudes of networks and penetrate almost all aspects of everyday life to streamline urban activities, collect data and respond in real time to people's needs. (Halegoua, 2020)

There are statistics which support the importance of smart city approach for future developments and sustainability of regions all around the world: the number of people living in cities has an increased trend while the number of people living in rural areas decreases; in 2014, the percentage was slightly in the favor of cities- 54% but for the middle of the 21st century 70% is expected. Additionally, cities will be responsible by then for up to 80% of the total energy demand and for 75% of the total carbon dioxide emissions. It is obvious that special attention is required as articles mention. Thus, anticipating the exponential growth of the urban population will increase the space and resources needed to support it, which creates a situation that requires immediate action. (Gassmann et al., 2019; Halegoua, 2020)

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We consider that the benefits for developing sustainable urban areas are multiple, as are the challenges arising from urban digitalization. Next, some of the most actual issues that stand in the way of the development of a smart city will be presented:

Despite the fact that the emergence of new technologies has changed everyday life to a large extent, the infrastructure in the vast majority of cities has not undergone huge changes in the last two centuries. In order to fully benefit from turning a city into a smart city, an advanced infrastructure is needed, supported by innovative hardware devices. Most cities in developed countries already face infrastructure problems such as water pipes, extremely high traffic volume, high-speed internet, electricity, etc. (Chalimov, 2019)

To fully benefit from the opportunities of a smart city, citizens must be considered a priority in the sense of making them prepared for the complex changes that follow. Thus, a lot of attention should be paid for educational programs, from the general ones, by revealing the benefits of smart ideas implemented in administration of cities, to the very specific ones, which give citizens information about future projects in certain field of the city. In general, people are resilient to change, and building smart cities should involve educational initiatives in order to make them supportive and to make them co-authors to the changes. Such initiatives could include various promotional campaigns, in-person meetings with representatives of the local government, online educational platforms and printed handouts – anything that could help citizens accept the change and make the transition less unnatural. (Chalimov, 2019)

As cities seek to improve their infrastructure with smart technologies, the budget for such projects is a major challenge when introducing large-scale smart technologies. Providing funding to start the project and ensuring that there are sufficient resources to support the project over time requires significant investment.

The aim of this research is a double-targeted one. On one hand, it is aimed at highlighting the strategic steps achieved until now in the development of the Cluj-Napoca Smart City, and on the other hand to evaluate the perception of the Cluj-Napoca residents as a key factor in the future implementation of smart projects.

2. SMART CITY – HISTORY, ROLE AND CURRENT STATUS

The idea and existence of the smart city concept is a relatively new one. The use of computational statistical analysis by the Los Angeles Community Analysis Bureau in the late 1960s and Singapore's establishment of the National Computer Board in 1981 are cited as among the earliest cyber interventions in urban planning. IBM launched its "Smarter Cities" marketing initiative in 2008. In 2010, Cisco Systems, with $25 million from the Clinton Foundation, established the connected urban development program in partnership with San Francisco, Amsterdam, and Seoul. In 2011, in Barcelona, a world congress "Smart City Expo" was held, attended by 6000 people from 50 countries. In 2012, the European Commission created the Smart Cities Marketplace, a centralized hub for urban initiatives in the European Union. (Mills, Pudney, Pevcin, Dvorak & Evidence, 2022)

Urban centers are important for the development of any region up to the national economic level. The city is a complex system created by subsystems with individual objectives, most of the time divergent. Those subsystems represent needs and interests of different stakeholders, as well as development factors. It is very important to develop the concept in an effective manner in order to ensure a convergent approach for the future. Statistics predict that by the year 2050 about 70% of the world's population will live in cities, so it is absolutely necessary to implement the smart city concept so that cities can host the future population of the world. The urban transformation from a disorganized system to a society where there are controlled technological systems becomes the goal and justification for the development of the smart city concept. (Halegoua, 2020; Kozłowski & Suwar, 2021)

The implementation of the smart city concept promises to bring, among other things, the following benefits:

Efficiency - When the global or national economy suffers, cities reorganize using strategic technology-based management that can restructure mobility models and service delivery. The transport, communication, waste system or the production of water needs are optimized by new technologies that produce more efficient results at lower costs. For example, the London-based transport agency implemented a system in 2014 that allowed Residents and London's 19 million visitors to pay for bus and subway charges faster and safer than in the past. Thus, the city has benefited from the reduction in the costs of managing its tariff payment system, and users have benefited from faster services. (Futurism, 2017; Halegoua, 2020)

Sustainability - Smart City is also a plan for how cities can cope with the growth of urbanization and population by promoting a sustainable life. The vision of this concept is a future in which management practices will prevent environmental catastrophes (pollution, climate change and abundant consumption of natural resources). Siemens also offers a number of arguments by which it emphasizes the need for smart cities: energy reserves are limited, we are forced to limit the use of resources, the importance of renewable energy is constantly growing.

By collecting and analyzing data from interactions in the urban environment, municipal organizations can make more informed decisions. By measuring elements such as pollution, water and energy use, waste accumulation and environmental factors such as the sun, wind, rain and temperature changes, smart city proponents aim to make them greener cities that allow them to accommodate the ever-increasing number of inhabitants. Sensors that measure variables such as carbon dioxide emissions and greenhouse gases, or the use of energy and utilities, report back to websites and centralized or open-access databases are joint initiatives of a smart city. Copenhagen is at the forefront of smart cities with the best strategy to use technology to make the city greener and improve the overall quality of life. The city intelligently uses wireless data from mobile devices, GPS from buses and sensors in sewers and trash cans to assess the state of the city in real time and make improvements to reduce traffic, air pollution and CO2 emissions. (Halegoua, 2020; Hamza, 2021)

Economic development - The economic justifications for developing a smart city tend to revolve around three topics: increased savings for city administrations, new revenue streams from the sale of smart city products and the incubation of business and talent and attracting global business or new businesses, thus establishing the city as a center for economic activity. The promise of lower costs is closely linked to the optimization of infrastructure and public services, but the potential for revenues stems from the transformation of cities into laboratories for new digital technologies. The smart city is promoted as an incubator for entrepreneurs and markets that use technology. (Halegoua, 2020)

The promise of economic development is based on the idea that a smart city will be able to develop, test and then export state-of-the-art technologies or services to other cities. Creating a smart city is seen as an advantage in local branding and intercity competitions. Municipal officials and companies that develop technology welcome the idea of developing the smart city concept, because the image of the city as a leader in the technological sectors will be cultivated and the desire to improve the lives of citizens will be appreciated. (Halegoua, 2020)

2.1 Services - content and evolution in the Smart City concept

Although there is no exact or universal definition of the smart city concept, the specialists agreed and identified six dimensions. They lead to the conclusion that the smart city initiative is a city that, based on modern information and communication technologies, integrates the economy, people, life, environment, governance, and mobility. The six dimensions of the smart city concept will be described below:

Smart Environment - focuses in particular on minimizing the ecological footprint of a city, but without affecting the quality of life of citizens. The main objectives include efficient waste management, the use of renewable energy sources and green urban planning. New urban planning concepts introduce new elements, such as banks with moss surfaces filtering out dust particles. This concept aims to achieve the following objectives: energy efficiency, use of renewable energy sources, pollution reduction, homes to produce energy, etc. (Gassmann et al., 2019)

Smart Living - encompasses different aspects of quality of life. Some areas of the broad concept are considered by Gassmann et al. (2019): the health, safety, culture and living conditions of people. Various examples could be given: fire detectors, software monitoring 24/7, intelligent detection and prevention of fires; video surveillance, to increase public safety and perform predictive analysis to optimize traffic flow; air conditioning, for monitoring and controlling temperature and humidity indoor/outdoor.

Smart Economy - another important service area in a smart city. The main objective of this concept is to increase the competitiveness of the city and to obtain a higher efficiency of local processes, using supportive new technologies. The municipality needs to pay attention to the following factors: the innovative thinking, entrepreneurship, new equipment productivity, adaptability of the labor market. Currently, many cities are trying to establish innovation ecosystems where established companies, startups and other interest groups can collaborate or compete in the development of innovative solutions and business models. (Gassmann et al., 2019)

Smart Mobility - a basic element of the smart city initiative, because urban mobility is one of the major factors that causes many inconveniences to the inhabitants of a city, due to frequent traffic congestion. Smart mobility initiatives take into account the following factors: sustainable, innovative and safe transport systems; quick access to various modes of transport, inclusion of non-motorized transport. On the other hand, various innovative solutions are already in the implementation stage. Existing projects include traffic guidance systems, parking spaces with sensors (allowing online verification of the number of available places), smart traffic lights, and bicycle or car sharing systems. (Gassmann et al., 2019)

Smart Government - is mainly described by an efficient public administration, the quality of public services and the participation of citizens in decision-making on the city's projects. Initiatives in this area should create greater transparency at the level of administrative structures, as well as the active participation of urban inhabitants. Most of the ideas in this field are oriented around a simple form of digitization: all documents previously printed on paper can be accessed online.

On this issue, Estonia currently has one of the most ambitious projects in the world in the field of technology-assisted policies. It includes anyone involved in the government and has changed the daily lives of citizens. Almost all public services are involved: legislation, voting, education, justice, health, the bank, taxes and the police. They are digitally connected to each other through a single platform. Only for marriages, divorces and real estate transactions is a visit to the city hall mandatory. (van den Bosch, 2021)

Smart People - the concept is closely related to the qualifications and education of the inhabitants of the city, as well as to the social interactions related to integration and public life and openness to new technologies. In more concrete terms, the purpose of this dimension is at least to preserve - preferably growth - the social and human capital of a city. The ability of individuals to develop their full potential and to actively engage in public and social life is pursued. Early conceptions of the smart city initiative focused on the use of digital technology to encourage communication between residents and to combat the sense of anonymity felt within cities. This dimension aims to improve the following aspects: social and ethnic diversity, creativity, openness to everything new, participation in public life, involvement of citizens in a process of lifelong learning. (Gassmann et al., 2019; Kozłowski & Suwar, 2021)

3. The Smart City concept - practical approach at the level of Cluj-Napoca

3.1 Digital development strategy for Cluj-Napoca

Digital transformation must be understood as a continuous process, with flexible, dynamic objectives that can be modified or eliminated, depending on factors such as: crisis situations, changing strategic priorities, economic development, and technological innovations. When it comes to a digital development strategy, the central element around which it is built are the citizens. Technology plays an important role in the lives of Cluj residents, and it is a key element that contributes to increasing the quality of life of citizens. In crisis situations, the authorities can use the technology to provide quality services, adapted to the new conditions, having even more certainty that these services will be able to work regardless of the situation they are going through.

Digital transformation must also be seen as a strategic move, as it generates benefits for the city, citizens, public institutions and stakeholders. This transformation contributes to the city's transition to a society where all actors are interconnected in an innovative ecosystem. A digital development strategy capitalizes on the potential of innovation and digitalization, in line with the metropolitan and regional connection strategy that Cluj-Napoca will pursue in the next period. (FSPAC, 2021)

3.1.1 Strategic principles and priorities

The priorities of the digital development strategy of Cluj-Napoca are:

- The central point is the citizen's need
- Supporting startups and creating an economic environment conducive to private companies
- Focus on protecting citizens' personal data
- Optimizing the exchange of information between departments, institutions and citizens and institutions
- Involvement of all relevant actors in the field of ICT: private companies, local authorities, citizens, digital innovation hubs, NGOs
- Prioritizing innovation in all areas and forms
- Projects need to be interconnection-ready, provide accurate measurement and analysis capabilities, support decision-making
- Developing a flexible, easy-to-adapt strategy

3.1.2 Vision

Cluj-Napoca will integrate technology into the lives of citizens with the aim of sustainably increasing the quality of life and prosperity of Cluj residents in local, metropolitan and regional communities. The entire process of the digital development strategy must be understood as an intelligent community platform that allows continuous, connected and active interaction and participation of different actors interested in the digital transformation process.
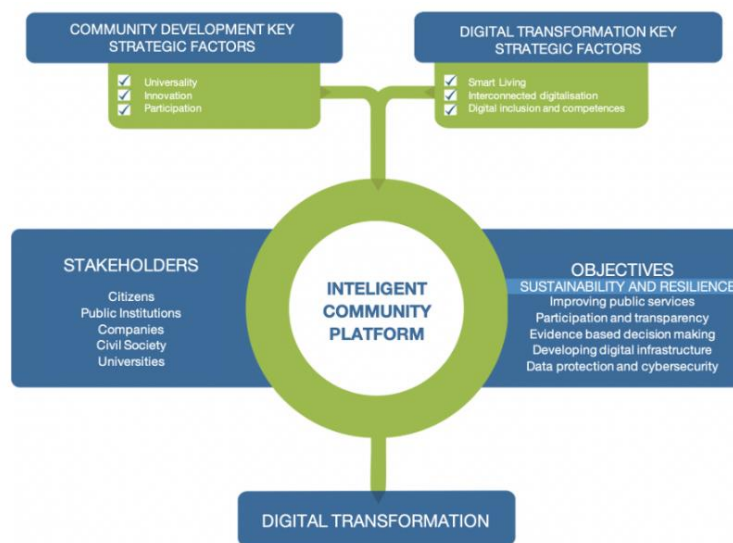
Figure 1. Smart Community Platform
Source: FSPAC (2021)

3.1.3 Key strategic factors

Technology can be a decisive factor in the development of essential areas in Cluj-Napoca. At the level of local administration, it is desired to increase the degree of digitization of local public institutions and automate repetitive processes. The educational system at all levels has contributed massively to the success of the city and it is necessary to continue investing in digitalization in order to be able to attract the best pupils and students in Cluj-Napoca. It is desired to streamline the interaction of pupils and students with local institutions, and to value universities, because they can have a decisive role in the effort of digital transformation. Health also occupies an important place in the plans of public institutions, because it is one of the most important aspects regarding the quality of life of citizens, and this system must always be prepared for crisis situations or unforeseen events. The accelerated growth of Cluj municipality is largely due to the local business environment, which is why the interaction with the state institutions must be simplified and streamlined, a friendly business environment must be created in order to be able to attract as much new capital as possible to the city. The quality of life is also strongly influenced by the environment. Digitalization can facilitate the streamlining and systematization of environmental data collection in order to improve the quality of air, water, soils, the quality of green spaces, the collection and recycling of waste. The digitalization of environmental information must be doubled by the transparency of their communication to citizens and interested entities, which will lead to a better understanding of local environmental issues by the general public, to a greater receptivity to the environmental public policies of the local administration, as well as to a higher quality of life. (FSPAC, 2021)

The lack of interoperability of existing IT systems and applications is an impediment when trying to digitize. There is a need to define standards related to data collection and storage, security and privacy policies, and access policies.

3.2 Progress and steps in the implementation of the Smart City concept

The initiatives regarding the Smart City concept in Cluj-Napoca and the efforts made regarding this initiative are well known not only locally, but also at European level. Next, the projects implemented from 5 thematic areas will be described: transport and urban mobility, citizen's safety, energy and environment, citizen-city hall relationship, internet access.

On energy and the environment, the following projects are underway or have been completed:

- rehabilitation of schools: For example, in 2021, an investment of 6 million euros was completed for the construction of a new building for the Theoretical High School "Onisifor Ghibu". Renewable energy sources have also been installed.
- rehabilitation of blocks of flats: A project worth 80 million euros was approved
- facilities for green buildings: in 2012 the Local Council of Cluj-Napoca reduced the tax for buildings with superior energy performance, certified as "green buildings"
- LED lighting devices
- Smart lighting in the Central Park: In 2019, a project of 535,000 lei was completed for the modernization of the public lighting systems by reconfiguring and using LEDs.
- promoting renewable energies

Urban transport and mobility greatly influence the quality of life of the inhabitants of a city. In Cluj-Napoca there are the following projects aimed at improving urban mobility:

smart ticketing systems, self-service network for bicycle rental, interconnected traffic light systems: A system of this kind, for streamlining traffic, was introduced in the Lucian Blaga Square area (February, 2021), payment by SMS, mobilPay, 24pay and credit card for public transport, Cluj Parking: application for displaying free places in the barrier parking lots in the city

To improve the citizen-town hall relationship, many of the services that required physical travel can now be paid for online:

- first virtual civil servant, "Antonia": It shortens, according to the local authorities, by 40% the time of the circuit of documents in the institution, as a result of the fact that the applications are registered directly with the heads of services or offices. The creation of this "official" based on artificial intelligence is part of the process of digitization of the procedures in the local public administration in Cluj.
- paying local taxes online and with smart devices
- scheduling marriages online
- online payment of foreclosures, traffic fines and local police fines
- online tracking of the resolution of any application submitted online or at the counter
- My Cluj app: Allows citizens to register complaints

At the same time, citizens and tourists can access the Internet through free Wi-Fi points installed in the central area of the city but also in neighborhoods – over 30 hotspots installed. For the safety of citizens there is a traffic monitoring system with over 295 surveillance cameras.

Also in Cluj-Napoca was inaugurated the first smart street in Romania. Molnar Piuariu Street with trees planted and an irrigation system with sensors and a modern pedestrian corridor, with the prioritization of non-motorized means of transport. Four places for charging electric cars and 15 parking spaces for motor vehicles, 30 places for charging electric bicycles/scooters and 22 bicycle parking spaces, free Wi-Fi and USB sockets for charging mobile devices are available to locals and tourists. In the area, an intelligent, energy-efficient public lighting system, an improved rainwater collection system, an irrigation system with sensors, benches, chairs, tables, bicycle parking frames, display systems, and chimneys were installed. (Cluj-Napoca City Hall, 2020)

All these initiatives in Cluj-Napoca, as well as the efforts of the local public authorities, have not gone unnoticed even at European level. Thus, at the beginning of 2021, Cluj-Napoca was designated the winner of the 1st place within Emerging Europe, the "Smart City" category. Cluj, is also the first city in emerging Europe that managed to qualify for the last stage of the European Capital of Innovation Award, has been seen in recent times as one of the main innovation hubs in the east of the continent. It is estimated that about 10% of the city's workforce works in IT and other startups.

3.3 Practical study - residents' perception of the digitalization of services

The purpose of this research is to identify what is the perception of the inhabitants of Cluj-Napoca on the Smart City concept, which are the areas with the greatest potential for digitalization and

innovation, and to find out what is the opinion of the citizens regarding the level of involvement of the local authorities regarding various areas that can benefit from the implementation of the Smart City concept.

In order to analyze the perception of the inhabitants of Cluj-Napoca on the Smart City concept, the questionnaire, distributed in the online environment, was chosen as a research tool. It was composed of two sections: general questions on the implementation of the Smart City concept in Cluj-Napoca and noting the degree of involvement of local authorities in Smart City initiatives. The platform used was Google Forms and there were 74 respondents that answered the questions.

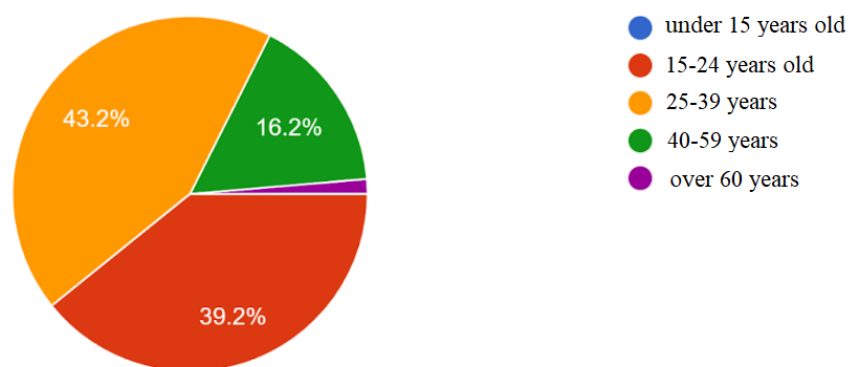The segmentation was carried out on the following age categories:

Figure 2. Study questionnaire, Question 1: Which age group do you belong to?
Source: developed by the authors

As can be seen, there are respondents from almost all age categories, and predominant are the categories 25-39 years, with a percentage of 43.2% and 15-24 years, with a percentage of 39.2%. Next, the first section of the questionnaire concerned general questions on the Smart City concept as follows:
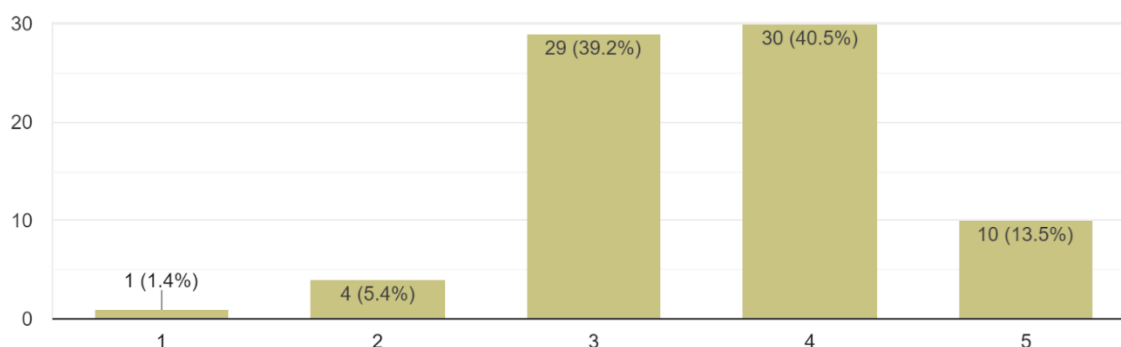

Figure 3. Study questionnaire, Question 2:
How familiar are you with the Smart City concept?
Source: developed by the authors

The results reveal that the inhabitants of Cluj-Napoca are largely familiar with the Smart City concept (93.2% appreciated this question with a grade greater than or equal to three). More than half of the citizens gave the mark greater than or equal to four, from which it appears that there is a certain desire for involvement in this initiative.

The next question concerns what are the first 3 priorities that should be asked in order for the city of Cluj-Napoca to reach a higher degree of intelligence. The first 3 priorities chosen by the participants are: projects for smart education systems (56.8%), urban mobility initiatives (52.7%) and urban planning projects and green areas and their interconnection (50%). At the same time, 41.9% of citizens also consider green energy initiatives as a priority. From these answers we note that citizens want to prioritize investments in education, so that new generations grow in an environment where intelligent systems are implemented, they can feel all the advantages of these systems and to awaken in them the desire to have as many such systems as possible at municipality level.

In order to choose the areas with the greatest potential for digitalization and innovation, the participants had the possibility to choose at most three answers. The social and educational field was at the top of the preferences, being chosen by 54.1% of the participants, followed by lifestyle and quality of housing (48.6%), government and public administration (47.3%), economy and business environment (45.9%). At the opposite pole are the changes for the environment, where only 18.9% of the participants considered that there is a great potential for innovation, which may also be due to the major investments lately regarding the arrangement of the green spaces that the people of Cluj can enjoy (e.g. Gheorgheni sports base, rehabilitation of certain parks).
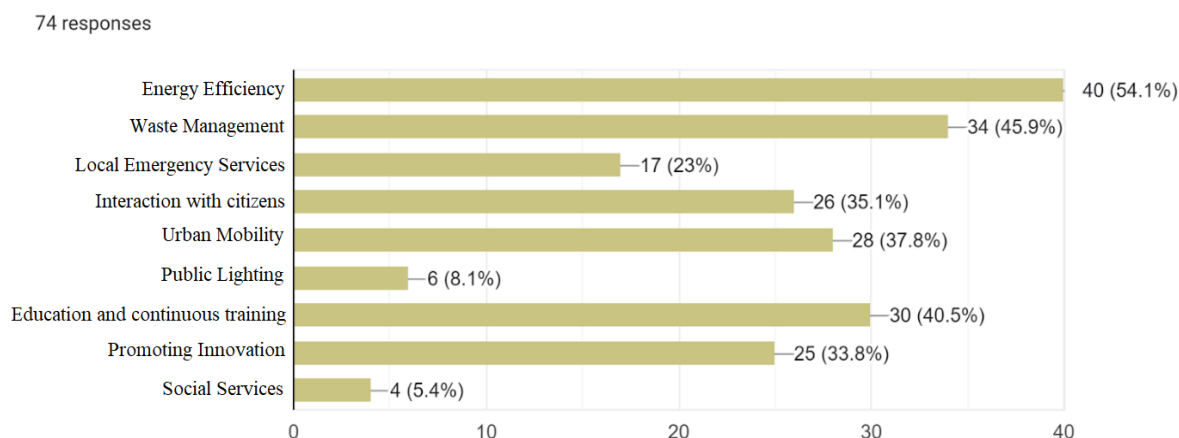

Figure 4. Study Questionnaire, Question 5:
Which local services could benefit more from the development of the Smart City concept?
Source: developed by the authors

Those surveyed consider that the local services that could benefit the most from the development of the Smart City concept are: energy efficiency (54.1%), waste management (45.9%), education and continuous training (40.5%). Both from this question and from the answers given in other questions, the intense concern of citizens for the protection of the environment and for the education system is noted. 37.8% of respondents believe that urban mobility can also be improved following the implementation of the Smart City concept, while the other percentages were as follows: 23% chose local emergency services, 35.1% interaction with the citizens, 33.8% promoting innovation and 5.4% social services.

Surprisingly, public lighting was chosen by only 8.1% of those surveyed. According to the World Bank, it accounts for up to 65% of a city's electricity costs and 10% of its total budget. The demand for lighting is increasing significantly due to rapid urbanization, thus consuming even more energy

and money. Therefore, it is necessary to implement smarter solutions to reduce costs (Silicon Labs, 2022).

In implementing any new initiative, there are certainly some challenges. Those surveyed consider that the main challenge is public-private collaboration (40.5%) without which, it is impossible to develop projects within a Smart City. 32.4% of respondents consider that ensuring the involvement of citizens can also be a critical point, and 25.7% consider that an efficient collaboration between local decision-makers is needed.

The last question in the first section of the questionnaire concerns citizens about the integration of technology-based solutions. 35.1% of them consider that information security is the main danger, in second place is the difficulty to accommodate and use technology (23%), and followed by human interaction. One aspect worthy of consideration is that citizens fear that the implementation of this concept may affect the interaction between them. 14.9% of the respondents believe that their privacy can be invaded, and only 9.5% consider that the costs of these digital solutions should be a cause for concern, because the municipality of Cluj-Napoca has attracted funds for the implementation of such solutions on a number of occasions. The rest of the respondents indicated human interaction (17.6%).

In the second section of the questionnaire, the citizens of Cluj-Napoca were asked to evaluate the level of involvement of the local authorities regarding various aspects that are part of the 6 components of the Smart City concept: Smart Environment, Smart Living, Smart Economy, Smart Mobility, Smart Government, and Smart People. Each aspect of the Smart City components could be noted with the following ratings: "Low level of involvement" (purple), "Significant level of involvement, but the measures taken are insufficient" (green), "Average level of involvement" (orange), "High level of involvement" (red), "Very high level of involvement" (blue).

As with question 5 we saw that the local services that could benefit more from the development of the Smart City concept were more centered upon the Smart Environment and Smart Living components, we decided to include the visual representation of those components as figures 5 and 6 in order to better underline the results and implications of that part of the survey.
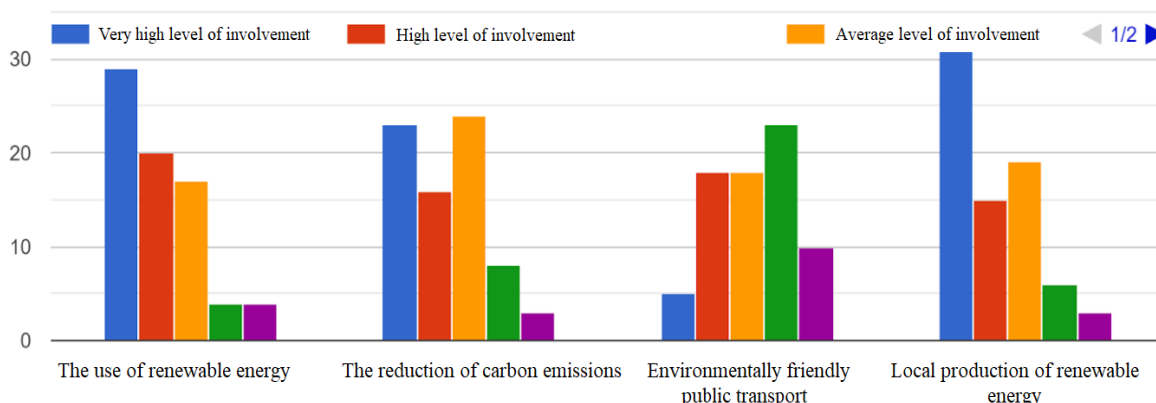

Figure 5. Study Questionnaire, Question 8: Smart Environment
Source: developed by the authors

Four subcategories were chosen for the Smart Environment component: the use of renewable energy, the reduction of carbon emissions, the environmentally friendly public transport, the local production of renewable energy. As it turned out from the first section of the questionnaire, the citizens of Cluj-Napoca want to get involved in initiatives that protect the environment. On the use

of renewable energy, 29 out of the 74 surveyed consider that there is a low level of involvement, 17 consider that the measures taken are not enough and only 8 consider that the level of involvement of local authorities is high or very high. 63 of the 74 respondents believe that the level of engagement is at most average to reduce carbon emissions. Surprisingly, although it is well known that Cluj-Napoca has the largest electric fleet for public transport, 41 people believe that the level of involvement is below an average level. Regarding the local production of renewable energy, respondents are of the opinion that the measures taken are almost non-existent, with only 9 people considering that there is at least a high level of involvement.
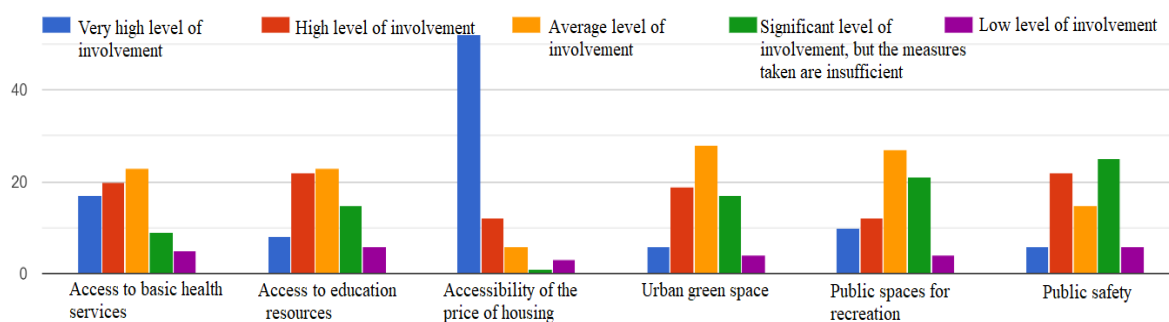

Figure 6. Study Questionnaire, Question 9: Smart Living
Source: developed by the authors

The Smart Living component refers to the quality of life of citizens. For access to basic health services, at most, an average level of involvement is noted, as in the case of access to resources for education. The biggest imbalance regarding the answers offered for this component is found in the accessibility of the price of housing where 52 of the 74 people surveyed consider that there is a low level of involvement, which can greatly affect the population of a city, can remove those who want to move to Cluj-Napoca, or it can make the current inhabitants go to other cities. Cluj residents consider that there is a medium to high level of involvement regarding green spaces and those for recreation. In the top of the safest cities in the world (year 2021), there are 5 cities in Romania, Cluj-Napoca being on the best position, the 14th place, according to the data provided by Numbeo. More than half of the respondents believe that the level of involvement of local authorities on public safety is at least average.

For the Smart Economy component, aspects such as: stimulating local producers/entrepreneurs, innovation centers in the municipality, facilities for startups and supporting research at local level were analyzed. Although some programmers have been carried out to support local producers and entrepreneurs, 59 out of the 74 respondents believe that more could be done and that the level of involvement is below average. Although it was invested in research centers at the level of Cluj-Napoca, it is possible that the general public does not know this information, because many answers were for a low level of involvement. As well as for the facilities offered to startups and the support of research at local level, there is a possibility that citizens who are not directly involved will not have a lot of information about the investments made at this level.

Urban mobility is another aspect of great interest for the inhabitants of a city. As a result of the investments in the public electric transport in Cluj-Napoca, 58 out of the 74 respondents believe that there is a high level of involvement of the local authorities. Regarding the quality of the streets/roadway, opinions are divided 27 people consider that the measures taken are not enough, 21 consider that there is an average level of involvement, and 26 people believe that the level of

involvement is at least high. Parking spaces are proving to be a problem for the municipality of Cluj-Napoca, with 49 people considering that more measures should be taken on this issue. For the extended pedestrian areas and bike lanes, there is a certain dissatisfaction of those surveyed and the desire to take measures to improve these aspects.

For the Smart Government component, the following aspects were taken into account: the transparency of the decisions at the administrative level, the involvement of citizens regarding the decisions at the administrative level, the digitalization of the public services. Respondents argue that there is a need for more transparency on decisions at the administrative level, as well as more involvement of citizens on some decisions that directly affect them. On the digitalization of public services, two distinct categories are differentiated, on the one hand those who consider that the measures taken are insufficient, and another category that considers that there is a high level of involvement in these services. We can conclude that those who are not familiar with technology are unable to use these services, and the local government may not make an effort in training citizens either.

The last component of the Smart City concept is Smart People. From the results, it appears that the citizens are not actively encouraged regarding the relationship with the local administration and that there are no programs to explain to them the advantages of implementing the smart city concept. It seems that the world feels the lack of courses on accommodating citizens with new technologies, which are the key to the successful implementation of the Smart City concept. Another problem identified is the lack of programs for training the elderly, those who require special attention to new technologies, since they need long-term assistance to be able to take advantage of the benefits brought by the Smart City concept.

4. CONCLUSIONS

Cluj-Napoca is one of the most active cities in Romania when it comes to implementing and attracting funds for Smart City initiatives. The purpose of the research was to find out how the people of Cluj perceive all these steps, what are their priorities regarding the Smart City concept and what is the degree of satisfaction regarding the involvement of the local public authorities in the implementation of these initiatives.

The research tool used to observe the perception of Cluj-Napoca's perception of the Smart City concept was the questionnaire, distributed in the online environment and 74 responses were recorded. After analyzing the answers of those surveyed, it turned out that most of them are concerned about all Smart City initiatives, they are aware of the benefits they bring both to themselves and to the environment. The massive investments in recent years at the level of Cluj-Napoca municipality have increased the quality of life of the citizens and the prosperity of the Cluj community. But with this visible increase, citizens' expectations have increased in direct proportion. The answers of those questioned reveal a high dose of exigency, a series of dissatisfaction, but the desire of the Cluj community to have a continuous evolution can only be regarded as a positive aspect that will provide the local authorities with the support and motivation necessary to follow up on the projects in the sphere of the Smart City concept.

The analysis of the questionnaires reveals some wishes or dissatisfaction of the citizens regarding the actions of the local authorities regarding the Smart City concept. Several questions show the desire of Cluj residents to invest, as a priority, in education, urban mobility, urban planning and green spaces, governance and public administration. These seem to be the key points that contribute to the quality of life of citizens and more attention should be paid by the authorities on these issues. The main concern about the integration of technology-based solutions is, from the perspective of those surveyed, information security. Even if the city hall develops solutions in which cyber security is integrated and automatically personal data is very well secured, cyber security is a concept with which the vast majority of people are not familiar and it could be useful meetings in

which to explain to people the mechanisms behind this concept and studies that prove the effectiveness of its implementation.

Based on the results recorded following the distribution of the questionnaires, it emerged that the citizens of Cluj-Napoca are responsible and have the desire to be actively involved in order to protect the environment. For the solutions implemented on the production and use of renewable energy and the reduction of carbon emissions, citizens were very dissatisfied. Local authorities should make the most of this concern of citizens and initiate projects in this direction. Environmentally friendly public transport seems to be a strong point of the city due to the investments made in this direction, but citizens feel the need to create more parking spaces, more bike lanes and extensive pedestrian areas.

One of the biggest problem a Smart City can face is the inability of people to use the new technology, which can profoundly affect the positive impact that technology brings to the lives of citizens. Unfortunately, the people of Cluj feel the lack of courses for accommodation with new technologies, and the dissatisfaction is even greater when it comes to the lack of programs for training older people. It is a critical point that must be taken very seriously, otherwise all the efforts made to implement these concepts are in vain. A project should only be considered completed when all citizens fully understand the benefits and know how to use that service. As a result, it is imperative to implement programs to train all citizens and to intensely publicize how technology can make life easier for citizens.

Based on our theoretical review and on the results from the practical study we can develop some managerial implications for the studied city, Cluj-Napoca:

- More focus on Smart mobility through projects development due to often congestions in traffic - intelligent lightening system, more efficient public transportation, an intelligent system for parking;
- More focus on Smart people in order to gain support from more people and to attract more private funding - multiple information channels, a closer approach between municipality representatives and the citizens;
- An ongoing focus for increasing digitalization level in any potential service at the municipality level which will determine good and expected results in all six areas, ultimately.

The limits of the practical study refer to the restricted area of Cluj-Napoca. On one hand, we chose that city because it is representative for the smart city concepts that are being developed in Romania but, on the other hand, we cannot extend the results to national level. Still, due to the already recognized results we consider it to be a solid case study with good practices for smart city implementation.

According to Vegacomp Consulting (2022), which conducts an annual report called Smart City Scan in Romania, Cluj-Napoca is the number 1 city in Romania by quality of life and in terms of culture, also being the most appealing city in Romania. Cluj-Napoca also ranks first in terms of cities with completed Smart City projects.

In terms of Smart City components, Cluj-Napoca ranks first in Romania at Smart Governance, second at Smart Environment, Smart Mobility, Smart People and third at Smart Economy and Smart Living. (Vegacomp Consulting, 2022)

  Our future researches will be oriented to analyze the possible correlations between general strategy of different municipalities and the six components, to compare different smart cities development and how they individually contribute to the region development in order to demonstrate that every action for Smart city development will determine the sustainable growth of urban areas.

In conclusion, the results of the research highlighted the concern of the people of Cluj and the desire to get involved in all the initiatives around the Smart City concept. The critical spirit of the people of Cluj can only motivate the local public authorities, which until now have been an example worthy to follow both at national and European level. The digital transformation process is not an easy one and of course many things can be improved, but the most important factor is the long-term

vision of the authorities in the municipality of Cluj-Napoca, a vision that includes the participation of all interested actors and is a guarantor of success in the efforts made to transform the city and to improve the quality of life of citizens. The approach proposed in this article can be changed in correlation with new statistical data obtained by investigating a larger population and other stakeholders. A future analysis may focus on the aspects that differentiate self-declared smart cities and other cities, namely the difference between a strategic approach having as finality a coordinated process and natural development, with the typical framing in the general technological trends.

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