

Miskolc as a “Smart City” – Experiences of a Questionnaire Survey

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SUMMARY

In today's globalized world the socio-economic role of cities is decisive, therefore they have become one of the most important scenes where responses are given to the complex challenges facing our society. For a city to be successful and competitive, it is necessary to strengthen its flexible resistance, in other words, its resilience. For this purpose, efficient steps could be taken, benefiting from the results of digitization and Industry 4.0, by using smart applications and developments. Nowadays, smart city development and the application of smart/intelligent technologies are gaining an increasing focus in the development of a city. In our study we present the partial results of a primary quantitative research that we conducted in 2019 among the inhabitants of the City of Miskolc, in the age group of 20-64 years. With the help of a questionnaire survey, we were looking for the main focus points that should be given priority in urban smart developments according to the inhabitants' opinion.

Currently, Miskolc is at a medium level in terms of available smart cities technologies – in the inhabitants' view. According to the opinion of the inhabitants of Miskolc it would be of outstanding importance to introduce smart solutions in the health care, education, safety and fire protection, environmental protection and air pollution.

Key words: smart city concept; resilience; smart applications; urban development areas

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INTRODUCTION, RESEARCH QUESTION

The role of cities in today's intensively globalizing world is unquestionable. According to the World Economic Forum Report 2014 the contribution of cities to global GDP reached 80 per cent, and further growth may be expected (Hajduk, 2016; Kola-Bezka et al. 2016; World Bank, 2018). In 1950 there were only 80 cities in the world with a population exceeding one million, and in 2011 their number went up to 480. Currently, more than three billion city dwellers live on the Earth, and their number may reach five billion in 2050. In addition to a decisive share of cities in global GDP and the world's population, 75 per cent of the

world's energy consumption and 80 per cent of the global CO₂ emission can also be associated with cities.

Cities are determining scenes of economic growth. There are more and more signs indicating that the challenges facing us (sustainable development, energy transmission, carbon neutrality, circular economy – just to mention the most important ones) can be managed efficiently at this level. Cities should also respond to the challenges of globalization, with special regard to various exogenous economic, social or environmental shocks. In this respect such a city can be competitive and successful in the long run that possesses factors strengthening its resilience. One typical case of increasing adaptive capacity could be to use the results of digitization and Industry 4.0 via smart applications and developments. Nowadays, an increasing emphasis is put on the use of smart urban development and the

application of smart/intelligent technologies on almost all the continents, with different focuses occasionally. The purpose of this study is to analyse the effectiveness of the smart strategy of a Hungarian county seat city from the inhabitants’ perspective, using primary data collection.

We defined the following research questions during our investigations:

- Q1: To what extent is the term “smart city” known by the population? Are there any differences between the individual demographic groups regarding the knowledge of the term?
- Q2: What are the most important challenges that the city dwellers are confronted with in Miskolc?
- Q3: At what stage is Miskolc in the process of becoming a smart city? How is the city evaluated in terms of the currently available technologies? How do the inhabitants of Miskolc evaluate the implemented smart applications?
- Q4: In which areas are developments required in the process of becoming a smart city? How important/useful are the recently implemented or planned initiatives according to the inhabitants?
- Q5: To what extent do they consider the possible drawbacks of smart solutions dangerous? To what extent can smart solutions help fend off unfavourable impacts?

In order to reply to the above research questions we conducted a primary quantitative research among the inhabitants of the City of Miskolc, in the age group of 20-64 years. Of the nearly 100 000 base population 540 gave assessable replies to the questionnaire compiled by us, owing to which the results deriving from the sample can be projected on the full base population.

Hereinafter we are going to present the most important characteristics of a smart city, also covering the main correlations between resilience and adaptive capacity. Besides describing the basic concepts, we will also cover the advantages realisable by the various

social groups (stake holder), and draw attention to the threats hidden in such developments. Summing up the results of the questionnaire survey (including the representative character of the survey), we will put forward suggestions with regard to the boundaries of the areas to be developed.

Literature review

It is not an easy task to define a smart city, as numerous approaches have been published over recent years. According to the definition of (Hall 2000) the smart city monitors and integrates all critical infrastructures, including roads, bridges, tunnels, railways, the metro, airports, ports, communication, water, energy and the main buildings. Thus it optimizes its resources in a better way, it plans its activities and controls safety criteria, while maximizing the services provided for the inhabitants. (Komninos 2011) speaks about regions where the ratio of knowledge and innovation is very high, which is partly ensured by the creative inhabitants of the city, and partly by the digital infrastructure and knowledge management. According to the definition of (Giffinger et al. 2007) it is about a digital platform, where the various actors create a complex ecosystem to enhance development, and where all the information is tracked by sensors, offering the best service at each time instant. The definition of (Szendi 2017) can be interpreted as the common intersection of the approaches with different orientations, according to which the smart city can be described as a complex concept. It is a city that uses innovative strategy and solutions to improve its inhabitants’ life quality, while it efficiently uses the creativity and knowledge base of the inhabitants. It is important to examine what advantages are offered by the developments related to smart cities for the individual stake holder groups.

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Ten most important advantages of smart cities for the individual stake holder groups

Government	City dwellers	Business sector
Better public services		
Safety		
Economic competitiveness		
Increase of income/revenue		
Improvement of business productivity	Improvement of the ability to attract the inhabitants and tourists	Improvement of city workers’ performance
Improvement of the ability to attract the inhabitants and tourists	Investment luring ability	Improvement of innovation ability
Inclusive growth	Improvement of innovation ability	Inclusive growth
Improvement of city workers’ performance		Greater satisfaction with government services
Improving infrastructure	Improvement of business productivity	
Investment luring ability	Easier commuting and access to services	

Source: Authors’ editing based on ESI ThoughtLab (2018)

The first table shows that there are several overlaps perceived in relation to the advantages offered by smart cities. At the same time specific advantages appear which can only be perceived at certain social groups.

The definitions of the smart city, apart from emphasizing the role of ICT, also highlight the significant contribution of developments to the promotion of economic growth, the support of sustainable development and the improvement of the living standards of the inhabitants. To attain these objectives, knowledge and innovation, as the tools of value creation, assume a significant role.

(Péter & Orosz 2018) investigated at what stage the Hungarian county seat cities are in the process of becoming smart cities. In the course of this, in the first phase the researchers gave an overview of the use of the 6 dimensions mentioned in the study of (Giffinger et al. 2007), then they illustrated the situation of the cities examined with good practices and developments related to geoinformatics. During their research they found that our county seat cities are starting to realise the opportunities included in the ‘smart city’, but only four cities (Debrecen, Győr, Miskolc and Szolnok) are at the level that qualifies them to be called smart cities. In the other county seat cities primarily transport development, infrastructure development and/or environmental development have a greater emphasis instead of the integrated approach. In their research they also pointed out that the role of geoinformatics is getting more and more significant in the lives of smart cities, as it is capable of displaying and analysing both spatial and non-spatial data at the same time, which are equally important for the development and control of the city.

The range of smart city applications is extremely extensive, examples can be collected from various areas (e.g. energy supply, water supply, transport, health, education, public administration, building, safety, waste management, etc.). However, the real challenge is to group these applications so that the individual groups mutually exclude each other, and they cover the occurring applications together.

Of the groupings so far published, one of the most significant is the work of Giffinger et al. (2007), according to which smart city applications can be classified in six groups: (1) smart economy, (2) smart people, (3) smart government, (4) smart mobility, (5) smart environment, and (6) smart living conditions. Sallai (2018) is also of the opinion that a smart city has six subsystems: (1) smart lifestyle, (2) smart transport, (3) smart city administration, (4) smart information communication infrastructure, (5) smart city environment and (6) smart power. At the same time, the concept developed by Huawei (2017) differs from these to a small extent. Five sectors are defined in smart cities, which are dominated by the areas that may be associated with the environment: (1) smart energy, (2) smart transport, (3) smart water and waste, (4) smart community and safe city, (5) smart buildings. (Lados et al. 2011) in their analysis investigated the

situation of smart cities based on seven subsystems: people subsystem, business subsystem, city services subsystem, transport subsystem, communication subsystem, water management subsystem, energy management subsystem. During the researches they examined 278 basic indicators, of which they narrowed down the applied data sets by main component analysis.

Smart city applications may extremely improve the city dwellers’ quality of life, however they also carry risks as it will be more and more difficult to strike a balance between the city dwellers’ rights to freedom and the use of technology. The other problem area is the safety of systems, which may be jeopardized by external attacks, and apart from that, human negligence (e.g. the use of insufficiently strong passwords) may also cause problems. According to Gartner Research and Analysis Centre (2020) as many as one third of the ongoing smart projects may stop until 2023, which may have several reasons. It names, as a potential source of danger, technological development not being able to keep pace with increasing demands. Loss of confidence related to data processing may also occur, and it may turn out about some projects that they are not as important as they were thought to be previously (or simply, they do not serve the objectives of smart cities well, and they do not produce the expected multiplicative effects sufficiently).

In parallel with the smart city concept urban resilience has been gaining increasing importance, which is defined by the World Bank (2014) “as the ability of a system, entity, community, or person to adapt to a variety of changing conditions and to withstand shocks while still maintaining its essential functions” (World Bank 2016). Cities should endeavour to avoid shocks and reduce risks, though it must be noted here that these shocks cannot be predicted in many cases. The aim is to keep urban functions in their original state or to make them restorable within a short period. Adaptive capacity appears to be key to resilience (Bristow & Healy, 2018). It shows how resistant a city is and how fast it is able to react to external changes (World Bank 2016). Adaptive capacity is “a characteristic of a given system, which ensures the long-term sustainable functioning of subsystems in spite of changing external conditions, and it also provides sufficient flexibility for partial or full transformation” (Buzási 2017). Adaptive capacity makes it possible for a city to ensure the well-being of the people living there and to contribute to long-term sustainability. It means that the terms mentioned (adaptive capacity and sustainability) go hand in hand, and neither can exist without the other. As it is also pointed out by (Bănică & Muntele 2017), resilience is not only a normative but also a strategic concept.

The basic approach of the range of ideas on resilience, adaptation and stability is that cities are usually in a state of equilibrium and even if it is tilted by some external shock, the main objective afterwards

is to return or to attain a new state of balance (i.e. to find stability). This practically corresponds to what Pirisi (2019) understands under adaptive resilience: “adaptive resilience refers to a capability by which the system changes as a result of external effects or it adapts to the changed external conditions” (Pirisi, 2019) At the same time, Bănică A. and Muntele I. (2017) represent an entirely different point of view. Notably, urban development cannot be considered as an unbroken and smooth process, the aim of which is to attain a state of balance, it is much more about progressing between imbalances. On this basis, stability is rather relative, and it must be accepted that a city is able to function not only in a certain state of balance, but the actual aim is to continuously fine tune individual subsystems. This is exactly the flexible adaption to changes as a result of which a state of balance can be attained that can also be considered stable (Buzási 2017).

It is very important to investigate the question of time. While in the short term the main aim may be protection, in the long run adaptation comes to the foreground. Urban resilience can also be interpreted as a key element of sustainable development (World Bank 2016). Resilience is, actually, a tool with which sustainability (with its content largely reduced in many cases) can be achieved (Buzási 2017) (Pirisi 2019). Resilient city as a concept does not only mean

economic development (although in most cases it is measured by per capita gross value added, i.e. it is considered identical with economic growth), but it also covers the rehabilitation of brownfield areas or conscious urban planning and expansion. It includes the long-term improvement of the inhabitants’ quality of life and well-being, the healthy and safe environment, equality and fairness (Bănică & Muntele 2017).

It is important to examine the interrelation existing between the smart city concept, urban resilience, well-being and sustainable development. In our understanding the smart city can serve as a tool to improve the resilience of cities, which leads (may lead) to sustainable development. A tangible result of that is the increase of the well-being of the urban population, the inhabitants living there.

Data and methods

In order to achieve our research objectives we conducted a large-sample questionnaire survey with the inhabitants of Miskolc. The basic population of the research was provided by the inhabitants of Miskolc aged between 20 and 64 years, whose number (N) – according to the then available most recent data – was 99 899.

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Sample composition

Attribute	Attribute versions
Sex	Male: 49.1%; Female: 50.9%.
Age	20-29 years: 18.3%; 30-39 years: 22.8%; 40-49 years: 26.1%; 50-59 years: 20.4%; 60-64 years: 12.4%.
Highest education:	Primary school: 1.5%; Vocational school, vocational training school: 11.1%; School-leaving exam: 40.0%; Vocational technical secondary school: 10.9%; Higher educational degree: 36.3%.
Marital status	Married/cohabiting in a permanent relationship, without children: 23.5%; Married/cohabiting in a permanent relationship, with children: 38.7%; Single, without children: 29.4%; Single, with children: 8.1%.
Occupation	White-collar: 39.4%; Blue-collar: 22.4%; Entrepreneur: 5.6%; Student: 19.3%; GYES/GYED (On childcare allowance/fee): 3.1%; Retired: 7.2%; Unemployed: 3.0%
Net monthly income per person:	Less than HUF 50 thousand: 4.1%; HUF 50-100 th: 15.9%; HUF 100-150 th: 31.3%; HUF 150-250 th: 32.8%; More than HUF 250 th: 16.1%
Size of household	1 person: 9.8%; 2 persons: 31.3%; 3 persons: 27.2%; 4 persons: 24.8%; 5 persons or more: 6.9%

Source: Authors’ editing

As it would have been too expensive to assign a sampling frame to the population, we applied the so-called quota sampling, which belongs to the non-probability sampling methods. The final sample size (n=540) was composed of two sources, on the one hand, the questionnaire items were asked in person from 400 people, and on the other hand, the questions were asked online from 140 people. Fieldwork took place in February 2019. In the course of data collection we made every effort all the way through that the

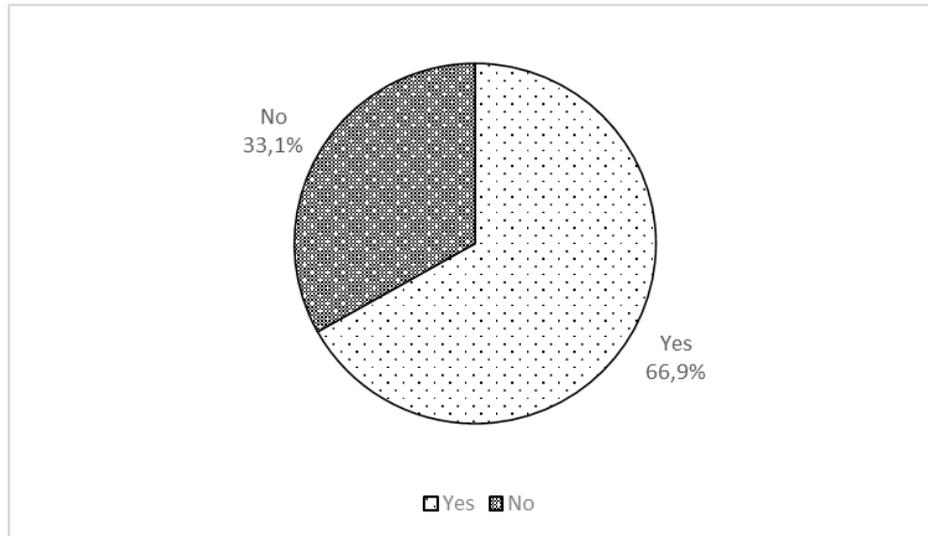
sample reflected the composition of the population. Accordingly, as a last step prior to the analysis, we set the cell representativity of the sample by carrying out weighting by sex (male and female) and age (20-29 years, 30-39 years, 40-49 years, 50-59 years, 60-64 years). The weights used were between 0.90 and 1.31. The maximum error rate of the sample thus obtained was +/- 4.21 percentage point (with a confidence level of 95.0 per cent). It can be stated that the conclusions drawn from the sample can be expanded to the base

population, so our results reflect the general opinion of the inhabitants of Miskolc.

Main findings and their relation to the reviewed literature

(Q1) As an introduction, we were curious to know if the inhabitants of Miskolc had heard the term “smart

city”, therefore this was the first question that we asked. It is obvious that the responses included some “compulsion to comply”, i.e. even those answered ‘yes’ who had not heard the term, but would not have wanted to look uninformed. Owing to this phenomenon, the responses are treated with reservation.



Source: Authors' editing

1.1. Have you heard the term “smart city” before?

Two thirds of the Miskolc inhabitants asked (66.9%) have heard the term “smart city”, whereas one third of them (33.1%) have come across the term for the first time.

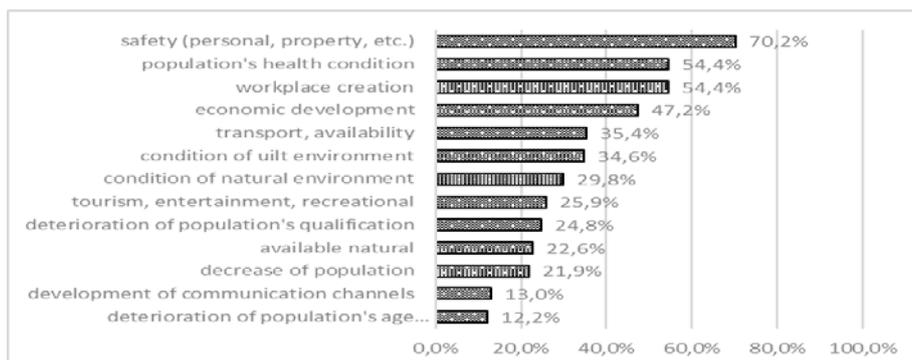
Although no significant relationship can be demonstrated (Chi-Square=3.239; P=0.082), but more men (70.6%) seem to know the term than women (63.3%). In our view this difference can also be explained by men’s interest in technology.

As regards education, the knowledge of the term “smart city” is overrepresented in the group with a higher educational degree (73.0%) and underrepresented in the case of people having primary school (25.0%) or vocational school and vocational training school (51.7%) education. A significant relationship (Chi-Square=18.068; P=0.001) can be demonstrated between the two variables (education vs. knowledge of the term “smart city”).

Being aware of the above figures, perhaps it is not surprising that white-collar workers (71.8%) know the term “smart city” at a significantly higher ratio than blue-collar workers (54.9%).

This sort of difference is also reflected in income relations, i.e. those with a lower income have a lower ratio of knowing the term than those with a higher income. This could be explained by the fact that those with a higher degree of education tend to work in white-collar jobs, and in such jobs salaries are higher. On the other hand, a better financial background also enables them to gain access to information more easily.

With regard to the other demographic variables examined in the questions, such as age, marital status, family size, no statistically significant relationship can be revealed.



Source: Authors' editing

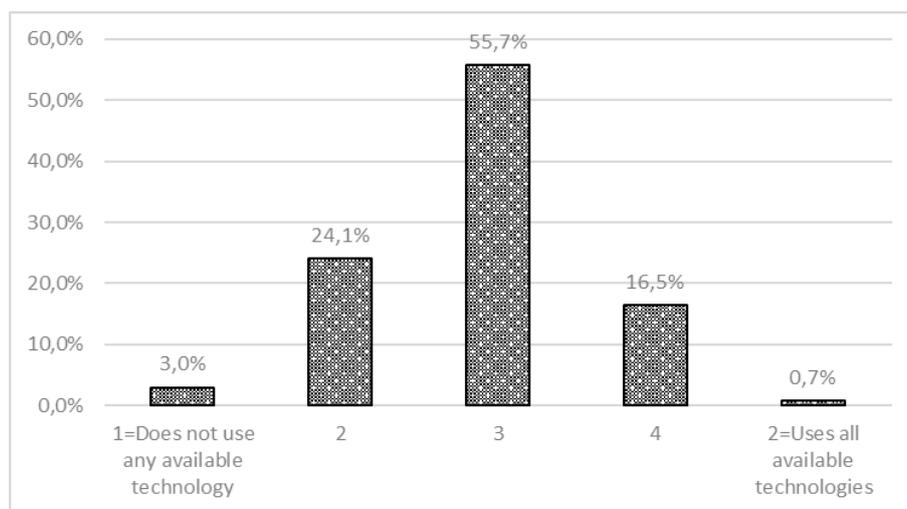
2.2. Which areas do you think pose the most important challenges in Miskolc?

(Q2) In our research we were also curious to know which areas are seen by Miskolc inhabitants as “challenges”. Regarding this question, 13 areas were identified and examined in our target group.

The most important challenge viewed by Miskolc inhabitants is the creation of safety (personal and property), this was indicated by more than two thirds of the respondents (70.2%).

More than half of the respondents (54.4-54.4%) consider the preservation and improvement of the

inhabitants' state of health and the creation of workplaces among the most important challenges. The problems of economic development are also regarded quite considerable (though the ratio does not reach 50%, based on the sample) according to the views of Miskolc inhabitants. The inhabitants of Miskolc put the least emphasis on the problems of the development of communication channels (mobile, internet, wifi) (13.0%) and the deterioration of the age composition of the population (12.2%).



Source: Authors' editing

3.3. Please evaluate Miskolc as a “smart city”, based on the use of currently available technologies.

Going a little deeper, analysing further details, it can be found that transport and accessibility receive a greater emphasis by men (39.2%), and the preservation and improvement of the inhabitants' state of health by women (60.0%). In connection with the other factors no significant difference was identified in men's and women's priorities.

(Q3) In our research we also investigated how the inhabitants evaluate Miskolc as a “smart city”, based on currently available technologies.

We received a mean of 2.88 at a 5-point scale, which can be regarded as a strong medium value. This is also borne out by the fact that the majority of

respondents (55.7%) indicated value 3 in their responses. (This is at the same time the mode and median of distribution). A little less than one fourth of the respondents (24.2%) assessed the “smart city” feature of the county seat with a value 2, and one sixth of them (16.5%) with a value 4. Those who did not think that the city uses any smart solutions only account for 3.0% of the sample. There were hardly any (0.7%) who said that there existed almost all smart solutions in Miskolc.

In our research we also made a comparative analysis in respect of the individual demographic

groups, but no statistically significant differences were revealed.

At the county seat of Borsod County numerous developments have been implemented over the past decade, which are determining elements in the process of its becoming a smart city, and they could even be regarded as a milestone. In our research the inhabitants were also asked to judge the quality of such implemented applications.

Regarding the quality of the smart applications implemented in Miskolc, the best score (4.00) was given to the ordering of food on a website/with an application. Smart banking (3.90) and the use of parcel delivery lockers (3.82) were also evaluated at a similar

high level. It must be mentioned that these smart solutions are not quite specific of Miskolc, they constitute a part of the business practice spread all over the country. The lowest rating (2.88) was allocated to the electric charging network available in Miskolc, which started a spectacular development in the year following the data collection. Newly established electric charging points can be discovered in the parking lots of several big stores, super and hypermarkets, the installation of which was primarily due to the business policy of the given retail chain, so it is not about a city decision and implementation.

3.3

Quality of the smart applications implemented in Miskolc

[scale from 1 (unsatisfactory) to 5 (excellent)]

	Mean	Standard deviation
Ordering food via an application, on a website	4.00	1.03
Smart banking	3.90	1.05
Use of parcel delivery lockers (e.g. Post-Office, Foxpost, etc.)	3.82	0.97
Parking with mobile application	3.74	1.10
Free wifi on the green arrow line	3.66	1.18
Timetable of Miskolc (MKV Zrt application)	3.62	1.17
Ordering of taxis with mobile app.	3.59	1.12
Digital public administration (electronic administration)	3.57	0.97
Timetable of Miskolc (not MKV Zrt application)	3.54	1.12
Intelligent passenger information system	3.53	1.10
Smart home system (google home, amazon alexa, mi home etc.)	3.42	1.25
Smart office building (e.g. NAV)	3.37	1.12
Reporting meter reading with an app	3.36	1.09
City card	3.35	1.15
Use of geothermal energy for heating (Avas)	3.34	1.17
Smart university applications (Neptun, student card)	3.28	1.25
Tourism application (e.g. guide@hand miskolc)	3.21	1.16
Intelligent space surveillance network	3.17	1.13
Digital community development – creating real and virtual spaces	3.12	1.10
Free wifi in public spaces	3.10	1.22
Giving priority to delayed trams	3.10	1.09
Electric charging network	2.88	1.24

Source: Authors' editing

(Q4) Besides the evaluation of implemented applications it may be an even more important question to determine what areas are required to be developed in the process of becoming a smart city. We also asked about these gaps, the result of which is summed up in the table below.

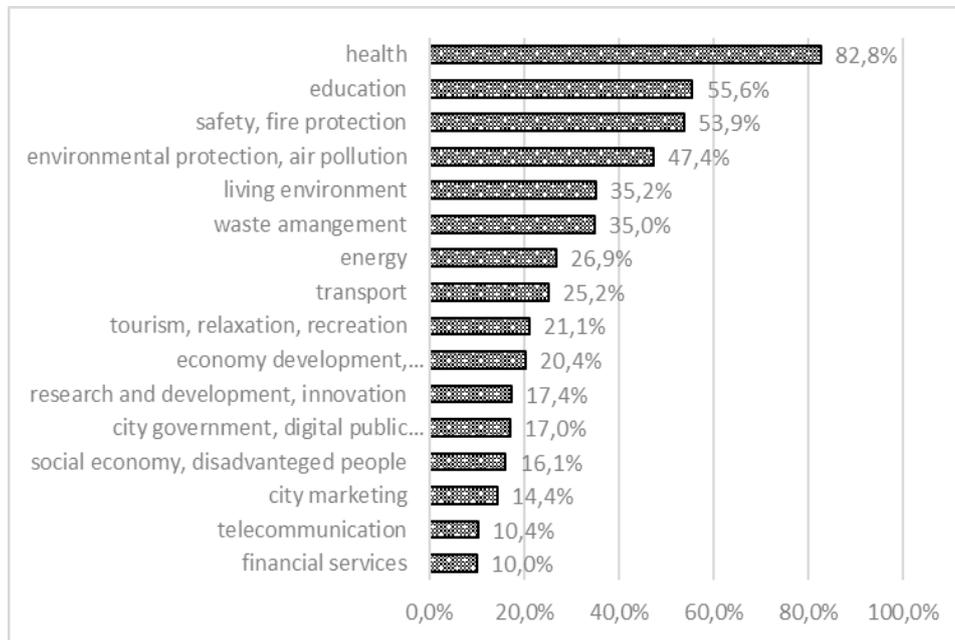
The majority of respondents (82.8%) indicated health care as such an area. This is followed by education (55.6%), safety, fire protection (53.9%) and environmental protection, air pollution (47.4%) in the order of importance. In contrast, telecommunication

(10.4%) and financial services (10.0%) are the areas where it is the least necessary/useful to introduce smart solutions according to the views of Miskolc inhabitants. We assume that in these areas there are well-established systems that appropriately serve the needs of inhabitants.

When looking for differences between sexes, we can discover that men rated the following areas at a significantly greater ratio: energy (31.3). The same concerning women's views: health (87.6%), environmental pollution, air pollution (52.4%)

In the city of Miskolc there have been a number of smart city projects proposed or being under planning or implementation recently. We wondered to what extent

the inhabitants considered the implementation of these initiatives important/useful.



Source: Authors' editing

4.4. Where would you consider it necessary/useful to introduce some smart solution in Miskolc?

Based on the responses given to this question it can be stated that the inhabitants can accept a large part of the ideas – such as electronic payment in public transport, which was rated as 4.00, luminous road surface signs and boards (3.97), intelligent traffic control (in public road junctions) (3.93) and intelligent (water and gas) measurement in real estates (3.93). On the other hand, there are initiatives regarding which

respondents are indifferent: e-taxi system (3.16), e-school bus (3.13) and electric city sight-seeing bus (2.94).

(Q5) Like everything, smart solutions may also have some drawbacks and negative impacts. Our next question asked was to what extent Miskolc inhabitants perceived these dangers with regard to smart solutions.

4 4

In Miskolc the following smart city project ideas have been raised or have been under planning or implementation recently. Please rate to what extent do you consider their implementation important/useful? [scale from 1 (not necessary at all) 5 (absolutely necessary)]

	Mean	Standard deviation
Electronic payment in public transport	4.00	1.10
Luminous road surface signs, signboards	3.97	1.12
Intelligent traffic control (public road junctions)	3.93	1.13
Smart (water, gas, etc.) measurement in real estates	3.93	1.09
Community bicycle system	3.74	1.16
Business administration system integrated at city level	3.70	1.08
E-taxi system in Miskolc	3.16	1.23
E-school bus	3.13	1.37
Electric city sight-seeing bus	2.94	1.24

Source: Authors' editing

5 5

The use of smart solutions may also have some dark sides. To what extent do you consider the following areas to be of potential problems?

[scale from 1 (not at all) 5 (extremely)]

	Mean	Standard deviation
Personal data protection	3.81	1.15
Vulnerability of computer systems, virtual attacks	3.53	1.10
Increase of social differences	3.37	1.21
Reduction in the number of workplaces	3.31	1.29
Information flow is not full	3.29	1.11
Isolation of inhabitants	3.20	1.20
Reduction of the unique characteristics of the city	2.84	1.25

Source: Authors' editing

What worries the respondents most is the protection of personal data (3.81) and the vulnerability of computer systems, the virtual attacks (3.53). Of the potential problems the least important was the reduction of the unique characteristics of the city (2.84) according to the participants of the survey.

Cities are frequently exposed to shock-like effects. The use of smart applications may also be helpful in fending off unfavourable trends. The question is only how big such help can be in individual areas.

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In ideal cases to what extent can smart solutions help fend off unfavourable impacts?

[scale from 1 (not at all) 5 (extremely)]

	Mean	Standard deviation
Fast technological shift	3.55	1.05
Overloading of transport infrastructure	3.38	1.09
Fast deterioration of public safety	3.28	1.15
Sudden increase in the number of tourists	3.17	1.18
Fundamental change in legal environment	3.15	1.03
Natural disaster (e.g. flood)	3.00	1.22
Climate change	2.98	1.21
National economic recession	2.90	1.10
Fundamental change in political environment	2.86	1.19
Global economic crisis	2.85	1.10
Population explosion	2.58	1.12
Depopulation	2.51	1.07
Mass immigration	2.50	1.22

Source: Authors' editing

Our respondents' view is that smart applications can offer solutions the most in the areas of fast technological shift (3.55), overload of transport infrastructure (3.38) and deterioration of public safety (3.28). The use of smart solutions can resolve demographic challenges the least, such as population explosion (2.58), depopulation (2.51) and mass immigration (2.50).

CONCLUSION

Finally, let us present the main findings of our research, which are based on the results of the large-

sample questionnaire survey conducted among the inhabitants of Miskolc in a representative manner.

A large part of the inhabitants of Miskolc (66.9%) – by their own admission – have heard the term “smart city” in their lives, so this name is not completely unfamiliar for the city dwellers. Unfortunately, we do not have reliable and accurate statistical data on what they really understand by this term, but according to our experiences it does not have an entirely unified meaning in terms of its content even among experts. Based on the results, it should be considered that in order to increase the awareness of this notion, the local government will take steps, especially if it wants to add it to the set of items associated with Miskolc.

With regard to the most important challenges concerning the city, we were able to identify at least four areas that deserve particular attention, as reflected by inhabitants' opinions. These are safety, preservation and improvement of the inhabitants' state of health, creation of workplaces and economic development. In the process of becoming a smart city, it is sensible to put special focus on these areas, and highlight those smart applications that bring about positive changes in these areas.

Currently, Miskolc is at a medium level in terms of available smart cities technologies – in the inhabitants' view. This is the point from where there is still room to develop. It is a fact that the process has started – the inhabitants also perceive it, however there is still plenty to do, and in the course of the process: scheduled, conscious and systematic building may be the key to success. The mean of the judgement of the available smart applications is scattered between medium (3) and good (4) values. There is no development that is judged expressly positive, but there is no development that is considered expressly negative either. This is also characteristic of the stage that has a development potential. Further, it is not certain if the city dwellers were sufficiently satisfied with the development itself. It may occur that simply they are not aware of developments or they have too little information.

According to the opinion of the inhabitants of Miskolc it would be of outstanding importance to introduce smart solutions in four areas. These are health care, education, safety and fire protection, and environmental protection and air pollution. In respect of the project ideas raised in the city there are also four areas that are considered important/useful by the

inhabitants: electronic payment in public transport; luminous road surface signs, signboards; intelligent traffic control; and smart measuring in the case of real estates.

We also provided space in our investigation for assessing the concerns related to smart city development, in this respect the greatest threats conceived, to the elimination of which serious attention should be paid, are the protection of personal data and the vulnerability of computer systems, the so-called virtual attacks. At the same time, fast technological shift, overload of transport infrastructure and deterioration of public safety are the areas where smart applications can provide solutions.

Finally we would like to highlight that it is important to define that key areas, where the city could be developed based on the inhabitants' opinion, and to adapt their ideas as bottom-up initiatives.

Based on our investigations, we can state that the majority of the municipal projects in Hungary are implemented from (EU) tenders the future of which is typically doubtful after the expiry of the obligations included in the contracts. Thanks to 'easy money', sustainability aspects rarely appear during the planning period, often smart applications don't fit the size of the municipalities, sometimes they focus on developments that already exist at the national or global level and/or there are free or cheap solutions focusing on the same tasks.

In conclusion, smart city projects should base on the real needs of the communities and the tools used should plan on the basis of cost-effectiveness and economic sustainability.

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