



IDENTIFICATION OF PUBLIC SMART SERVICES IN THE SLOVAK REPUBLIC

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Abstract: The aim of the article is the identification public smart services provided in the environment of Slovak cities and municipalities. Cities and municipalities are divided into two basic categories. The identified smart public services are divided into four areas, which are e-government, smart social services, smart resources and the environment, and smart mobility and the environment.

Keywords: e-governance, public services, smart services, smart city

Introduction

Smart cities have emerged as a result of the continuous development of urbanization and growing population in urban areas, which leads to several challenges in the field of environmental, economic and social sustainability. Smart cities aim to mitigate these challenges, to ultimately improve the quality of life of citizens. In recent years, smart cities projects have become more and more widespread all over the world. The constant increase in the number of urban residents and the difficulty of their management leads municipalities to use technologies to support a higher quality of the urban environment and a better offer of public services. Several stakeholders are involved in this development, such as political leaders, public servants, businesses, universities and citizens, who should mainly strive to achieve a higher quality of life in the city. [1][2][3][4]

Many of the smart cities projects currently being implemented depict the development of new or improved public services. In addition, the term smart city is usually associated with the use of smart solutions that allow modern cities to increase the quality of services provided to citizens. By using modern technologies and their connectivity, city officials can have direct interaction with the community of residents and with the infrastructure. It will allow them to monitor the state of the city and what services may be needed in the future to ensure a higher quality of life for all residents. Smart cities initiatives can deploy a wide range of public services, including transport, environment, buildings, education, tourism, healthcare and public safety. [5][6][7][8]

It should be mentioned that the concept of public service itself is not the same in all studies. In the environment of the Slovak Republic, it is possible to find definitions from various authors, for example O. Matoušek et al. define public services as *"services that are provided in the interest of the public, financed from public budgets and defined in more detail by legislation than other services, which makes them more dependent on the political decision-making of the state, region and municipalities"*. F. Protection defines this term as *"... a type of service whose user (consumer) is the public as a social entity. Public services are*

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produced, ensured or regulated by public administration authorities...". It follows from this that it is not excluded that a public service is also provided by a private entity that is invited or forced to do so (in extraordinary situations) and that can provide this service on a market or non-market basis. The general goal of this provision is for public services to satisfy social needs while respecting the principle of subsidiarity. Based on the principle of subsidiarity, measures and authority are carried out at the lowest possible level of administration, which enables their implementation and performance. [9]

Since it is possible to follow the development of traditional public services in smart cities, several authors decided to define a new concept of public smart services. Authors M. and R. Bolívar concluded in their literature review that *"city intelligence is the degree to which a city can attract and mobilize human capital and enable collaboration through the use of ICT."* For example, the authors K. Timeus et al. relied on this smart city concept. in defining smart public services as *"ICT-enabled public services that improve mobility, optimize resource consumption and facilitate collaboration"*. [2][10][11]

Methodology

The main goal of the contribution is to identify public smart services in the environment of the Slovak Republic. The objective was fulfilled through primary research. Before conducting the primary research, it was necessary to correctly define the target group, which were the cities and towns of Slovakia. Before the start of the primary research, a pre-test was conducted on a sample of 30 respondents, with the help of which possible errors and shortcomings of the electronic questionnaire were identified. Through the calculation of the selected sample, it was found that out of the total number of 2,890 towns and villages in Slovakia, with 95% reliability, it was necessary to obtain answers from at least 340 respondents. The following formula was used to calculate the sample:

$$n \geq \frac{N * t_{1-\frac{\alpha}{2}}^2 * \sigma^2}{(N - 1) * \Delta^2 + t_{1-\frac{\alpha}{2}}^2 * \sigma^2}$$

where n represents the minimum sample size; $t_{1-\alpha/2}$ represents the critical value determined from the tables; σ^2 is the variance; Δ represents the maximum permissible margin of error; N represents the size of the base file. Since the research was primarily focused on the analysis of cities and municipalities that provide at least one public smart service, the research was intended to fill the sample of 340 respondents with such respondents that provide these services.

Results

Out of the 2,004 towns and villages in Slovakia that were contacted, 709 respondents successfully completed the questionnaire. The return rate of the questionnaire was at the level of 35.4%. The necessary sample of 340 respondents was filled, and at the same time, the condition that at least 340 respondents provide at least one public smart service was met (345 respondents answered that they provide them). The opening part of the questionnaire consisted of identification questions, namely: *"In which region is your city/municipality located?"* and *"Which size category does your city/municipality belong to in terms of population?"*. The most answers from all 749 respondents were obtained in the Banská Bystrica Region (150 answers) and the Prešov Region (142 answers). The fewest answers were from the Bratislava Region (31 answers). The largest group, with a total of 213 respondents, were municipalities with a population in the range of 500-999 inhabitants. On the contrary, cities with a population of 100,000 or more had the smallest representation, of which only 1 respondent answered.

The purpose of the inquiry was to fill the calculated sample with respondents who provide at least one public smart service. In order to find out whether the respondents belong to this group, a filter question was created at the beginning of the questionnaire: *"Do you provide at least one public smart service in your city/municipality?"* At the beginning of the questionnaire, the respondents had at their disposal a portfolio of public smart services from chapter 2.1, in order to have an idea of what services does it go 345 respondents answered this question positively and 404 respondents answered negatively. If the respondents marked the answer *"no"*, they were invited to indicate the reason for not being interested in the provision of public smart services through the question: *"For what reason do you not provide a single public smart service in your city/municipality?"*. Among the most common reasons, they cited insufficient information (98 responses), demanding bureaucracy (72 responses), insufficient financial resources (70 responses) and insufficient human resources (59 responses). The number of respondents who marked the answer *"yes"* is shown in the figure in figure 2. Due to a large number of size categories and for a clearer evaluation, the respondents were divided into only two categories, following the example of the database of the Statistical Office, namely 1,999 inhabitants and less and 2,000 or more inhabitants.

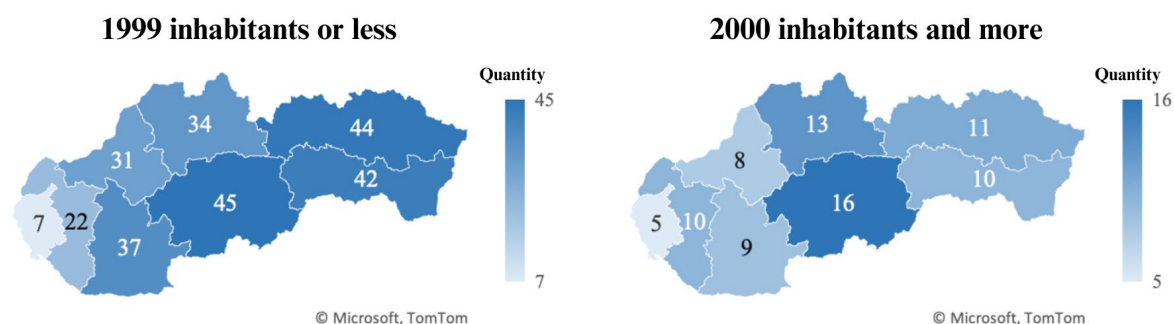


Figure 1. Number of cities and municipalities that provide at least one public smart service, categorized by region and size group (Source: Authors)

Respondents were also asked to answer the question *"In which area/areas do you provide public smart services?"*. They could choose from the areas of smart management and e-government, smart social services, smart resources and the environment, and smart mobility and infrastructure, and they could choose multiple answers. The group of 1,999 inhabitants and less has the most public smart services provided in the area of smart management and e-government (169 towns/municipalities provide at least one service in this area), the group of 2,000 inhabitants and more has the most public smart services provided in the same area (52 towns/municipalities provide at least one service in this area). Conversely, the fewest services are provided in the area of smart resources and the environment (101 cities/municipalities from the category 1999 and under and 32 cities/municipalities from the category 2000 and over provide at least one service in this area).

Subsequently, the respondents had through the question *"In the previous question, you stated that you provide a smart public service in the field of smart management and e-government/smart social services/smart resources and environment/smart mobility and infrastructure. State what specific services they are."*, state-specific public smart services that they provide in the areas marked by them. The list of the most frequently identified public smart services is shown in tables 1 to 4.

Table 1. Public smart services in the field of Smart management and e-government in Slovak cities/municipalities

Category									
1999 inhabitants or less									
Service	Number of cities/municipalities								Provider
	BB	BA	KE	NT	PO	TN	TT	ZA	
Information application/website of the municipality	18	4	20	27	20	14	16	15	City/municipality
Application: Report to the mayor	10	2	12	14	20	13	13	12	City/municipality
Citizen complaints system	9	2	13	9	9	7	8	7	City/municipality
Online system for reporting lost and found animals	1	2	0	0	1	2	0	0	Another entity
	5	2	8	7	8	2	4	2	City/municip. + other entity
Market information system	5	3	12	7	8	7	7	8	City/municipality
Online platform for petitions	1	0	3	4	2	2	2	3	City/municipality
	3	1	2	1	2	0	2	1	City/municip. + other entity
City live application: Current information about waiting times at the office	4	0	4	3	3	3	2	1	City/municipality
2000 inhabitants and more									
Information application/website of the municipality	9	3	6	9	6	5	8	6	City/municipality
Citizen complaints system	5	3	4	4	3	4	5	4	City/municipality
City live application: Current information about waiting times at the office	4	2	4	4	3	3	3	3	City/municipality
Online broadcasting of town meetings	4	3	4	3	4	3	3	3	City/municipality
Virtual department: registration/filing	3	2	3	3	4	3	2	2	City/municipality
Chatbot for public administration	4	2	3	3	3	2	3	2	City/municipality
Application: Voting of citizens	3	2	2	2	1	2	1	1	City/municipality
	1	0	0	0	2	0	0	0	City/municip. + other entity

Source: Authors.

In Table 1, it can be seen that the most frequently repeated service in cities and municipalities was informing citizens through an application or website.

Table 2. Public smart services in the area of Smart social services in Slovak cities/municipalities

Category									
1999 inhabitants or less									
Service	Number of cities/municipalities								Provider
	BB	BA	KE	NT	PO	TN	TT	ZA	
Information application/website about events and other cultural events	10	2	10	9	8	8	7	8	City/municipality
Online lending system in the library	6	3	7	5	6	7	5	4	City/municipality
Information application/website with pharmacies, emergency rooms and other health. devices	3	0	2	1	2	1	1	0	City/municipality
	1	0	3	1	1	0	0	1	City/municip. + other entity
Health care portal	0	0	1	2	1	0	0	0	Another entity
	3	1	4	2	4	3	3	1	City/municipality
Web portal for schools and kindergartens	4	1	4	5	5	3	2	2	City/municipality
Smart nursing home	3	0	1	2	1	1	0	2	City/municipality
2000 inhabitants and more									
Information application/website about events and other cultural events	6	3	3	3	3	4	5	5	City/municipality
Directory and map of adult education institutes, sports fields and other cultural centers	5	3	3	2	3	4	5	4	City/municip. + other entity
Online lending system in the library	5	2	2	2	1	2	4	3	City/municipality
Information application/website with pharmacies, emergency rooms and other health. devices	2	0	0	1	2	2	3	3	City/municipality
	1	1	2	0	0	0	1	0	City/municip. + other entity
Health care portal	3	1	2	4	2	2	2	1	City/municipality
Web portal for schools and kindergartens	4	2	3	2	1	1	1	2	City/municipality
Online education courses focused on digital skills	2	1	1	1	0	1	2	1	City/municipality
Online system: ordering to the doctor	2	1	2	1	1	0	1	1	City/municipality

Source: Authors.

Other services that appeared most often included multiple platforms where citizens can express their opinion, whether it is reporting complaints or other initiatives, and live city applications, which should provide real-time information on the current status of the local office. Among other interesting public smart services, which, however, occurred only occasionally, we can include an electronic labor market, an online permit service (e.g. permits for events), a platform for signing up for volunteer work, etc.

Table 2 shows the provision of similar public smart services in both size categories. This table includes the most frequently marked services, but other public smart services provided in Slovak cities/municipalities include, for example, the first responders application: notification and support in case of emergency, provision of medical consultation via video call (respondents stated that they provided this service mainly during the pandemic covid-19), a smart attendance system in schools (so that parents can track their children), a chatbot on a local website to help inform about cultural events, etc.

As in the previous table and Table 3, it can be seen that the provided public smart services in cities/towns in the size category of 1,999 inhabitants and less are almost the same as in the size category of 2,000 and more inhabitants.

Table 3. Public smart services in the field of Smart resources and the environment in Slovak cities/municipalities

Category									
1999 inhabitants or less									
Service	Number of cities/municipalities								Provider
	BB	BA	KE	NT	PO	TN	TT	ZA	
Information app/website about waste recycling	12	2	9	7	8	9	8	9	City/municipality
The system for reporting offenses in the field of waste management, illegal landfills, etc.	10	1	9	14	7	7	5	5	City/municipality
App/website with data on air pressure, water level, etc. provided in real time	6	1	4	5	3	4	4	4	City/municipality
Sensors in garbage cans	4	1	3	2	3	3	2	3	City/municipality
Information website about the possibility to participate in the cleaning of public space + the organization of this cleaning	3	2	4	1	2	1	2	2	City/municipality
2000 inhabitants and more									
Information app/website about waste recycling	7	2	3	3	3	3	3	6	City/municipality
The system for reporting offenses in the field of waste management, illegal landfills, etc.	7	2	3	3	2	3	4	5	City/municipality
App/website with data on air pressure, water level, etc. provided in real time	4	1	1	2	3	2	2	4	City/municipality
Sensors in garbage cans	1	0	1	0	0	0	0	1	City/municip. + other entity
	1	1	0	0	1	0	0	1	Another entity
Information website about the possibility to participate in the cleaning of public space + the organization of this cleaning	3	1	1	1	1	1	2	3	City/municipality
	4	2	2	1	0	1	2	2	City/municipality
Electric trolleybuses	1	1	0	0	0	0	1	0	City/municipality
	1	1	2	1	1	1	1	1	City/municip. + other entity
Free drinking water stations	2	1	0	1	1	0	1	1	City/municipality
Free solar charging stations (e.g. smart bench)	2	1	1	0	1	0	1	1	City/municip. + other entity

Source: Authors.

From the results in Table 4, it is clear that most often cities/municipalities provide services in the form of applications that share data in real time or in the form of shared means of transport. In this area, the respondents said that they still provide services such as a bus application through which it is possible to follow a bus or buy a ticket, an application where citizens can share the current traffic situation, an application for reporting damage to roads and sidewalks, an application for sharing private means of transport, etc.

Table 4. Public smart services in the field of Smart mobility and infrastructure in Slovak cities/municipalities

Category									
1999 inhabitants or less									
Service	Number of cities/municipalities								Provider
	BB	BA	KE	NT	PO	TN	TT	ZA	
Traffic app for public transport, timetables, delay alerts, etc.	19	2	12	11	10	7	8	9	City/municipality
City live application: free parking spaces in real time	5	2	7	7	5	3	5	3	City/municipality
	6	0	3	0	5	1	0	3	City/municip. + other entity
Online payment for parking	6	1	2	1	3	2	1	2	City/municipality
Shuttle	2	2	3	3	4	2	3	4	City/municipality
	4	2	1	0	1	0	1	2	City/municip. + other entity
Car sharing platform	3	1	1	2	1	1	0	1	City/municipality
	1	2	1	0	1	2	1	2	Another entity
Shared bicycles and scooters	2	0	1	0	0	1	0	1	City/municipality
	1	1	2	1	1	1	2	1	City/municip. + other entity
Free charging stations for electric bicycles and scooters	1	0	0	0	1	0	0	1	City/municip. + other entity
2000 inhabitants and more									
Traffic app for public transport, timetables, delay alerts, etc.	10	3	5	5	4	4	4	4	City/municipality
Online payment for parking	10	3	4	5	4	4	4	4	City/municipality
Electronic payments in public transport	3	2	2	3	1	2	1	2	City/municipality
	4	1	2	1	3	1	1	1	City/municip. + other entity
Shared bicycles and scooters	1	1	0	1	1	0	3	1	City/municipality
	1	1	1	0	0	1	0	1	Another entity
	2	3	1	2	2	1	1	2	City/municip. + other entity
City live application: free parking spaces in real time	5	2	3	2	3	3	1	2	City/municipality
Car sharing platform	1	0	1	1	0	1	1	1	City/municipality
	3	2	2	1	2	2	2	1	City/municip. + other entity
An integrated, well-developed cycling network	1	1	2	1	1	1	1	1	City/municipality
Free charging stations for electric bicycles and scooters	1	0	1	0	0	1	0	0	City/municipality
	0	0	0	0	1	0	0	1	City/municip. + other entity

Source: Authors.

Conclusion

From the analysis of the available characteristics of public service and public smart service, it is possible to identify the main difference, which is the role of technology in their provision. Public service refers to services provided by government or public sector organizations to meet the needs of citizens. This includes services such as health care, education, transportation, and public safety that are typically delivered through traditional channels such as face-to-face interactions, phone calls, or paper-based systems. The key difference between a public service and a smart public service is that a smart public service incorporates technology as a core component to deliver better services, while a public service represents a more traditional approach to service delivery.

References

- [1] NEIROTTI, P., DE MARCO, A., CAGLIANO, A. C., MANGANO, G. a SCORRANO, F. 2014. Current trends in Smart City initiatives: Some stylised facts. In *Cities*. 2014, vol. 38, s. 25-36. Available on: <https://www.sciencedirect.com/science/article/abs/pii/S0264275113001935>
- [2] BOLIVAR, M. P. 2019. *Setting Foundations for the Creation of Public Value in Smart Cities*. Cham: Springer International Publishing. Dostupné na: <https://link.springer.com/book/10.1007/978-3-319-98953-2>
- [3] KARAGULYAN, E. A., ZAKHAROVA, O. V., BATYREVA, M. V. a DUSSEAUULT, D. L. 2020. Smart City — Prosperity for All? In: *Zhurnal Ekonomicheskoy Teorii*. 2020,

- vol. 17, no. 3, s. 657–678. Available on: <https://jet-russia.com/wp-content/uploads/2020/12/11iKaragulyan-3-2020.pdf>
- [4] ANTTIROIKO, A., VALKAMA, P. a BAILEY, S. J. 2014. Smart cities in the new service economy: building platforms for smart services. In: *AI & SOCIETY*, 2014, vol. 29, no. 3, s. 323–334. Available on: <https://link.springer.com/article/10.1007/s00146-013-0464-0>
- [5] JANOŠKOVÁ, P. 2020. The smart cities concept as part of a digital society and their evaluation. In *Rozvoj euroregiónu Beskydy 14: Diagnostika spoločensko-ekonomických podmienok „dve desaťročia nového tisícročia a budúcnosť“*. 1. vydanie. Žilina: Vydavateľstvo EDIS, 2020, s. 84-93. ISBN 978-80-554-1742-4.
- [6] MORACI, F., ERRIGO, M. F., FAZIA, C., CAMPISI, T. a CASTELLI, F. 2020. Cities under Pressure: Strategies and Tools to Face Climate Change and Pandemic. In *Sustainability*. 2020, vol. 12, no. 18, s. 7743. Available on: <https://www.mdpi.com/2071-1050/12/18/7743>
- [7] REPKOVÁ ŠTOFKOVÁ, K. a JANOŠKOVÁ, P. 2021. Analysis of Selected Smart Cities in the European Union. In *International Journal of Interdisciplinarity in Theory and Practice*. 2021, vol. 23, s. 37-43. Available on: <http://www.itpb.eu/index.php/ct-menu-item-3/15-economics/537-23-cislo-clanok-7>
- [8] LYTRAS, M. a VISVIZI, A. 2018. Who Uses Smart City Services and What to Make of It: Toward Interdisciplinary Smart Cities Research. In *Sustainability*. 2018, vol. 10, no. 6, s. 1998. Available on: <https://www.mdpi.com/2071-1050/10/6/1998>
- [9] KOTULÁK, J. 2020. Štandard verejnej služby v hodnotení kvality verejnej správy. In *Finančné trhy*. 2020, vol. 1. Available on: https://www.derivat.sk/files/2020%20financne%20trhy/FT_1_2020_Kotulak_Standard_v_erejnej_sluzby.pdf
- [10] ČOREJOVÁ, T., HALAMOVI, E., MADLEŇÁK, R. a NESZMÉLYI, G. I. 2021. The concept of smart city and the perceptions of urban inhabitants: a case study from Žilina, Slovakia. In *Hungarian Geographical Bulletin*. 2021, vol. 70, no. 2, s. 113-128. Available on: <https://ojs.mtak.hu/index.php/hungeobull/article/view/5519/5326>
- [11] OSTERWALDER, A., PIGNEUR, Y., BERNARDA, G., SMITH, A. a PAPADAKOS, T. 2014. *Value Proposition Design*. 1. vydanie. New Jersey: John Wiley & Sons, 2014. 320 s. ISBN 978-1-11896-805-5.