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A Conceptual Model for Creating Smart Cities in Czechia Based on Smart Specialization in the Tourism Industry

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Abstract

The modern 21st century makes developed countries introduce advanced IT technologies, such as smart solutions, which penetrate into the public administration environment and are used by municipalities to improve the life of citizens. Modern programs for developing and implementing “smart city” solutions are focused primarily on the interests and needs of the population. As a result, this trend directly affects the development of tourism by improving the quality of tourist services. The purpose of the study is to offer a conceptual model for creating “smart cities” in Czechia based on smart specialization in the tourism industry by introducing modern technologies and innovations, which will result in bettering the quality of tourism services, increasing the number of tourists and improving the image of the city as a tourist destination. The methodological approach to this study is a systematic literature review. The authors identify which “smart cities” are effective, efficient, productive, sustainable and unsustainable, and the difference between effective and productive “smart cities”. The creation of “smart cities” in Czechia on the basis of smart specialization in the tourism industry is substantiated. It is noted that the size of the city and the number of its inhabitants do not affect the creation of a “smart city”. Increasing the tourist attractiveness of Czech cities will enable cities of any size to become “smart”. The authors have determined which components of the developed conceptual model will affect its effectiveness. The findings indicate that the impact of new technologies, thanks to the advanced implementation of information and communication technology (ICT) applications, play a crucial role in data collecting and sharing for the “smart cities” development. The article mentions examples of successful implementation of the concept in the Czech cities of Prague, Hradec Králové and Brno. In general, a “smart city” of Czechia can make the tourism industry more accessible and efficient for both tourists and locals, ensure the sustainability of tourism in the city and increase its competitiveness in the tourism market.

Keywords

Smart strategy, Smart city, Tourism industry, Concept

JEL Classification

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Introduction

Rapid changes in living conditions cause constant migration movements of people who believe that a change of environment will bring them a better life, better economic, social, and sometimes even cultural conditions, in short, improve their quality of life. As urbanization processes continue, especially intensive direct urbanization, the need to adapt to new modern conditions is growing. Often, the scale of cities is expanding beyond their own administrative boundaries. The intensity of ties between the core and the periphery is determined by overcoming

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distances. Regional ties in megacities or agglomerations are strengthening, and requirements for actual territory management are growing. Effective territory management requires modern smart solutions that make life easier for people not only in the core but also on the periphery. The classical division of settlements into municipalities, towns, cities, statutory towns, etc. has long been outdated and can only be used for administrative purposes. The modern world focuses on overcoming the classical fixed boundaries of settlements and introducing advantages (smart technologies) to improve the lives of residents, reduce environmental impact, and ensure efficient use of resources. "Smart cities are able to ensure the efficient operation of urban infrastructure, improve the quality of life of residents, and ensure economic development. In addition, due to the growing demand for technology and high-speed Internet, smart cities can provide cities with a competitive advantage and attractiveness for living and doing business. In Czechia, the implementation of the “smart city” has its own peculiarities, which can be summarized in the following areas:

A. Tourism – countries with a developed tourism sector – the creation of smart technologies and the use of smart specialization helps to make cities more attractive to tourists, improve tourism infrastructure and increase tourist flows;

B. Transportation – the density of the transport network in cities and its hinterland, the growing trend of individual motorized transport and its combination with public transport, the provision of transport services, the improvement of transport accessibility, etc. are factors that are much susceptible to introducing new modern solutions. Time and finance play a huge role here.

C. Environmental – the motivation for building smart cities is to reduce negative environmental impacts and improve the quality of life of their inhabitants. The use of smart specialisation can help to reduce the cost of energy supply, increase the level of environmental safety, and use resources rationally.

The purpose of the paper is to offer a conceptual model for creating “smart cities” in Czechia based on smart specialization in the tourism industry by introducing modern technologies and innovations, which will result in bettering the quality of tourism services, increasing the number of tourists, and improving the image of the city as a tourist destination.

The implementation of the “Smart City” concept is based on the successful adaptation to new conditions by all components of the urban environment, where not only the morphological structure, but above all the functional use of space is changing. Large world metropolises such as Vienna (Horngacher et. al., 2012), Barcelona, Copenhagen, London, Amsterdam (Cohen, 2012) or US cities such as Washington, Atlanta, San Francisco, etc. (Smart Cities Week, 2015) were the first settlements to address the Smart City concept. One of the first in Czechia was the Statutory City of Brno, which already in 2015 started to implement the Smart City concept. The practical implications of introducing this concept for the city of Brno will be mentioned later in the article. Brno was later followed by other Czech cities, such as Prague, Plzeň, Hradec Králové, České Budějovice, among smaller towns, Litoměřice, Kolín, Svitavy or Písek. Therefore, the creation of smart cities is an extremely urgent task for Czechia, which can ensure an effective development of such cities, improve the quality of life and guarantee sustainable development of the country as a whole.

A number of studies and publications provide different approaches to understanding the basic definitions, strategies and tactics for implementing “smart city” technologies Kitchin (2023), Mikšíková et al. (2023), Abdalla et al. (2023), Richter et. al. (2022), Cunha et al. (2022), Esteban-Narro et al. (2022), Ševčík, et al. (2022), Momot,.& Muraev, (2021), Brown et al. (2020), Kourtit (2021), (Giffinger et. al., 2007) et al.. These include conceptual considerations of what makes a city “smart”. Some scholars study digital technologies and their impact on the progressiveness of cities around the world; others use leading international rankings of “smart cities”; some focus on existing barriers in local authorities; others compare a particular country with existing “smart city” tools, identifying the dynamics of “smart city” development as not so effective as in comparable “smart cities” and countries; some scientists studying network urbanism point out the dangers of technology implementation, which consists in a number of social, political, ethical and legal problems related to the kind of society that seeks to create “smart city” initiatives. Since the research of smart city projects by scientists was carried out on specific objects and areas or within a particular country using different methods that did not take into account the peculiarities of the tourism industry development and the interaction of public authorities and the population, the study conducted by the authors focuses on the development of a conceptual model of smart cities in Czechia on the basis of smart specialization. All of this leads to identifying and justifying the situations that have arisen in the implementation of intelligent solutions in “smart cities”, specifying their development mainly on the example of the Czech tourism industry, as the tourism sector is becoming increasingly important in the economies of many regions and countries, organizations and territories that interact and promote each other to attract tourists, significantly affect the success of the industry and digital marketing strategies and significantly increase the country's GDP. It is important that the tourism industry finds innovative and differentiating marketing and communication strategies in the digital society, and has an inextricable link of trust and communication between the government and the public. The development of the Czech tourism industry is entirely dependent on the use of smart technologies in the tourism industry. The Czech tourism industry has a gap in defining smart infrastructure in the areas of legislative, institutional and financial support, applying the

experience of developed and developing countries, while balancing the current requirements of environmental and financial sustainability, despite the constant reduction in the cost of technology. Since the introduction of smart solutions in the tourism industry remains quite limited and most solutions are at the level of pilot projects, the purpose of the study is to offer a conceptual model for creating “smart cities” in Czechia based on smart specialization in the tourism industry by introducing modern technologies and innovations, which will result in bettering the quality of tourism services, increasing the number of tourists and improving the image of the city as a tourist destination.

Literature Review

The concept of a smart city is now a common concept that almost everyone has encountered, either directly, by being involved in the development or implementation, or indirectly, by being a user of smart city services.

Rudolf Giffinger from the Technical University of Vienna was one of the first authors to write about the Smart City concept. "The idea of a smart city is to create and connect human capital, social capital and IT infrastructure in order to ensure sustainable economic development and improve the quality of life of city residents" (Giffinger et. al., 2007). At the same time, the authors defined 6 basic areas of application of the new concept (smart economy, smart people, smart governance, smart transport, smart environment and smart living). Furthermore, for example, the European Union defined the term “smart” to qualify the sustainability of projects and actions in urban spaces (Cocchia, 2014).

Current approaches to the topic are offered by many world experts. Studies of digital inequality, the dangers of smart cities are presented in the works of Thompson (2016), Graham (2002), Kitchin (2021), Richter et. al. (2022), Kourtit (2021), Vershitsky et al. (2022), Esteban-Narro et al. (2022), Cunha et al. (2022), Abdalla et al. (2023), Brown et al. (2020), Garlík (2020) and others.

Research on inclusive growth of world cities, analysis of technologies was carried out by special agencies: the Global power City index, Bee Smart City, European strategy for smart, sustainable and inclusive growth, IESE Business School and others.

In addition, many online resources offer approaches to the development and implementation of digital city development technologies. Global experience, active development of technologies allows accelerating the possibilities of implementing elements of the smart city, to support the development of ecological systems with subsequent capacity increase, to adapt to changes and to cover all components of the socio-cultural-economic system of the city. According to Kitchen's definition, a smart city is a set of diverse infrastructures, technologies and people for the development of an economy based on innovation, creativity, entrepreneurship. The triple helix, i.e. institutions, technology, people, and the relationships between them, forms the foundation of a smart city. The human component can be divided according to the target groups of city residents interested in its development Kitchin (2023), Brown et al. (2020), Momot,.& Muraev, (2021), Thompson (2016), Graham (2002).

The European model of smart city development implies the introduction of smart components, such as economy, mobility, ecological approach to environmental protection; digital technologies; development of information, digital and general culture of citizens; lifestyle; e-government. The implementation of certain approaches provides a comprehensive approach to the use of all components in the development strategies of urban communities and their territories and the creation of an evenly developed infrastructure and information ecosystem. But even the most digitized cities have an insufficiently balanced set of "smart" services. The analysis of theoretical foundations and practical examples of smart city implementation refers to different approaches and challenges on the way to its realization

The author (Kitchin) examines the implementation of “smart cities” from a negative perspective. He argues that there are a number of social, political, ethical, and legal issues associated with the kind of society that seeks to create “smart city” initiatives. He points to the pace of development of “smart city” technology deployment that is far outpacing wider reflection, critique, and regulation and suggests analysing the vision and implementation of “smart cities” in different regions and rethink their ideals and ethics to ensure that we are prioritizing the positive (Kitchin, 2023).

The analysis of UK cities also suggests fragmented innovation and a lack of systemic strategies (Brown et al., 2020). Chinese government initiatives have focused primarily on addressing environmental issues, the impact of epidemics and other emergencies (Tencent's "smart city" seen as a model for post-coronavirus).

The impact of COVID-19 on “smart cities” has also had negative consequences for the development of “smart cities”, while it is necessary to apply the experience of overcoming the crisis.

Abdalla et al. (2023) offer a conceptual model and illustrate various components and links among smart cities strategies, KM and COVID-19, and how this can inform, facilitate, and enhance decision-making to take steps for the path of recovery.

The inclusion of the idea of replication in smart city initiatives and funding schemes by European Commission policy

makers has fallen short of expectations and has limited applicability to urban transformation projects in their current form. Therefore, the researcher Ruess (2021) offered to overcome the current challenges in this area using a problem-solving method – group modelling (GMB). This approach substantiates the existence of current problems in creating “smart cities” in urban areas and with local authorities. The advantage is to build a group model (GMB) that will lead to generating, perceiving and processing information. However, replication strategies do not meet expectations and in their current form have limited applicability to urban transformation projects.

Richter et al. (2022) studied smart cities based on modelling comparisons of different cities and scenarios of autonomous vehicles (AVs) implementation to understand which aspects of cities lead to positive results of AV implementation. The author conducts modelling-based comparisons between different cities and scenarios of autonomous vehicles (AVs) implementation to understand which aspects of cities lead to positive results of AV implementation. A key area for investing in the sustainable development of smart cities is the impact of new technologies and the adoption and investment in new technologies to solve urban mobility problems.

According to the 2023 ranking, based on an updated methodology compiled from the results of the study by the Swiss business school IMD examining the level of technology implementation and residents' views, the top cities are Zurich, Oslo, Canberra. In the ranking of experts at the Navarra University Business School in Spain (IESE Business School), London is the 2022 leader (IESE Cities in Motion Index 2022). The rating indicators can also be the ones for the development of smart city elements, in particular, the latest ranking evaluated mobility and transport, human capital, international communication, citizen cohesion, urban planning, economy and environment.

Esteban-Narro et al. (2022) present a proposal for the structure of a smart project assessment model specifically for urban centres between 100,000 and 450,000 inhabitants, based on a holistic concept of the city, considering its different dimensions and sub-dimensions, introducing the main urban stakeholders and the specific challenges as a part of the model that this kind of cities must face, with the ultimate goal of developing a tool to help in the decision-making processes of urban transformation. This study confirms the need to create conceptual models for the development of cities that have specific problems, as they are comparatively limited in terms of economic, technical and financial resources in the transformation process.

Kourtit (2021) studied the current era of digital technologies embodied in the XXQ-principle (achieving the highest possible level of urban quality of life). The author argues for the systematic application of this principle to improve the efficiency of “smart cities” which is called the XXQ performance value by using urban intelligence models, 'flying disc', including key performance indicators (KPIs). This study points to the need to develop conceptual and methodological thinking based on the principles of intelligent spatial planning for “smart city” management,

Vershitsky et al. (2021) investigated the implementation of Smart City policy using a survey method, which revealed the main directions and preferences of residents for the implementation of SC technologies in cities, developed step-by-step recommendations for municipalities seeking to implement smart initiatives in a Smart City. This study points to the implementation of “smart city” policies that will be useful for municipal authorities.

Momot,.& Muraev, (2021) a comparative analysis of the Top 10 smartest cities in the world in terms of leading international rankings; on the basis of the conducted analysis the components of the assessment of smart cities are systematized within the framework of the studied methodological approaches to the assessment of smart cities according to international rankings. a model of organizational and information support for the development of a smart cities strategy on a balanced system of indicators was developed, which is considered as an integrated assessment system; the information and analytical tools for assessing the level of balanced development of smart cities. The scientists’ approach is focused on developing theoretical and methodological provisions and substantiating practical recommendations for the formation of an organizational and information support model for the development of a “smart cities” strategy based on a balanced scorecard.

The experience of the European Model for Urban Development and other business schools, including research papers that point to positive and negative factors influencing “smart cities”, is found useful. However, the creation of a conceptual model for the development of “smart cities” based on smart specialization in the Czech tourism industry indicates the need to study the experience of Czech scientists who are trying to improve the socio-economic development of the country and the tourism industry using different approaches, ways and methods.

Other scholars, Cunha et al. (2022), exploring information and communication technologies in the digital society, highlight technologies and combine them into a conceptual model that they propose as an enhancement to an immersive and innovative digital marketing strategy in order to promote tourist destinations. This study points to creating a conceptual model in the tourism industry that will combine mobile technologies, innovative, communication strategies, digital marketing and will have a positive impact on the tourism industry.

Czech researchers Ševčík, et al. (2022) and Neumannová, (2022) studied “smart cities” in Czechia and their positive impact on the living standards of the population through interviews with urban policy experts and desk research of available information.

For example, Ševčík, et al. (2022) in their study described the perception of barriers to the implementation of smart projects from the point of view of fifteen representatives and officials of local authorities located in the Brno metropolitan region in Czechia. The results indicated that the existing barriers to the implementation of smart projects are related to internal factors in municipalities: lack of interest of municipal leaders and officials; potential technical difficulties accompanying the projects' implementation. However, it was determined that there is an unclear understanding of the concept of "smart cities" or the cyber threat by the Czech government. The studied barriers to the implementation of smart projects in rural areas, small towns and the Brno metropolitan region were classified according to their type and schematized.

The scientist Neumannova, (2022) pointed out the importance of using best practices for post-socialist cities in Western European countries in the process of transforming areas into "smart districts". One of the possible ways is to join the European Union's Lighthouse project.

For example, Czech scientists Mikšíková et al. (2023) conducted an objective expert analysis of "smart cities" in Czechia, the results of which pointed to a situation where the implementation of "smart city" concepts in Czechia is less dynamic and not as successful as in comparable regions. The purpose of the study was to determine whether there is a need and demand to invest other financial resources and instruments into these "smart city" concepts, as well as to assess the feasibility of creating new tools and approaches for "smart cities".

Czech experts do not lag behind the world's authors either. The introduction of the concept has been presented, for example, by Slavík (2017), Garlík (2020), the application of the approach in the field of tourism and its sustainability by Zelenka et al. (2008), Zelenka & Kysela (2013); Zelenka et al. (2013), Pásková (2014) or in the field of smart transport by Bárta (2015). The issues of the legal aspect of the definition of a smart city have been addressed in the works of, for example, Kasl (2018).

However, the question of creating "smart cities" on the basis of smart specialization in the tourism industry of Czechia is not sufficiently addressed. All these factors prove the need for further research on the "smart city" implementation by using smart technologies in the tourism industry while developing a strategy of individual cities.

Tools for creating "smart cities"

The term "Smart" (smart) in relation to growth and development was used in the Europe 2020 strategy, which identified three key development priorities for the European Union in response to the continent's serious structural problems (Adamuscin, 2016).

"Smart city" is the concept of integrating multiple information and communication technologies and the Internet of Things (IoT solutions) to manage city assets; city assets include, among others, local information systems departments, schools, libraries, transportation, hospitals, power plants, water and waste management systems, law enforcement agencies, and other public services The goal of creating a "smart city" is to improve the quality of life by using urban information technology to increase service efficiency and meet the residents' needs. The concept of "smart cities" involves solving a whole range of tasks. When considering the concept of "smart cities", three principles should be emphasized: comfort, convenience, and safety of city residents and visitors. Thus, today the concept is increasingly associated with modern trends in urban development, which allow ensuring high quality of the urban environment Ryabev at el. (2022).

The smart specialisation methodology is used to prioritise regional development areas and smart technology deployment, based on the idea that each region can find its own competitive advantages in using smart technologies in its development.

In the initial phase of smart city development, the key goals and objectives of the project are defined and a smart technology deployment strategy is developed. Experts from different sectors can be brought in to help identify the most effective technologies and projects for a particular city.

A "smart city" can be considered operational according to the algorithm developed by the European Commission, which represents a sequence of six steps to transform the regional economy towards "smart sustainable development":

- analysing the regional context and innovation potential;
- creating an inclusive governance structure;
- developing a shared vision for the future of the region;
- selecting a limited number of priorities for regional development;
- setting an agreed policy, roadmap and action plan;
- establishing a monitoring and evaluation system (Figure 1).

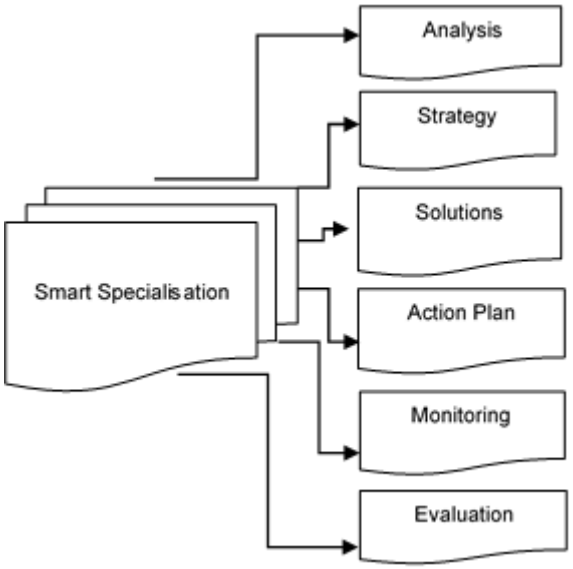

Fig. 1. Smart specialisation methodology.
Source: developed by the authors.

I. Phase I of the analysis of the regional context and innovation potential identifies the available resources, strengths and weaknesses of the region, taking into account its specificities and institutional conditions, namely: gathering the information needed for strategic planning; analysis of regional assumptions; qualitative and quantitative analysis of economic and innovation potential.

II. The next phase of the methodology is the creation of an inclusive governance structure. This phase of the regional team includes defining the organizational structure and key stakeholders: building effective communication; engaging stakeholders; achieving mutual understanding; defining the legal and governance structure.

III. The phase of developing a shared vision for the future of the region involves dialogue and interaction with regional stakeholders to assess future development pathways for the region. This involves developing a comprehensive scenario of the regional economy; assessing long-term challenges; identifying strategic goals for the region; and pre-developing priority areas for the Entrepreneurial Discovery Process (EDP).

Figure 2 clearly shows the components of the smart specialisation methodology with regard to smart and innovative development actions to develop a "smart city".

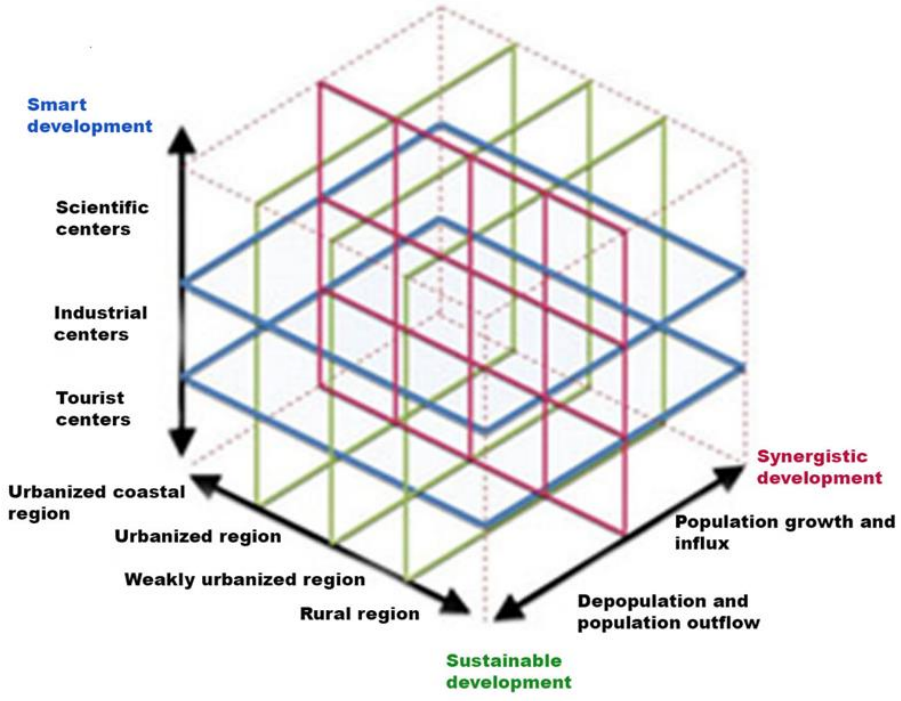

Fig. 2. Components of SMART Specialisation.
Source: developed by the authors.

IV. The selection phase of a limited number of priorities for regional development consists in focusing on a limited number of research and innovation areas in line with a certain potential of the region: stakeholder involvement; creation of EDP focus groups; definition of clear and realistic tasks; final approval of priorities.

V. Phase V of the definition of the agreed policy, plan and action plan consists of coordinating the policy processes and creating a multiannual plan for the implementation of the strategy: defining the rules and tools for the implementation of the strategic objectives; drawing up a list of actors and their responsibilities; creating a budget and deadlines; launching competitions for pilot projects.

The implementation phase of the monitoring and evaluation system includes controlling and following up planned activities and using properly financial resources. This is due to the development of the monitoring and evaluation system; setting clear deadlines for the completion of each task; analysing the results of the indicators; reviewing the strategy based on the evaluation results.

Thus, the main driver in building a "smart city" is collecting and processing big data (Big Data). It is the management of data that enables city services to improve the quality of life of residents. Therefore, a key tool for the development of smart cities is smart technologies - a variety of innovative technologies used to collect, analyse and transmit data in real time. In a smart city, smart technologies are used to collect data from various sources such as sensors, security cameras, mobile devices, and others to ensure more efficient management of various systems such as transportation system, energy system, water supply and sewerage, wastewater systems, and others. Smart technologies are also used to provide more effective communication between residents and city authorities (Figure 3).

Figure 3 shows the interactions between residents and city authorities – all of these functions contribute to increasing management efficiency and improving the quality of life in smart cities. The effectiveness of “smart cities” is determined by the level of the population’s satisfaction with the quality of life.

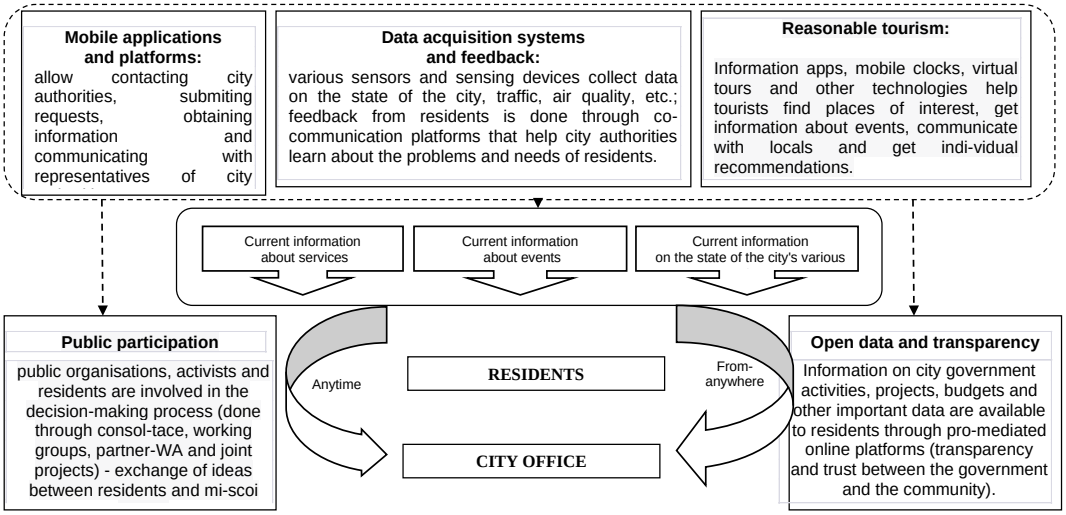

Fig. 3. Effective interaction between residents and city authorities.
Source: developed by the authors.

The methodology for creating a “smart city” using smart specialization is based on the experience of more successful countries, recommendations for improving living conditions, and their detailed package of measures that is designed for the long term and reflects the efforts to create each component as efficiently as possible. The experience of countries that have succeeded in improving living conditions, their detailed package of measures, which is designed for the long term and reflects the attempt to create each component as efficiently as possible must be used.

It can be argued that the components of a “smart city” are: smart infrastructure, smart transportation, smart energy, smart healthcare, smart governance, smart economy, smart citizens, and smart technologies. The tools for creating smart cities include: identifying its resources; collecting information; strategic planning structures; rebuilding the management team; developing priority areas of the process; defining clear objectives and limiting the number of innovative research areas; defining rules for strategic goals and creating control over the implementation of the “smart city” tool.

Global experience in implementing “smart cities”

More than 2,500 cities around the world are already implementing the “smart city” concept. One option is to build a city from scratch. An example is Masdar in the UAE. It is the world's first green city project with zero carbon

emissions. The city that will run exclusively on solar energy and other renewable energy sources. It will be the first example of an eco-city in the world, which is planned to be developed by 2025. However, most cities are gradually introducing “smart city” technologies into the existing urban system. The idea of a Smart City combines a variety of innovative tools that allow each city to choose an individual solution to a problem. The Internet of Things technology helps in this regard, as it allows monitoring various objects and analysing their condition.

There are studies that continue to confirm the effectiveness of smart cities in large urban agglomerations with high population densities. For example, in the city of Singapore, where the population density is more than 8,000 inhabitants per sq. km, the implementation of smart technologies has ensured more efficient management of transport, energy and water supply, a better waste management system and provided a high standard of living for the city's residents. The same success has been achieved in other cities around the world, such as in Europe: Oslo (population: 1,064,235; density: 9 985 inhabitants/km2), Zurich (427 487 people; density: 12 599 inhabitants/km2), Copenhagen (population: 653 664; density: 7 407 inhabitants/km2) (Mi, 2023).

The performance of “smart cities” is compiled according to the global Smart City Index. It was improved by using a new methodology in 2023. Therefore, there are changes in the performance of the “smart city” ranking compared to 2021 and 2023.

In the context of “smart city” development performance, the Smart City Index can be reported. The index was developed by the International Institute for Management Development in collaboration with the Singapore University of Technology and Design. The Smart City Index 2023, published by the Swiss business school Institute for Management Development (IMD), ranks 141 cities on how they use technology to address the challenges they face to achieve a higher quality of life. Singapore was considered the leading smart city in Asia and the seventh smartest city in the world. In 2020 and 2021, Singapore was also ranked seventh in the world, up three positions from its 10th place ranking in 2019. It was ranked first in 2019 to 2021, but these past rankings have been adjusted to reflect the new methodology used for the 2023 index (Tables 1 and 2). In the updated 2023 edition of the IMD Smart City Index (SCI), Asian and European economies dominate the Top 20. The top three leaders are Zurich (1st place), Oslo (2nd place) and Canberra (3rd place). Of the Top 20, six cities have steadily improved since 2019: Zurich, Oslo, Singapore, Beijing, Seoul and Hong Kong (Table 2).

The 2023 results also show an increase in the «smartness» of second-tier cities such as Montreal, Denver, Lausanne, Bilbao, Bangalore, Brisbane, Busan, Sydney, Hong Kong and Shanghai, IMD Smart City Index 2023, (2023).

Table 1. Top 10 Smartest Cities in the World Smart City Index.

Smart City Index 2020 (old method)	Smart City Index 2021 (old method)	Smart City Index 2023 (new methodology)
Singapore	Singapore	Zurich
Gelsinki	Zurich	Oslo
Zurich	Oslo	Canberra
Auckland	Taipei	Copenhagen
Oslo	Lausanne	Lausanne
Copenhagen	Helsinki	London
Geneva	Copenhagen	Singapore
Taipei	Geneva	Helsinki
Amsterdam	Auckland	Geneva
New York	Bilbao	Stockholm
Number of cities analysed		
109	118	141
Among the top 10:		
6 European cities	7 European cities	8 European cities

Source: Smart City Index, 2023.

Changes in the “smart cities” ranking can be observed after the Smart City Index calculation methodology is updated.

Table 2 shows the results of the Smart Cities Index according to the new methodology Mehr Sicherheit durch IoT Security (2023).

Table 2. Top 10 Smartest Cities in the World Smart City Index (ranked according to the new methodology).

City	HDI (2023)	2023	2021	2020	2019
Zurich	0,989	1	1	1	1
Oslo	0,98	2	2	2	2
Canberra	0,98	3	–	–	–
Copenhagen	0,967	4	5	3	4
Lausanne	0,966	5	4	–	–
London	0,973	6	3	10	3
Singapore	0,939	7	7	7	10
Helsinki	0,96	8	8	5	6
Geneva	0,966	9	6	8	7
Stockholm	0,972	10	11	9	9
Prague	0,96	14	10	4	8

Note: HDI = Human development index. **Source:** IMD Smart City Index 2023 (2023).

Prague has been included among the indexed cities since 2019. In the first year of the index's publication (2019), Prague was positively rated in the areas of mobility and public transport, safety or job opportunities. The approved Smart Prague 2030 Concept was developed along with the city's strategic plan and defines six key areas with a real impact on the city's citizens (Future Mobility, Smart Buildings and Energy, Waste-Free City, Attractive Tourism, People and Urban Environment and Data). According to the new methodology, Prague's overall position in the index has deteriorated by 6 places in the 2019/2023 comparison. There are several reasons for this. In general, there is an increase in the number of indexed cities (102 cities in 2019 and already 118 in 2023). It should be noted that Prague is still the only representative on this indexed list. Compared to 2019, Prague has seen a deterioration in the traffic mobility indicator, namely the traffic congestion rating (a decrease of 2.86 points). The increase in traffic in Prague, especially in the inner city and around the historic centre on the arterial road, is a major problem that has been referred to for several years. However, due to the relief and hydrological conditions (the Vltava River) and the concentration of historical monuments inside the core city, the solution to the traffic situation is not entirely straightforward. For example, according to the TomTom Traffic Index, tracked by the Dutch company TomTom, in 2022 drivers spent a total of 151 hours in the centre of Prague at peak times. This compares with 123 hours in Brno and only 97 hours in Ostrava the same year. Of the cities surveyed, Almere in the Netherlands is the best performing city (68 hours) and London the worst (325 hours) (Tomtom, 2023).

Another indicator showing a decline over the years under review is access to education, specifically access to education and lifelong learning opportunities. The aforementioned Smart Prague 2030 Concept aims to comprehensively address the area of transport, where one of the set priorities is Mobility of the Future, measured in terms of strengthening the role of public «clean» transport. The area of education is dealt with at a more central level, e.g. by the Education Act (Ministry of education, youth, sports, 2023).

Thus, the effectiveness of “smart cities” is determined by the level of the population’s satisfaction with the quality of life. And the effectiveness can be observed in the ranking of global “smart cities” by the Smart Cities Index.

When exploring different scenarios and objects to quickly and accurately train AI perception, it is worth considering the volume of consumption of innovative services. The results of the Smart Cities Index Report (2023) showed which sectors are experiencing the growth of service innovation in smart cities.

The study was conducted from 2019 to 2021 among 31 countries of the world where the largest number of services provided by smart cities is defined. These include transport, tourism and recreation; culture; energy and environment.

A sustainable or unsustainable “smart city” can be determined by the amount of renewable energy in the total amount of electricity produced. “Smart cities” with large populations set goals to switch energy production from traditional sources to wind and nuclear power. This criterion for defining a “smart city” indicates progress in innovation and sustainable development.

The continuous improvement of smart cities is linked to the needs of the market as a key driver of development. 32% of the services provided are transport-related. Further 17% is related to the culture, tourism and recreation sector. 12% is in the energy and environment sector.

In terms of service applications, 36% are related to transport. 23% of services provided in applications and on the Internet belong to the Culture, Tourism and Recreation sector; 11% to Social Services. (Smart cities index report, 2023). Therefore, the development of tourism is absolutely essential for the creation of smart cities.

The Index, thus, serves as a valuable guide to progress in the areas of openness, innovation, inclusion and sustainability.

Interestingly, a study by Deloitte published a list of cities due to the size of the city and the level of solar and wind energy use in electricity: (1) those with the highest use of wind energy; (2) the cleanest cities where wind energy use already exceeds 40% among other energy sources; and (3) new cities that have 100% wind energy use (Table 3).

Table 3. The most sustainable cities.

City	Country	Population, million persons	% of renewable energy in total electricity generated	Targets for wind power generation or decarbonisation (in the case of decarbonisation targets, traditional energy sources such as nuclear power are set)
Soul	South Korea	10.3	8.3	1 GW of solar generation by 2022.
Singapore	Singapore	5.5	3.9	350 MW of solar generation by 2020
London	UK	8.8	24.6	Achieve carbon neutrality by 2050, 1 W of installed solar generation by 2030, or 2 GW by 2050.
Los Angeles	USA	3.9	29.0	65% by 2036.
Paris	France	2.8	18.0	100% EE by 2050 (25% by 2020 /45% by 2030)
Stockholm	Sweden	1.9	19.0	Fossil fuel use to be phased out by 2040. 2023 emission targets, 2040 climate budget and the new (sixth) Climate Action Plan.
Tokyo	Japan	13.5	9.0	20% by 2023.
Chicago	USA	2.7	5.0	100% EE by 2025 for municipal construction
Birmingham	UK	1.1	4.4	60% reduction in CO2 emissions by 2027 (from 1990 levels.
Manchester	UK	2.8	13.1	Achieve carbon neutrality by 2038.
Calgary	Canada	1.2	9.4	30% E by 2036.
Nelson Mandela Bay	South Africa	1.2	10.0	Nationally achieving 35.6% of generation from wind and solar by 2030.
Hamburg	Germany	1.8	29.9	35% energy efficiency by 2022; 50% reduction in CO2 emissions by 2030 or 80% reduction by 2050 (from 1990 levels)
Toronto	Canada	2.8	36.0	75% wind power or carbon neutrality by 2050.
Madrid	Spain	3.2	41.2	100% wind power nationally by 2050
Copenhagen	Denmark	0.6	60.0	Achieve carbon neutrality by 2025
Diu	India	0.05	100.0	Achieving carbon neutrality by 2029
Pena Station Next	USA	0.05	100.0	Targets are met
Xiongan	China	2.5	100.0	

Source: Deloitte Insights (2019).

"Smart" cities use digital technologies to make them more efficient and sustainable. Sensors embedded in buildings and infrastructure networks support the use of renewable energy sources or enable energy conservation (including street lights only in the presence of an object on the road). Sensors, smart cards and digital cameras transmit real-time data to integrated control systems, and big data and analytics technologies can inform decision-making and improve city management. So-called smart houses generally combine four basic systems – a house's automation system, a telecommunication system, a space automation system, and a computer-controlled house management system (Wong & So, 1997).

In the coming decades, energy systems are expected to become more connected, reliable and sustainable through digital technologies.

The efficiency and performance of energy systems will improve by reducing operation and maintenance costs, reducing unplanned outages and disruptions, and extending the life of assets.

According to the MEA28, the total savings from these measures could reach approximately 80 billion/year over 2016-2040, about 5% of the total annual cost of electricity generation, based on the increased global deployment of available digital technologies in the grid infrastructure.

However, there are cities in Czechia that have plans to switch to 100% renewable energy consumption (The need for changes in the energy sector of Ukraine for the development of smart cities, p. 245). However, these are often not entire cities, but only local parts or parts of settlements, where concepts of so-called self-sufficient municipalities are emerging. These are based on the use of bio-waste, community solar energy production, a system of domestic wastewater treatment plants, an electrified vehicle or a municipal e-shop (Self-Sustaining Village, 2022). Czech towns, such as Tábor, Bělá pod Bezdězem or Židlochovice, have signed up to the concept, and smaller municipalities, such as Dlouhoňovice, Ropice or Blešno, have signed up.

City and business leaders will benefit from membership of the beesmart.city platform, a database of projects (about 700 smart solutions) from around the world. There are 1,190 cities registered on the platform, with which experiences can be exchanged. In addition, the platform has its own ranking of smart cities and publishes useful analyses and profiles of smart cities. Using the smart solutions database beesmart.city, it is useful to compare the main problems that their cities are trying to solve with smart solutions in each of the areas and the immediate tools that underpin these solutions (Bee Smart City, 2023).

In Latvia, for example, RIS3 enabled to improve management of R&D systems and the creation of 'regional learning spaces', but the introduction of digital technologies has not led to automatic continuous electronic data processing; multilateral approaches to decision-making are still needed (OECD, 2019).

In Romania, whose regions are the least developed in the European Union, there is a low involvement of stakeholders in the innovation process, which does not allow to fully trigger the four-point innovation spiral, thus replacing the "smart specialisation" strategies of the traditional top-down innovation policy practices in the country (Storonianska, 2020).

In Ireland, the experience of identifying new areas of activity that create competitive advantage shows an excessive fascination with traditional economic activity with an emphasis on improving it. In seeking to develop new opportunities for development towards 'smart' growth, regions have experienced a dependence on corporate and political influences that limit inclusion in the innovation process with low employment (Paolo Cardullo & Rob Kitchin, 2019).

In general, summarizing the European experience of smart growth allows drawing lessons that need to be taken into account given the rather contradictory results of the implementation of these strategies.

The modern system of managing the urban infrastructure of “smart cities” with the help of information and communication technologies, combined with the operation of IT applications, helps city residents to use public services. Elements of smart cities can be found in the organization of transport, garbage collection, parking lots, bus stops, and street lighting. New smart city services automate urban management processes. Cameras and sensors collect and analyse information, and they can be used to manage processes that have always been manually controlled. The data generated by a “smart city” and associated with spatial and temporal tags form the basis of big data. Big data in “smart cities” are accumulated as a result of the operation of IoT sensors, websites, mobile applications, and social networks. The “smart city” system has its advantages for the authorities and for residents. If the mayor's office makes efforts to develop the city, takes into account the needs of residents, makes it more convenient and safer, it receives: population growth; investments; taxes.

Thus, the use of the world's experience in creating smart cities can be applied to the creation of “smart cities” in Czechia on the basis of smart specialization in the tourism industry. Existing approaches to creating “smart cities” based on smart specialization are used in successful countries, applied to improve the residents’ living conditions by increasing the efficiency of “smart cities”, have a detailed package of measures designed for the long-term development of all sectors of the economy through the use of intelligent solutions.

Rationale for creating “smart cities „in the Czech tourism industry

In our opinion, the application of smart city technology can be useful even for tourist saturated cities with low population density. In these cities, tourist flow monitoring systems can be used to enable optimal use of the city's resources and efficient management of traffic flows; technologies that provide better services to tourists, such as e-queue systems, mobile applications for tourists, and others, can be introduced. A modern “smart city” is a complex entity with a well-developed technological infrastructure, where a person’s life takes on a new quality thanks to smart solutions. It is with the ability to use new technologies and the digitalization of traditional services that users will be able to use their resources and time rationally and efficiently.

For example, in 2012 Barcelona became the first city to introduce the "Smart City" concept. It involved the widespread application of technology in city management, particularly in the areas of transport, energy saving and tourism development. One example of the use of smart technologies in the city's tourism sector is the development of the "Smart Destination" tourism portal. This portal allows tourists to get real-time information about the city, including weather, nearby events and popular places to visit. (Bakici et al., 2012).

Barcelona also has a "Smart Tourism Card" system that allows tourists to get discounts on tickets to museums,

theatres and other attractions in the city. This system is linked to a mobile app that allows you to get information on tourist sites and timetables.

In addition, Barcelona has a “Smart Lighting” system, which makes it possible to reduce electricity consumption by street lights, and “Smart Transport”, which ensures more efficient transport in the city (Bakici et al., 2012).

All these initiatives help Barcelona to become more attractive to tourists, reduce electricity costs and ensure more efficient city management.

Czechia is one of the most attractive countries for tourists. The location of a large number of attractions is due to the combination of nature, history and cultural traditions. However, the implementation of the Smart City concept in the tourism sector is still very limited. Emphasis is placed on "enhancing" the attractiveness of tourist destinations. For example, Czechia has tourist-friendly cities. Prague, Český Krumlov, České Budějovice, Brno, Pilsen, Ostrava, Karlovy Vary, Marianské Lázně, Telč, Liberec, are mainly determined by the approach of individual stakeholders (local governments, voluntary associations of municipalities, travel agencies and private enterprises operating in the tourism sector).

In Table 4, the study of the size of the tourism potential per sq. km among the regions of Czechia shows a significant potential of Prague, Liberec, Hradec Králové, Moravia-Silesia, Zlín, and South Moravian regions.

Table 4. Tourism potential in the regions of Czechia, 2022.

Region	Area in km^2	Potential point values	Potential per km^2	Population density (km^2)
The capital city of Prague	496	6,120	12.34	2,360
Liberec	3,163	12,210	3.86	135
Hradec Králové	4,759	13,785	2.90	115
Moravian-Silesian	5,427	15,035	2.77	227
Zlínský	3,964	10,015	2.53	149
South Moravian Region	7,195	16,840	2.34	159
Ústí nad Labem	5,335	11,850	2.22	154
Karlovarský	3,314	7,315	2.21	92
Pardubice	4,519	9,955	2.20	112
Plzeňský	7,561	16,205	2.14	73
Central Bohemia	11,015	23,540	2.14	104
Olomouc	5,267	10,565	2.01	123
South Bohemia	10,057	19,340	1.92	62
Vysočina	6,796	12,495	1.84	75

Source: CZSO (2023).

The data from the following Table 6 show that the "smart" city of Prague receives 50% of tourists, compared to the number of tourists in the country during the year (Table 5).

Table 5. Number of visitors in the world and smaller regions in 2022.

Number of foreign tourist arrivals (million)								World market share (%)
	1995	2000	2005	2010	2015	2019	2022	2022
The World	531	680	809	952	1195	1461	900	100
Europe	308	393	453	487	607	742	585	65
Czechia		4.70	6.30	6.30	8.70	10.90	5.00	0.60
Prague		2.30	3.70	4.10	5.70	6.60	4.26	0.50

Note: data before 2000 are not shown due to a number of statistically significant changes in data collection. **Source:** UNWTO, 2023.

The introduction of the smart city concept can be relevant for any tourist city that aims to improve the quality of life of its inhabitants and its attractiveness for tourists.

To determine which cities in Czechia can be “smart” in the first place, the ranking of the best cities in Czechia by quality of life in 2022 can be used (Table 6). The company Municipalities and Data compares the quality of life in 205 municipalities with extended jurisdiction and Prague. A comprehensive quality of life index is created from the

indicators: total population growth, crime rate, life expectancy, the number of traffic accidents, the number of working doctors, ecology, unemployment rate, average wages, the number of companies and private entrepreneurs, the number of schools and nurseries, availability of leisure facilities, the number of restaurants, ATMs, pharmacies and other services.

Table 6. Best cities by quality of life in Czechia (2022).

	City	Category	Population, thousands	Region
1	Říčany	10.0	15,570	Central Bohemia
2	Prague	8.9	1,275,406	Central Bohemia
3	Brandýs nad Labem	8.1	18,982	Central Bohemia
4	Hustopeče	8.1	5,975	South Moravia
5	Černošice	7.5	7,331	Central Bohemia
6	Židlochovice	7.3	3,834	South Moravia
7	Slavkov u Brna	7.3	6,662	South Moravia
8	Rosice	7.2	5,504	South Moravia
9	Brno	7.1	379,466	South Moravian
10	Třeboň	7.1	8,092	South Bohemia

Source: Obce v datech (Settlements in Data), (2023).

1. Prague, the capital of Czechia, accounts for half of the foreign tourists who come to Czechia. Prague has had a Smart Prague 2030 Concept approved since 2015, which is based on the use of state-of-the-art technologies to transform the metropolis into a more pleasant place to live. One of the priorities is attractive tourism, where the vision for 2030 is to have a tourism that will be:

- mobile - everything important for tourists available on mobile;
- data-driven - using Big Data for better management;
- friendly and entertaining - advanced technologies for navigation, entertainment, and information for tourists (Smart Prague 2030 Concept)

In order to achieve the set goals, in our opinion, it is necessary to add technologies to improve tourism, namely, to improve the mobility of tourists and make their stay in the city more enjoyable without disturbing the urban population and taking into account environmental safety.

2. Brno, as the second largest city in Czechia and one of the top 10 best cities in Czechia, can use smart technologies to improve transport infrastructure, increase safety and comfort of residents and tourists. In 2017, the #brno2050 Strategy was approved, which addresses, among other things, the established Smart City concept. The main goal in the area of Smart City Brno is "a change of approach". The sub-projects that are already being addressed in 2023 serve to fulfil this goal. These include the projects Brno ID, data.brno.cz, the Inter-University Student Competition (MUNISS) or the Let's give it to you - in support of participatory budgeting.

3. Karlovy Vary is a city belonging to the UNESCO triangle and known for its historical and spa potential, as well as the number of tourists. Smart technologies can help to improve the quality of services for tourists and reduce negative impacts on the environment. There is no separate smart city concept at the city level. The city has an approved StrategyKV°2040, where which prioritizes the implementation of smart solutions in transportation, business, culture, and local government.

4. Ostrava, Liberec, Hradec Kralove are cities that lead in several indicators: the largest number and generosity of inhabitants, high tourism potential, a well-known cultural heritage that can use smart technologies to store and present its history and culture electronically for tourists and residents. Of the cities mentioned, Hradec Kralove, for example, has had an approved SMART Hradec Kralove Concept since 2016. The content of the concept consists of six priority areas (economy, people, governance, mobility, environment and housing). The smart housing area concerns the quality of life.

The strategic issues of the concept of smart or intelligent cities are left purely in the hands of local governments within their independent competence. Methodological management from the central level is provided by the Ministry of Regional Development, which in 2015 in cooperation with the Centre for Transport Research published the Methodology of the Smart Cities Concept (Ministry of Regional Development, 2015). The Methodology is a kind of guide for implementation in key areas of IT technologies application, i.e. transport and energy.

The research shows that in creating "smart" sustainable cities in Czechia it is appropriate to focus on individual

cities rather than regions. The highest degree of implementation is achieved by large cities. In terms of implementation compared to other cities, the capital city of Prague is the most advanced. The inspiration of Prague or Brno can serve as a guide for other cities.

The application of smart technologies in tourist attraction cities can provide a better travel experience, reduce costs and increase tourist safety.

The application of smart technologies in tourist attraction cities in Czechia can have the following benefits (Figure 4).

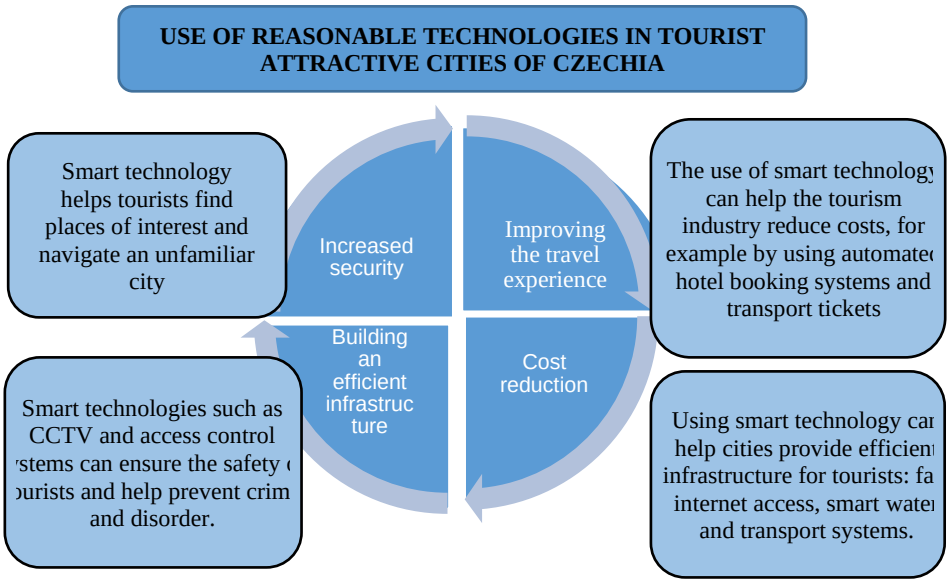

Fig. 4. Application of smart technologies in tourist attractive cities of Czechia.
Source: developed by the authors.

The main goal of the smart strategy is therefore to create a "smart city" that ensures an optimal quality of life combined with the greatest possible conservation of resources for all citizens. The main areas of smart technologies for the development of a “smart city” tourism product are shown in Table 7.

Table 7. Signs of creating a “smart city” in the tourism industry.

Main areas of smart technologies	Tourism product development
Introducing cloud technologies and the Internet of Things	Expanding the use of Wi-Fi (in the tourism sector, public places and transportation)
“Smart city“ application	Creating a tourist mobile application for the city
Using QR-codes	Using QR codes at all tourist sites (including museums, parks, near monuments, etc.) that would allow receiving text, graphic, 3D models, audio (audio guides) information in many languages
Single tourist ticket (City Tourism Card)	For all types of transport, as well as considering the possibility of introducing an Internet tourist card (for example, using NFC technology on mobile devices)
Placing webcams	Near the city’s main tourist attractions (including parks, squares, monuments, etc.), as well as placing information on stands about a particular object in different languages with QR codes
Smart elements in English at ground public transport stops	Equipping all ground public transport stops with smart elements in English about the route of a certain type of transport, a map of the route, transfer options and arrival time at public transport stops, the use of electronic anti-vandal touch cards (with Google maps technology), where the consumer of transport services can choose a language and design a route (by viewing transport schemes), while seeing the movement of public transport along the city's transport routes online
Installing electronic boards in museums	On these boards, one can view information about a particular museum exhibit in different languages, download an audio guide in a foreign language to one’s smartphone using a QR code, and find out the location of hotels, restaurants, and tourist attractions, as well as leave a comment
Electronic panels for interaction between local authorities and the public with collective accommodation facilities	Interaction of local authorities and the public with collective accommodation facilities through electronic panels where guests could design their route and save it on their own smartphones, choose a tourist attraction, book tickets, download information in their native language, and leave a comment. This tool also allows broadcasting tourist

	information about the city on corporate (in-house) television in hotels with the option of choosing the accompanying language
Ensuring the accessibility of tourist facilities for people with limited mobility and physiological disabilities	For this purpose, information boards about a tourist attraction should be placed at different levels (for people of different heights), using large text fonts, and the most popular attractions should have signs in Braille

Source: developed by the authors based on data Ryabev et al. (2022).

All elements of a smart destination should serve tourists and the local population. The current pace of society development, the emergence of the digital economy, as well as new trends prevailing in all spheres of life can all lead to creating new concepts to ensure a decent standard of living, meet the needs of citizens, and increase the profit of the tourism industry.

In examining tourism development in Czechia, it should be noted that the country is taking advantage of the outlined areas for the use and implementation of smart strategies that are clearly articulated in the country's tourism development strategy. The smart strategy for tourism development in Czechia uses smart solutions to exchange data, information and best practices. A key factor of the strategy is the emphasis on the use of modern technologies as the main tool for communication between businesses and authorities (public administration). The aim of the strategy is, as in the whole public administration, to digitise and automate routine processes. "Every hour in the office means one hour less time spent on business and customer care." This measure coincides with the objectives of Czechia Digital programme and the Information Concept of Czechia. In accordance with its principles and in line with current trends, steps are being taken to maximise data exchange, automate data collection and evaluation where it is appropriate, and share conclusions from analytical documents and research.

It should be noted that the objectives of the tourism development strategy in Czechia use smart strategies and will facilitate the integration of tourism into e-government. The reason for this is the creation of a platform based on the exchange of information on tourist accommodation facilities in Czechia. Such a platform is designed to increase and rationalize the collection, joint recreation, evaluation, and information of tourists, including the procedure for paying for their accommodation. The principle of the platform's operation is to create a central data repository that allows extracting information and data related to the tourism economy from the registers of state and local governments through authorized access channels.

The measures of the smart strategy for the development of tourism in Czechia will focus on making information on the possibilities of cooperation and financing of tourism projects available to entrepreneurs. The measure should also focus on the overall support for the development of innovation in the tourism sector, the digitalization of activities and processes in the tourism and the exchange of data among tourism entities. These measures will also lead to further development of the MIS system (Figure 5).

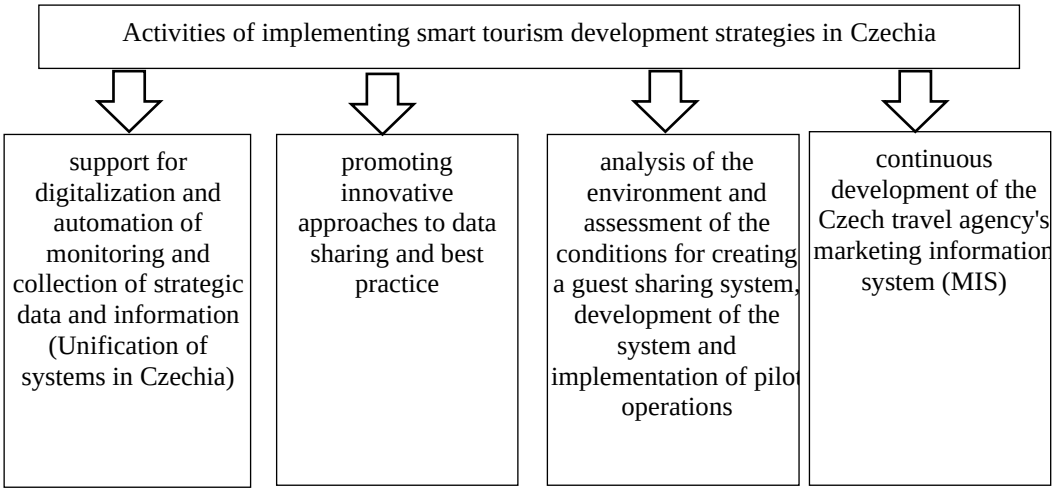

Fig. 5. Measures of the Smart Strategy for the Development of Tourism in Czechia (Czech Development Strategy).
Source: developed by the authors.

There are many smart tools for the development of the Czech tourism industry. These can be mobile applications, smart browsers, mapping portals, smart games in tourism, Smart destination – destination marketing 3.0, automatic visitor counting and others. Regions have not yet fully exploited these intellectual elements in tourism.

A conceptual model development in Czechia

It should be borne in mind that the Czech tourism industry has a great potential for creating smart cities. This is not "just" revenue from entrance fees, but also support for hotels, restaurants, attractions (e.g. a water park), local artists, shops, local entrepreneurs offering services, etc. that contribute to the development of the regions.

However, the (tourist) information centres operating in the Czech regions are aware of this and are working together to intensify tourism: digital tourist websites; real-time collection of information and statistics using IoT, big data; virtual tours, reconstruction for advanced technologies of virtual, augmented and mixed reality (VR/AR/n), 3D modelling, equipment with webcams for tourism; introduction of QR codes; tag reading system (radio-frequency identification); cashless payment systems; introduction of loyalty programs and tourist e-cards; creation of mobile tourist delivery cards (with route maps, audio guides, geolocations); e-receipts for tourist tours and in trust bookmarks; digital museums (e-catalogues), audio and e-guides.

Thus, the results of the analysis of the world cities that use a “smart city” strategy represent the basic foundation on which it is possible to develop a conceptual model for creating “smart cities” in Czechia based on smart specialization for the tourism industry. The involvement of the world's best practices of "smart cities" shows that the practical key factors that influence the creation of a "smart city" are primarily the level of trust of the inhabitants and the number of inhabitants of the city, the size of the city. It is necessary to ensure a high level of trust among residents through government support for urban modernisation. Also, the positive perception of change by the residents of Czechia can be the development of a conceptual model for creating “smart cities” in Czechia based on smart specialization in the tourism industry. It is based on the proposed model for creating a smart, sustainable city, which includes social, technological, environmental and management components (Figure 6).

The platform of the conceptual model includes the components of a “smart city”: smart infrastructure, smart transport, smart energy, smart healthcare, smart governance, smart economy, smart citizens, smart technologies.

The results obtained in the development of the conceptual model of “smart cities” in Czechia on the basis of smart specialization in the tourism industry are presented below:

- the need to ensure a high level of government support;
- a high level of trust and willingness of its residents to accept and participate in changes;
- the use of modern technologies: mobile applications, video surveillance systems;
- technological infrastructure: high-quality management of fuel costs;
- intellectual capital: digital access, digital literacy; digital participation;
- improvement of environmental safety for society;
- creation of platforms with information about popular places to visit, weather data;
- creation of a platform based on the exchange of information on tourist accommodation;
- creation of a “Smart Tourist Card” system that will allow tourists to receive discounts on tickets to museums, galleries, theaters, and other tourist attractions, as well as public transportation schedules;
- creation of a separate public transport for tourists along a separate tourist route.

When implementing the model, it is also necessary to consider that the size of the city and the number of its inhabitants do not affect the creation of a “smart city”.

The proposed model describes an implementation approach, especially for strategic urban management, and research results that can be used by other scientists.

Subsequently, it is planned to validate the model in urban practice. The results of the study reflect the problems evaluated, i.e. the scarcity of limited resources, population growth in cities and the lack of solutions to this problem in Czech cities.

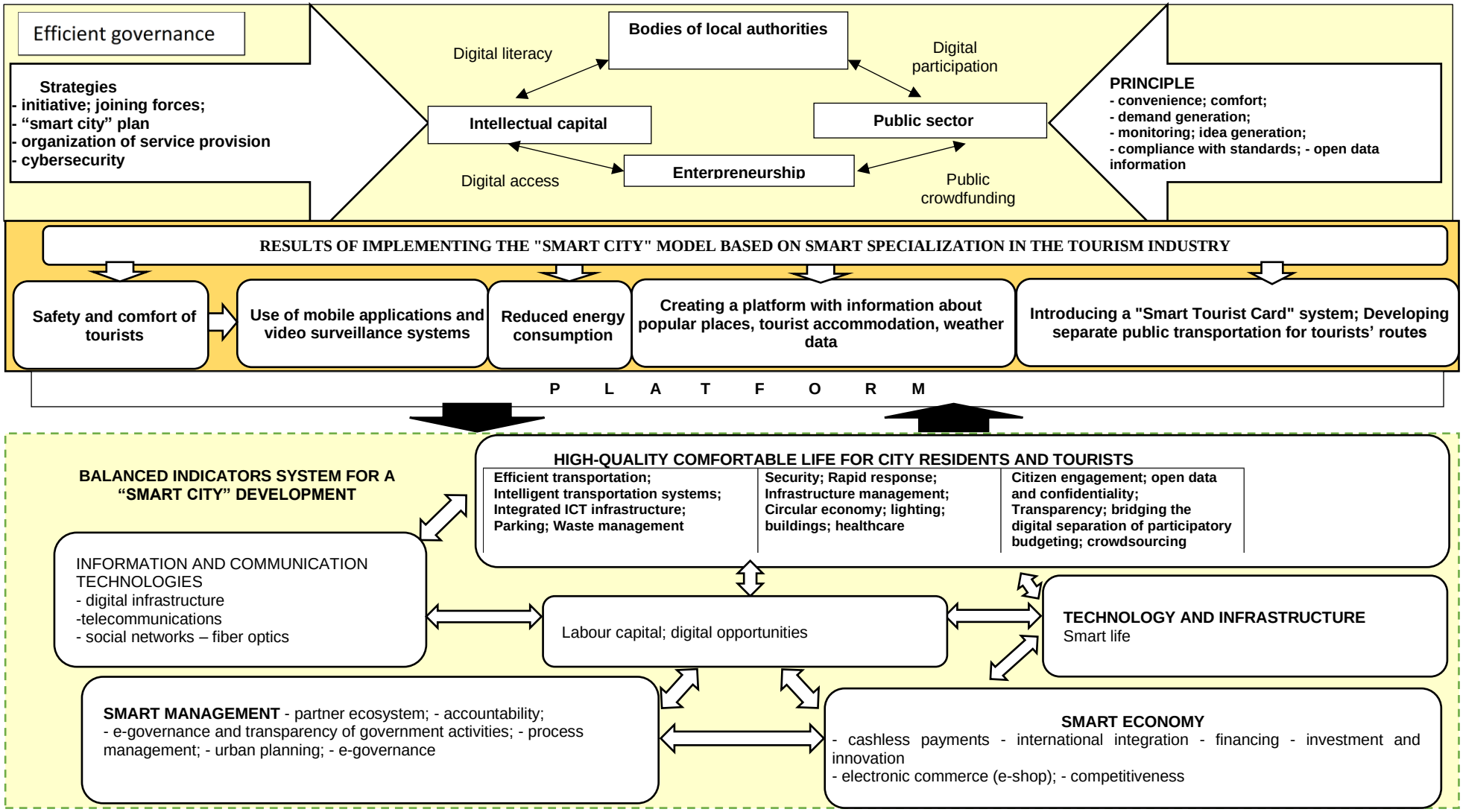

Fig. 6. Conceptual model of organizational and informational support for the creation of a "smart city" in Czechia based on a smart network in the tourism industry.
Source: developed by the authors.

Discussion

With 75% of the European Union's population living in cities, the European Union is committed to making cities more sustainable. The study found that the most studied “smart cities” in Czechia are Prague, Brno, and Hradec Králové. The proposed components in the developed conceptual model of creating “smart cities” in Czechia on the basis of smart specialization will make it possible to determine the efficiency, effectiveness, sustainability, and productiveness of the Czech “smart cities” at the expense of the tourism industry. It is necessary to take into account the impact of the level of residents' trust in the authorities. A study of the best cities’ ranking in Czechia in terms of quality of life in 2022 showed that the size of the city and the number of its inhabitants do not affect the creation of a “smart city”. To ensure that the size of a city does not affect the creation of a “smart city”, it is necessary to increase its tourist attractiveness. When creating “smart cities”, a database of projects from around the world should be used: beesmart.city. The advantage of such a platform is the exchange of experience, open access to useful information, analytical materials, and profiles of “smart cities” in various sectors of economy. All cities should join the platform, as only 1190 cities are registered on it.

Existing rankings of “smart cities” (Cultural Creative Cities Index, Smart Cities Index) suggest that it would be useful to explore further relationships, for which the right quality and quantity of data are needed.

Some scholars have proposed the creation of an economic index that measures the efficiency of regional centers in Central and Eastern Europe, which would help regional and city authorities, as well as potential investors, to obtain an up-to-date and comprehensive picture of regional centers in the area (Kézai & Rámháp, 2022).

Consequently, numerous studies by scientists who have tried to evaluate “smart city” projects using different approaches do not meet expectations, but only confirm the need to create conceptual models for the “smart cities” development, namely:

- by overcoming current problems in this area, using the problem-solving method of group modeling (GMB) Ruess (2021);
- through modeling-based comparisons between different cities and scenarios of autonomous vehicles (AV) deployment (Richter et al. (2022);
- due to the comparative limitations of “smart cities” in terms of economic, technical and financial resources in the transformation processes Esteban-Narro et al. (2022);
- through the use of urban intelligence models, 'flying disc’, including key performance indicators (KPIs) Kourtit (2021);
- by implementing a “smart city” policy that will be useful to governing authorities and which is based on a survey method that identified the main directions and preferences of residents regarding the implementation of “smart cities” Vershitsky et al. (2021);
- through the development of a model based on a balanced scorecard using the analysis of international rankings Momot & Muraev, (2021);
- by combining mobile technologies, innovation, communication strategy, and digital marketing Cunha et al. (2022).

Since the research of smart city projects by scientists was carried out on specific objects and areas or within a particular country using different methods that did not take into account the peculiarities of the tourism industry development and the interaction of public authorities and the population, the study conducted by the authors focuses on the development of a conceptual model of smart cities in Czechia on the basis of smart specialization will allow realizing how the tourism potential of the “smart city” in Czechia is being formed: by using mobile applications and video surveillance systems; by improving tourists' impressions and their staying in the city; by reducing energy consumption; through quality management of fuel costs; by improving environmental safety for society, creating platforms with information about popular places to visit, weather data, tourist accommodation; creating a “Smart Tourist Card” system to provide discounts to tourists; creating separate public transport for tourists on a separate tourist route; ensuring sustainability.

In addition to active communication between the population and local authorities, the conceptual model of a “smart city” shows the use and impact of smart technology in the tourism industry.

Further research is planned in the future to develop a sub-model that covers the management of specific limited resources that people consider critical for future generations.

Thus, a conceptual model of organizational and information support for the creation of smart cities in the Czech Republic based on smart specialization in the tourism industry has been proposed, which will allow us to understand how the tourism potential of a smart city in the Czech Republic is formed.

Conclusion

Thus, a conceptual model of organizational and information support for creating “smart cities” in Czechia based on smart specialization in the tourism industry has been proposed, which will allow realizing how the tourism potential of a “smart city” in Czechia is formed. Strong local authorities’ support is crucial for the success of smart projects.

Local authorities should be the initiators of these projects and influence the city at various levels to participate in regional government programs to finance the development of the digital economy.

It is established that the components of a “smart city” are: smart infrastructure, smart transport, smart energy, smart healthcare, smart governance, smart economy, smart citizens, and smart technologies. The tools for creating “smart cities” can be considered as follows: determining its resources; collecting information; strategic planning structures; rebuilding the management team; developing priority areas of the process; defining clear tasks and limiting the number of innovative research areas; defining the rules of strategic goals and creating control over the implementation of the tool for creating “smart cities”.

The author investigates which smart cities are considered effective, efficient, productive, sustainable, or unsustainable. The difference between effective and productive smart cities is determined. The creation of “smart cities” in Czechia on the basis of smart specialization in the tourism industry is substantiated. It is noted that the size of the city and the number of its inhabitants do not affect the creation of a “smart city”.

Effective results from implementing the developed conceptual model of “smart cities” of Czechia on the basis of smart specialization in the tourism industry will depend on:

- the need to ensure a high level of state support;
- smart management with a high level of trust and willingness of its residents to accept and participate in changes;
- use of modern technologies: mobile applications, video surveillance systems;
- technological infrastructure: quality management of fuel costs;
- intellectual capital: digital access, digital literacy; digital participation;
- improving environmental safety for society;
- creating platforms with information about popular places to visit, weather data;
- creating a platform based on the exchange of information on tourist accommodation;
- introducing a “Smart Tourist Card” system that will allow tourists to receive discounts on tickets to museums, galleries, theatres, and other tourist attractions, as well as public transportation schedules;
- developing a separate public transport for tourists on popular tourist routes.

The state's support will be in solving urban problems: 1) provide the necessary regulatory framework for creating new business models to protect the interests of citizens; 2) provide modern transportation infrastructure, power grids and digital networks; implement standards that make this infrastructure stable and secure; 3) create an environment in which smart solutions can be created and developed. Given the importance of smart infrastructure for economic and social development, it is important for decision makers to find a balance between the main goals of improving communication, competition, stimulating innovation, and increasing the welfare of the population.

The overall result of the developed model of building a “smart city”, which includes social, technological, environmental and governance components based on smart specialization, is sustainability, city participation, efficiency and productivity, social support and better adaptation of citizens through the theory of change, effective urban governance combined with social entrepreneurship and public administration, and then the responsibility of actors for the environment.

Smart technologies in tourism industry will provide “smart cities” in Czechia with advantages. In general, a “smart city” can make the tourism industry more accessible and efficient for both tourists and local residents, while the project will ensure the sustainability of tourism in the cities and increase its competitiveness in the tourism market.

References

Abdalla, W., Renukappa, S. & Suresh, S. (2023). Managing COVID-19-related knowledge: A smart cities perspective. *Knowledge and Process Management,* 30(1), 87-109. https://doi.org/10.1002/kpm.1706.

About Laws for People. Act No. 561/2004 Coll. Act on pre-school, primary, secondary, higher vocational and other education (school law). Available at: URL: https://www.zakonyprolidi.cz/cs/2004-561#. [Accessed 10 July, 2023].

Adamuscin, A., Golej, J., & Panik, M. (2016). Bratislava Towards Achieving the Concept of Smart City: Inspirations from Smart City Vienna. *Conference: Smart City 360°. 2016. Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering*. https://doi.org/10.1007/978-3-319-33681-7_72.

Asian and European citizens see their cities as the ‘smartest’, finds 2023 IMD Smart City Index. Available at: URL: https://www.imd.org/news/asian-and-european-citizens-see-their-cities-as-the-smartest-finds-2023-imd-smart-city-index/. [Accessed 10 July, 2023].

Bakici T., Almirall E. & Wareham J. (2012). A Smart City Initiative: The Case of Barcelona. *Journal of the Knowledge Economy, 4*(2). https://doi.org/10.1007/s13132-012-0084-9.

Bárta, D. (2015). Methodology of the Smart Cities Concept. Brno: Centrum dopravního výzkumu, v.v.i., 2015. Available at: URL: https://www.mmr.cz/getmedia/b6b19c98-5b08-48bd-bb99-756194f6531d/tb930mmr001_metodika-konceptu-inteligentnich-mest-2015.pdf. [Accessed 10 July, 2023].

Bárta, D. (2016). Smart Mobility. In: Smart Cities. Available at: URL: https://www.scmagazine.cz/casopis/00-16-00-16/chytra-mobilita_locale_cs/. [Accessed 10 July, 2023].

Bee Smart City (2023). Smart city preparedness: which city is ready for the future? Available at: URL: https://www.beesmart.city/. [Accessed 10 July, 2023].

Bezkhlibna, A., But, T. & Nykonenko, S. (2018). Assessment of tourism industry clustering potential. *Scientific papers of the University of Pardubice, Series D, Faculty of Economics and Administration*, 43/2018.

Brown, W., King M. & Goh, Y.M. (2020). UK smart cities present and future: An analysis of British smart cities through current and emerging technologies and practices. *Emerald Open Research*, 2(4).

Building an Information Society: Resources and Technologies: Proceedings of the XVIII International Scientific and Practical Conference, Kyiv. MON Ukrainy,UkrINTE. Kyiv: UkrINTEI. 2019. 404.

But, T., Mamotenko D., Zaytseva V., Pulina T. & Bukoros T. (2021). Business Innovation in the hotel industry. SHS Web of Conferences 100, 01017 (2021). ISCSAI 2021. https://doi.org/10.1051/shsconf/202110001017.

Cardullo, P. & Kitchin, R. (2019). Being a ‘citizen’ in the smart city: up and down the scaffold of smart citizen participation in Dublin, Ireland. *GeoJournal,* 84(4), 1–13. https://doi:10.1007/s10708-018-9845-8.

Cardullo, P. & Kitchin, R. (2019). Being a ‘citizen’ in the smart city: up and down the scaffold of smart citizen participation in Dublin, Ireland. *GeoJournal*, 84(4), 1-13. https://doi.org/10.1007/s10708-018-9845-8.

City: one. (2023). Vienna has the best sound in Europe. Available at: URL: https://www.cityone.cz/viden-ma-v-evrope-ten-nejlepsi-zvuk/t6180. [Accessed 10 July, 2023].

Cocchia, A. (2014) Smart and Digital City: A Systematic Literature Review. In: Dameri, R.P. and Rosenthal-Sabroux, C., Eds., *Smart City.* 13-43. https://doi.org/10.1007/978-3-319-06160-3_2.

Concept of Smart Prague by 2030. (2017). Management summary. Prague: Deloitte Czech Republic. Available at: URL: https://smartprague.eu/files/koncepce_smartprague.pdf. [Accessed 10 July, 2023].

Cunha, C.R., Lopes, L., & Mendonça, V. (2022). Immersive Digital Marketing for Smart Cities Focusing Tourism. *Smart Innovation, Systems and Technologies.* 279. 605-614. https://doi.org/10.1007/978-981-16-9268-0_51.

Czech Statistical Office (2023). Available at: URL: https://www.czso.cz/csu/czso/statistiky. [Accessed 10 July, 2023].

Deloitte Insights (2019). Renewables (em)power smart cities. Available at: URL: https://www2.deloitte.com/xe/en/insights/industry/power-and-utilities/smart-renewable-cities-wind-solar.html. [Accessed 10 July, 2023].

Digital agenda for Europe. Available at: URL: https://ec.europa.eu/digital-singlemarket/en/digital-agenda-europe-key-publications. [Accessed 10 July, 2023].

Esteban-Narro, R., Lo-Iacono-Ferreira, V.G., Cloquell-Ballester, V.A. & Torregrosa-López, J.I. (2022). SMART CITY project assessment models: a proposal of model structure for small cities. Proceedings from the International Congress on Project Management and Engineering. 2022 July, 457-470 *26th International Congress on Project Management and Engineering (Terrassa).*

Europe 2020 flagship initiative Innovation Union. Available at: URL: https://ec.europa.eu/research/innovation-union/pdf/innovation-unioncommunication-brochure_en.pdf. [Accessed 10 July, 2023].

Europe 2020. A European strategy for smart, sustainable and inclusive growth. Available at: URL: https://ec.europa.eu/info/index_en. [Accessed 10 July, 2023].

European commission. (2020). Europe 2020. A European strategy for smart, sustainable and inclusive growth. Available at: URL: https://ec.europa.eu/info/index_en. [Accessed 10 July, 2023].

European innovation scoreboard, 2023. Available at: URL: https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en. [Accessed 10 July, 2023].

Fact Sheets on the European Union. (2023). Digital agenda for Europe. Available at: URL: https://ec.europa.eu/digital-singlemarket/en/digital-agenda-europe-key-publications. [Accessed 10 July, 2023].

Garlík, B. (2020). From smart grids to smart buildings, cities and transport in an artificial intelligence environment. *Praha: ČVUT*.

Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovic, N., & Meijers, E. (2007). Smart cities: Ranking of European medium-sized cities. *Vídeň: Centre of Regional Science*. Available at: URL: http://www.smart-cities.eu/download/smart_cities_final_report.pdf. [Accessed 10 July, 2023].

GIST (2016). Smart Hradec Králové. Programme concept. Available at: URL: https://www.hradeckralove.org/assets/File.ashx?id_org=4687&id_dokumenty=63345. [Accessed 10 July, 2023].

GIST (2016). Smart Hradec Králové. Programme design. Hradec Králové: Magistrát města Hradec Králové, 2016. Available at: URL: https://www.cirihk.cz/files/2016_10_19/smart-city-hradec-kralove-19.10.2016a.pdf. [Accessed 10 July, 2023].

Global power city index 2019. – Institute of Urban Strategies. The Mori Memorial Foundation. Available at: URL: http://mori-mfoundation.or.jp/english/ius2/gpci2/index.shtml. [Accessed 10 July, 2023].

Graham, S. (2002). Bridging Urban Digital Divides? Urban Polarisation and Information and Communications Technologies (ICTs). *Urban Studies,* 39(1), 33-56.

Harmonisation of the digital markets in the Eastern Partnership – Study report. Project ‘Short term high quality studies to support activities under the Eastern Partnership – HiQSTEP, EuropeAid/132574/C/SER/Multi’, 2015, 389. Available at: URL: https://europa.eu/capacity4dev/hiqstep/document/harmonisation-digital-markets-easternpartnership-study-report. [Accessed 10 July, 2023].

IMD (2023). Asian and European citizens see their cities as the 'smartest', finds 2023 IMD Smart City Index. Available at: URL: https://www.imd.org/news/asian-and-european-citizens-see-their-cities-as-the-smartest-finds-2023-imd-smart-city-index/. [Accessed 10 July, 2023].

IMD Smart City Index 2023. (2023). Introduction: AMore Precise, Relevant and Impactful Smart City Index. Available at: URL: https://imd.cld.bz/IMD-Smart-City-Index-Report-20231/6/. [Accessed 10 July, 2023].

IMD. (2023). IMD Smart City Index 2023: Results. Available at: URL: https://imd.cld.bz/IMD-Smart-City-Index-Report-20231/16/. [Accessed 10 July, 2023].

KarlovyVary°. (2020). StrategyKV°2040. Available at: URL: http://www.vary2040.cz/. [Accessed 10 July, 2023].

Kasl, F. & Marek J. (2018). Legal framework of publicly initiated development of smart city. In Czech law and information technology. Czech Republic. Available at: URL: https://is.muni.cz/publication/1449017/cs. [Accessed 10 July, 2023].

Kézai, P.K. & Rámháp, S. (2022). Central and Eastern European regional centers in the focus of urban rankings and urban indexes. *Economic Annals-XXI,* 195(1-2), 26 -35. https://doi.org/10.21003/ea.V195-03.

Kitchin, R. (2023). The Promises and Perils of Smart Cities / SCL Tech Law for Everyone. Available at: URL: https://www.scl.org/articles/3385-the-promise-and-perils-of-smart-cities. [Accessed 10 July, 2023].

Kourtit, K. (2021). City intelligence for enhancing urban performance value: a conceptual study on data decomposition in smart cities. *Asia-Pacific Journal of Regional Science*, 5(1), 191-222. https://doi.org/10.1007/s41685-021-00193-9.

Kovalenko, O. General model of the electronic information environment, based on the mirror concept. *Scientific Works of Vinnytsia National Technical University.* 2019. 4. URL: https://works.vntu.edu.ua/index.php/works/article/view/549. [Accessed 10 July, 2023].

Latvian open science strategy 2021-2027. for the year. Available at: URL: https://www.izm.gov.lv/lv/latvijas-atvertas-zinatnes-strategija-2021-2027-gadam?utm_source=https%3A%2F%2Fwww.google.com%2F. [Accessed 10 July, 2023].

Laws for the people. №.561/2004 Sb. Act on pre-school, primary, secondary, higher vocational and other education (school law). Available at: URL: https://www.zakonyprolidi.cz/cs/2004-561#. [Accessed 10 July, 2023].

Mi, D. (2019). Towards sustainable urban transport in Singapore: Policy instruments and mobility trends. *Transport Policy,* 81. 320-330. https://doi.org/10.1016/j.tranpol.2018.05.005.

Mikšíkova, S., Ulčak, D. & Kuta, D. (2023). The Challenges and Barriers for Smart City Investments in the Czech Republic. *Sustainability (Switzerland),* 15(3), 2205. https://doi.org/110.1109/SCSP58044.2023.10146120.

Ministry of education youth sports (2023). Act No. 561/2004 Coll. - Act on Preschool, Primary, Secondary, Higher Vocational and Other Education; Education Act. Available at: URL: https://www.msmt.cz/vzdelavani/skolstvi-v-cr/act-no-561-2004-coll-of-24-september-2004-on-pre-school?lang=1#:~:text=This%20Act%20shall%20regulate%20pre,legal%20persons%20involved%20in%20education%2C. [Accessed 10 July, 2023].

Momot, T. & Muraev, Ye. (2021). Model of organizational and information support of smart city strategy development in the conditions of digital economy. *Innovative Technologies and Scientific Solutions for Industries*, 1(15), 83-90. https://doi.org/10.30837/ITSSI.2021.15.083.

Muraiev, J.V. (2019). Organizational and informational support for the development of a strategy for smart cities in Ukraine in the digital economy. Abstract for the cand. of ec. Sc. Kharkiv, 2021. 29.

Neumannova, M. (2022). Smart districts: new phenomenon in sustainable urban development Case Study of Špitálka in Brno, Czech Republic. *Folia Geographica*, 64(1), 27–48.

Obce v datech, (2023). We are a data partner of Czech municipalities. Available at: URL: https://www.obcevdatech.cz/en/. [Accessed 10 July, 2023].

OECD (2019). Enhancing the contribution of digitalisation to the smart cities of the future. Available at: URL: https://www.oecd.org/regional/regionaldevelopment/Smart-Cities-FINAL.pdf. [Accessed 10 July, 2023].

Operator ICT. (2017). Smart Prague concept by 2030. Praha: Deloitte Czech Republic. Available at: URL: https://smartprague.eu/files/koncepce_smartprague.pdf. [Accessed 10 July, 2023].

Pásková, M. (2014). Sustainability of tourism. *Univerzita Hradec Králové: Gaudeamus*.

Pásková, M. (2014). Tourism sustainability. Hradec Králové: *Gaudeamus*.

Pulina, T., But, T., Khrystenko, O. & Zaytseva, V. (2020). Managing the Field of Reconstruction and Preservation of Historical and Cultural Complexes in Ukraine and Europe. *Lecture Notes in Civil Engineering* 73, 709-720. https://doi.org/10.1007/978-3-030-42939-3_70.

Research and innovation. (2023). European innovation scoreboard. Available at: URL: https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en. [Accessed 10 July, 2023].

Richter, M. A., Hagenmaier, A., Bandte, O., Parida V. & Wincent J. (2022). Smart cities, urban mobility and autonomous vehicles: How different cities needs different sustainable investment strategies. *Technological Forecasting and Social Change*. 184. https://doi.org/10.1016/j.techfore.2022.121857.

Ruess, P. (2021). Smart city replication and group model building: A conceptual comparison. *IEEE European Technology and Engineering Management Summit, E-TEMS 2021 - Conference Proceedings*. 27–32. https://doi.org/10.1109/E-TEMS51171.2021.9524862.

Růžička, J., Sliacky, M., Purkrábková, Z., Hajčiarová, E. (2023). Opportunities of LoRaWAN Technology for Smart Cities-A Review. *Conference Proceedings Smart Cities Symposium Prague,* SCSP. https://doi.org/10.1109/SCSP58044.2023.10146207.

Ryabev A., Tonkoshkur M. & Kravtsova S. (2022). Smart city concept and impact on the tourism in the digital economy. *Economy and society,* 35. https://doi.org/10.32782/2524-0072/2022-35-30.

Sevcík, M., Chaloupkova, M., Zourkova, I.& Janosíkova, L. (2022). Barriers to the Implementation of Smart Projects in Rural Areas, Small Towns, and the City in Brno Metropolitan Area. *European Countryside*, 14(4), 675–695. https://doi.org/10.2478/euco-2022-0034.

Shmygol, N., Schiavone, F., Trokhymets, O., Zavgorodniy, R. & Vorfolomeiev, A. (2020). Model for assessing and implementing resource-efficient strategy of industry. *CEUR Workshop Proceedings*, 2713, 277-294.

Slavík, J. (2017). Smart city in practice: how to use modern technologies to create a liveable and business-friendly city. Praha: *Profi Press*, 2017.

Smart cities index report (2022). Urban innovation. Available at: URL: https://smartcitiesindex.org/serviceinnovation. [Accessed 10 July, 2023].

Smart city Brno (2022). Brno 2050. Available at: URL: https://brno2050.cz/wp-content/uploads/2020/09/LEAFLET-SMART-CITY-BRNO-2020-CZ.pdf. [Accessed 10 July, 2023].

Smart city BRNO (2023). Brno: statutory city of Brno, 2020. Available at: URL: https://www.brno.cz/w/statut-mesta-brna-3049. [Accessed 10 July, 2023].

Smart City Experte. (2023). Inform the population in real time. Available at: URL: https://smartcitiestech.io/2023/04/zurich-tops-2023-imd-smart-city-index/. [Accessed 10 July, 2023].

Smart City tech. (2023). Zurich Tops 2023 IMD Smart City Index. Available at: URL: https://smartcitiestech.io/2023/04/zurich-tops-2023-imd-smart-city-index/. [Accessed 10 July, 2023].

Smart City: mehr Sicherheit durch IoT Security (2023). Available at: URL: https://imd.cld.bz/IMD-Smart-City-Index-Report-20231/16/. [Accessed 10 July, 2023].

Smart infrastructure in sustainable urban development: World Experience and Prospects for Ukraine. Kyiv: "*Zapovit*", 2021. Available at: URL: http://surl.li/asdhf. [Accessed 10 July, 2023].

Štěpánek, P. (2023). The Challenges and Barriers for Smart City Investments in the Czech Republic. *Conference Proceedings Smart Cities Symposium Prague, SCSP.* https://doi.org/10.1109/SCSP58044.2023.10146120.

Storonianska, I.Z. (2020). Territorial development and regional policy. Strategizing regional development on the basis of smart specialization: a scientific report. Lviv, IRD NANU. 141.

Strategie KV 2040 (2020). Karlovy Vary: Magistrát města Karlovy Vary. Available at: URL: http://www.vary2040.cz/. [Accessed 10 July, 2023].

Šulyová, D., Kubina, M. (2022). Creating Smart, Sustainable Cities: Results from Best Practice Smart Cities and Cities in Slovakia. *SciPap*, 30(3), 1606. https://doi.org/10.46585/sp30031606.

Svoboda, M. (2023). OBEC 2030 Příklady dobré praxe. Zlín. Available at: URL: https://obec2030.cz/#praxe. [Accessed 10 July, 2023].

Tencent's "smart city" seen as model for post-coronavirus. Available at: URL: https://news.trust.org/item/20200624080235-95zxs. [Accessed 10 July, 2023].

Thompson, E.M. (2016). What makes a city 'smart'? *International Journal of Architectural Computing,* 14(4), 358-371.

Thomson Reuters Foundation. (2020). Tencent's "smart city" seen as model for post-coronavirus China. Available at: URL: https://news.trust.org/item/20200624080235-95zxs. [Accessed 10 July, 2023].

Tomtom (2023). Tomtom traffic index. Available at: URL: https://www.tomtom.com/traffic-index/ranking/. [Accessed 10 July, 2023].

UNWTO. (2023). Tourism set to return to pre-pandemic levels in some regions in 2023. Available at: URL: https://www.unwto.org/news/tourism-set-to-return-to-pre-pandemic-levels-in-some-regions-in-2023. [Accessed 10 July, 2023].

Vershitsky, A., Egorova, M., Platonova, S., Berezniak, I. & Zatsarinnaya, E. (2021). Municipal infrastructure management using smart city technologies. *Theoretical and Empirical Researches in Urban Management,* 16(1), 20–39.

Wong A.C.W. &. So, A.T.P. (1997). Building automation in the 21st century. *Proc. 4th Int. Conf. Adv. Power Syst. Control Oper. Manage*. (APSCOM), I(2). 819-824, 1997.

Zelenka, J. (2012). Information and Communication Technology-perpetuum mobile tourism. *Czech Journal of Tourism,* 1(1), 5-17.

Zelenka, J., & Kysela, J. (2013). Information and communication technologies in tourism. Univerzita Hradec Králové*:* Gaudeamus*.*

Zelenka, J., Pechanec, V., Bureš, V., Čech, P., & Ponce, D. (2008). E-tourism in tourism. Praha: MMR.

Zelenka, J., Těšitel, J., Pásková, M., & Kušová, D. (2013). Sustainable tourism - tourism management in protected areas. Univerzita Hradec Králové: Gaudeamus.