

# Governing Geospatial Aspects of Smart Destination Development – The Case of Novi Sad, Serbia

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## KEYWORDS

geospatial aspects  
smart tourism  
smart tourism destination  
smart projects  
destination governance  
Novi Sad

## ABSTRACT

The development of smart cities and destinations heavily relies on geospatial technologies and intelligence. Geospatial aspects encompass location-based data and tools and are of significant importance in governing smart tourism destinations. This paper investigates the geospatial elements involved in the development of smart tourism destinations, by analyzing smart projects implemented in Novi Sad, Serbia. The theoretical framework draws upon the fields of geoinformatics, urban planning, and smart city development. Research conducted in Novi Sad reveals that the majority of smart initiatives, solutions, projects, and practices are geospatially oriented. To enhance the governing of smart cities, the paper introduces a comprehensive and adaptable catalogue of smart projects, which is easily navigable and comprehensible.

## Introduction

Smart destination development involves using technology and data to improve the sustainability, efficiency, and overall quality of tourism destinations (Cimbaljević et al., 2019; Gretzel & Stankov, 2021). Geospatial aspects refer to the location-based data and tools that can be used to inform and guide this development. Governing geospatial aspects of smart destination development refers to the policies, strategies, and decision-making processes that are used to guide the use of geospatial data and tools in the development of tourism destinations. This can include the development of regulations and standards for the collection and use of geospatial data, the establishment of public-private partnerships to support the implementation of smart destination initiatives, and the creation of governance structures to ensure that geospatial data is used ethically and responsibly. (Radojević et al., 2020). Some specific examples of how geospatial data can be used in smart

destination development include using location-based data to optimize transportation systems and reduce congestion in popular tourist areas, mapping tourist flows to identify areas of high and low traffic and to better understand visitor behaviour, using geospatial analysis to identify areas of natural or cultural significance that should be protected from over-tourism or development and creating virtual maps and immersive experiences to help visitors navigate and explore a destination. Overall, the governing of geospatial aspects of smart destination development is an important consideration for destination managers and policymakers who want to leverage technology and data to create sustainable, resilient, and attractive tourism destinations.

This research harbors multiple objectives. First and foremost, it aims to construct a comprehensive catalog of smart initiatives in Novi Sad, categorizing them for facile

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doi: 10.5937/gp27-44121

Received: April 22, 2023 | Revised: August 09, 2023 | Accepted: September 12, 2023

analysis and practical application. The study encompasses an overview of smart projects, their organization, the identification of key participants, and the most frequently employed geospatial technologies. Additionally, the researchers aim to demonstrate the prevalence of smart, geospatially oriented projects that collect, process, and display data with geospatial and temporal references. Organizing a catalogue of geospatially oriented smart pro-

jects for smart tourism destinations requires a focus on location-based data and tools, as well as an understanding of the specific needs and goals of the users who will be accessing the catalogue. The case study in Novi Sad forms an extensive catalogue of smart projects, and based on the analysis of geospatial aspects, conclusions are drawn, proposals for implementation are given, and guidelines for future research are derived.

## Theoretical background

The theoretical background of the geospatial aspect of governing smart destinations draws from a range of fields (Vujičić et al., 2020), including geoinformatics, urban planning, and smart city development, starting from the assumption that for smart tourism destinations and smart cities geospatial aspects, technologies, and geospatial concepts, especially positioning, geographic information systems, and geospatial data infrastructure, are an indispensable framework and that they play a very important role in the construction, use, and management of smart destinations and smart places in general (Li et al., 2013). Geospatial information sciences play a key role in providing the basis of the theoretical frame-

work and practical actions for the collection, processing, analysis, and presentation of data (Gruen, 2013). On the other hand, theorists of geospatial sciences (Gruen, 2013; Roche, 2014; Tao, 2013) claim that smart destinations must be geospatially enabled, open and accessible, and possess geospatial intelligence to create a geospatially aware and intelligent society, most often urban, so they provide a theoretical framework in their research and provide a series of practical procedures for building smart destinations, based on the mass use and ubiquity of ICT technologies and the collection, processing, analysis and transformation and use of huge amounts of data everywhere and at all times.

## Geospatial aspect of smart destinations

Geospatial technologies assume a pivotal role within the realm of smart destinations and cities, encompassing a diverse array of roles. They proficiently gather and amalgamate georeferenced data sourced from satellites, sensors, and devices, culminating in the creation of digital maps while furnishing predictive instruments indispensable for the strategic blueprinting of a sustainable smart urban milieu (Mete, 2023). This orchestration is further enriched by the utilization of Geographic Information Systems (GIS), allowing for the multi-layered analysis of data and thereby facilitating judicious resource allocation and informed urban design decisions (Liu et al., 2023; Mortaheb & Jankowski, 2023). Through the synchronization of temporal referencing and real-time monitoring via sensors and GPS, these technologies not only expedite responses to emergent situations but also engender an elevated urban quality of life. Moreover, the strategic deployment of these technologies fosters a heightened level of citizen involvement, exemplified through interactive maps and applications that cultivate collaboration within the urban planning domain. In the context of smart destinations, these geospatial tools extend their influence to augmenting tourist experiences in terms of smart navigation, location-based recommendations, virtual and augmented reality tours, real-time event and crowd management, smart

transportation, emergency management, sustainable development planning and tourist analytics and promotion (Cimbaljević et al., 2023; Yang et al., 2023). There is a parallel between smart cities and smart tourism destinations because a large number of researchers believe that smart tourism destinations are created as a consequence of the implementation of smart city dimensions at the destination (Buhalis & Amaranggana, 2013; 2015). As cities are geospatial entities, geography in general, and geospatial technologies in particular, play a major role in enabling the concept of a smart city. (Percivall et al., 2015). A smart city has various properties from a geospatial point of view, which includes seamless integration with digital cities, sensor networks, and self-networking and self-maintenance capabilities. However, digital cities, smart cities, and smart tourism destinations are not separate but can be seen as integrated and merged as one entity that could be called a smart location or smart place (Li et al., 2013). Gruen (Gruen, 2013) points out that if we understand geomatics as the science of collecting, modelling, analyzing, and presenting geospatially referenced data, it integrates geodesy, geodetic measurement, photogrammetry and remote sensing, cartography, and geoinformatics as key disciplines. Williamson (Williamson et al., 2010) responds to this point of view with the thesis that throughout history

geospatial information was mostly an exclusive technology for surveyors, cartographers, and later GIS professionals. Today, geospatial information is increasingly being used ubiquitously and transparently by governments and the wider society in most activities and business processes (Kranjac et al., 2019; Marković et al., 2013). Applications in tourism, especially at the destination, can be just the icing on the cake of the use and influence of geospatial information and the global transformation of paper maps into the digital world. Similar experiences are pouring in from countries around the world where governments, economies, and wider society are becoming geospatially enabled. Geospatial information and geospatial technologies are very important for providing a technological platform that forms the backbone of smart cities and smart tourism destinations (Gruen, 2013).

Li and associates (Li et al., 2013) consider geospatial technologies as auxiliary techniques in the construction of smart cities. He states that the smart city (smart place) model is based on 2D (two dimensions) digital maps and 3D digital city models, 4D geospatial-temporal databases, and points of interest (Li & Shao, 2009). Positioning and guidance are of irreplaceable importance for all smart places, smart tourism destinations, and smart cities, because they involve locating and tracking.

He sees positioning and navigation primarily through GPS technology, and sees it as sensory, as data acquisition devices that can be an integral part of the Internet of Things. Li (Li et al., 2013) points out that based on the integrated positioning of the global positioning system, accurate information about environmental locations can be obtained for analysis for further environmental preservation. Location and navigation are among the first functions where GPS helps urban dwellers and visitors to get the right directions (Tao, 2013). Indoor positioning system (IPS) and navigation based on it have a significant application in tourism in spaces such as museums, galleries, etc. Indoor positioning is also considered to be important for tourism and Li (Li et al., 2013) lists the main methods that can be used for indoor positioning. Tourist movement networks through the creation of a virtual model can be very useful for the management of the tourist destination and as an aid in the promotion of new products and services to tourists following their affinities and wishes. By analyzing the model, the manifestation of the movement of tourists can be seen. Conclusions of this type are particularly adequate for big data that can be passively generated by smartphones by tourists within a smart destination. Also, it is possible to include spatial and temporal determinants for data as well as tourist experience in movement patterns (Baggio & Scaglione, 2017). Integrating video with GIS can be a very useful tech-

nology. In traditional urban systems, the content of video surveillance footage is displayed on multiple screens, and operators visually identify people for whom there is some kind of suspicion. This way of functioning, of course, cannot predict criminal events, and the processing of a large number of video archives significantly slows down investigative activities. Smart places alternatively offer more efficient data collection from video material. It is possible to effectively spot objects, identify and track people, analyze flows, and recognize individual movements and gestures, all in the fight against crime (Li et al., 2013). Street images, such as Google StreetView, have gained immense popularity as they are used in the model generation process. Images generated by highly professional mapping systems on mobile devices or by tourists or residents are now available to millions of people online. However, the accuracy and completeness of the results are still problematic, which should be the subject of further research (Gruen, 2013). Drone footage has been getting a lot of attention lately. A large amount of visually appealing footage of various locations has been created, but there are still problems affecting their production and their significance. When creating these recordings, they have the possibility of temporal and geospatial referencing, so further development of this geospatial technology can be expected in the future (Stankov et al., 2019).

Remote sensors and smart infrastructure can generate large amounts of data that need to be processed and analyzed to be useful for tourists. Geospatial, temporal, and contextual information are critical components of this analysis, as they help to provide location-based and time-based context to the data. This contextual information can help to improve the relevance and accuracy of the data, making it more useful for tourists who are seeking specific information or experiences. In addition, data processing and analysis can help to identify patterns and trends in the data, which can inform destination management and policy-making decisions (Radojević et al., 2020). Tourists need to assess the effects of the information they use and develop the ability to respond appropriately to broader circumstances. (Batty et al., 2012). To tackle the modern challenges posed by smart technologies, both citizens and tourists need to develop a solid understanding of geospatial concepts. (Roche, 2014). Future technologies or techniques that currently exist but need to be further developed could be an integration of video and GIS, integration of space, air, and ground sensors and GIS, indoor and underground navigation, Ubiquitous Sensing via smartphones, Volunteered Geographic Information (VGI), geospatial-temporal data mining, integration of geospatial services and artificial intelligence, virtual and augmented reality, etc. (Li et al., 2013).

## Smart tourism destination governance

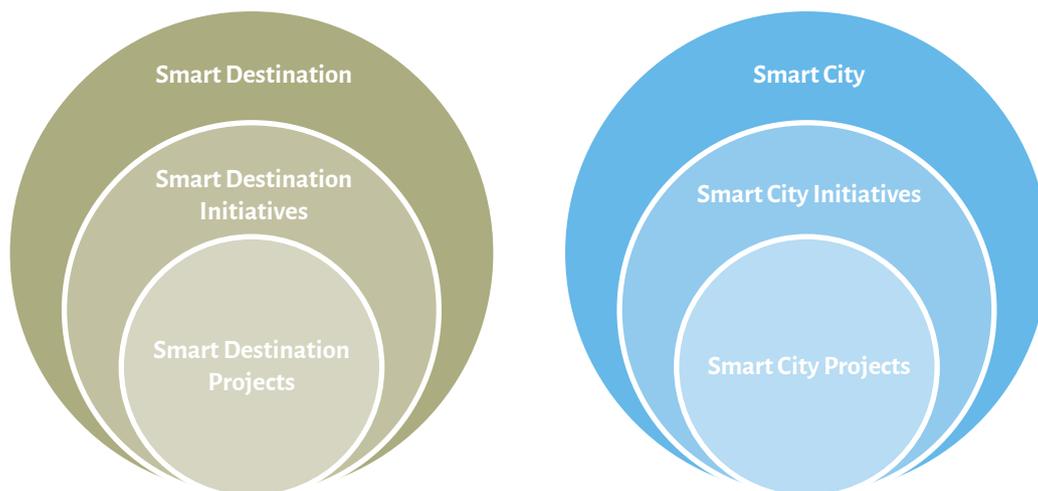
Smart tourism destination governance refers to how smart tourism destinations are managed and governed. It involves the coordination and cooperation between different stakeholders, such as government agencies, tourism industry organizations, and local communities, to develop and implement strategies that leverage technology and data to create more sustainable, efficient, and enjoyable visitor experiences. Geospatial understanding of smart tourism destination requirements from geospatial-temporal data can greatly improve management decisions, destination planning, destination marketing, and environmental protection, all of which are necessary to balance the experiences of tourists and residents at a destination (Supak et al., 2015; Stankov et al., 2022). The complexity of political, social, and economic processes and decision-making requires precise, reliable, real, and largely complete data. Most of this data is geospatially oriented (Dragović et al., 2019; Gruen, 2013). Local authorities and

businesses can use geospatial approaches to define the demand market and demographic profile of their customers, enabling smarter data-driven decision-making (Supak et al., 2015). In addition to the fact that at the global level countries and cities are facing very serious challenges of new technologies and new standards and great efforts in building new achievements and capacities, nevertheless, there is a general agreement that the benefits of investing in geospatial enablement are multiple and that the efforts in this direction more than justified (Williamson et al., 2010). A comprehensive effort needs to be made to provide a clearer view of the design choices of smart city strategies, where geospatial referencing can play a fundamental role (Angelidou, 2014). Making this data available using geospatial technologies can help improve a destination’s tourist experience and accessibility and improve overall support for tourists and residents in a smart destination (Coca-Stefaniak, 2020).

## Methodology

Although a smart tourism destination should be viewed holistically, we can see that the whole of smart layers within a smart tourism destination, in addition to being divided into smart destination dimensions, can also be divided into specific implementations within those dimensions or a part or whole smart destinations into complete structure entities of smart initiatives, solutions, projects, and practices (Boes et al., 2015). Smart cities base their growth on smart initiatives and smart projects (Manville et al., 2014), similarly smart initiatives, projects, and practices are crucial for smart tourism destinations, as shown in Figure 1.

Research in Novi Sad was carried out in the digital archives of institutions, local government, and public companies, also the websites of the city administration and city institutions, strategic documents, budget documents, and public studies prepared by the City of Novi Sad were searched. Then The compendium of best practices, which was created as a result of the competition for the prestigious title of the European capital of smart tourism, was processed (European Commission, 2019). The next important source of data on smart projects was the media archive of the Naslovi net portal (Naslovi.net),



**Figure 1.** Fundamental relations between smart tourism destinations and smart initiatives, projects, and practices, are similar to the relationship between projects, initiatives, and cities

Source: Manville et al., 2014

whose search yielded information on a significant number of smart projects. At the same time, the portal is an aggregator and search engine of news in Serbian, which creates a unique cross-section of over 120 media sources, covering almost the entire media and information space of Serbia (Naslovi net, 2020). The previous three years, namely 2018, 2019, and 2020, were searched in the archives of the Naslovi net portal using the adjective 'smart' as a keyword, and also Google's service for downloading mobile applications Google Play with the keywords 'Novi Sad' and 'smart'.

When evaluating and classifying smart projects, special attention is paid to their geospatial aspects. The first thing, that needed to be defined, was the spatial coverage of the project itself. Next, is the project geospatially oriented? Is there a possibility or is it necessary to geospatially enable the project itself (Roche, 2014)? Which layer of the urban information model do these smart projects belong

to (Harrison & Donnelly, 2011)? What are the types of primary and secondary data related to a smart project? What is the number of georeferenced data? What geodata topic does smart project data belong to? What level of geospatial literacy (Tao, 2013) corresponds to a smart project? Are basic geospatial data services used to find, view, download, transform, service call service, or perhaps additional geospatial data services: interaction, information management, work process management, spatial processing, thematic processing, temporal processing, metadata processing, and geospatial communication?

In the opinion of the authors of this article, 40 researched smart projects is a large enough number of projects that can provide, bearing in mind the limited possibilities of the physical scale of the research, a satisfactory volume and variety of collected data on the characteristics of smart projects to make relevant considerations and conclusions.

## Case area

Novi Sad is located in the north of the Republic of Serbia as the administrative and economic centre of the Autonomous Province of Vojvodina. It lies on the banks of the Danube within the Pannonian plain. The wider area of Novi Sad has approximately half a million inhabitants. The city has a developed urban and tourist infrastructure,

a highly educated workforce and a relatively efficient communal services system, and a high level of culture of living (Cimbaljević et al., 2021). The research covers the territory of the local self-government unit that extends within the municipality of Novi Sad.

## Catalogue

The research of smart projects in Novi Sad aimed to create an original classification in the form of a catalogue, that is, the form of a database of characteristics that would be the basis for analysis and conclusions, but would also have practical value and applicability as a

cross-section of the situation in Novi Sad. To translate the catalogue of projects into a table for machine calculation and achieve uniformity, a form was created to collect data on the characteristics of smart initiatives, projects, and practices.

## Results

Based on the research of smart initiatives, solutions, projects, and practices in Novi Sad, a catalogue of Novi Sad smart projects was created, and after that, a database with the characteristics of smart projects was formed. Among the researched smart projects were a bike-sharing system, public city transport on internet maps, air quality monitoring, smart city cards, smart parking, smart benches and trees, tourist mobile apps, etc. The dominant providers of Novi Sad's smart projects are the local government and public companies, while private companies lag behind them. Almost all researched smart projects are applicable in Novi Sad, except for a small number such as smart taxi transport, for the implementation of which there are legal

restrictions. According to the layers of the urban information model (Harrison & Donnelly, 2011), the most frequent are infrastructure and service projects. Some solutions are of high quality, and networking and sensors are used, but not artificial intelligence.

Among the 40 scrutinized smart projects, 21 employ networking, while sensors find application in 12, with potential integration in an additional 4 projects. Although artificial intelligence remains untapped, prospective integration for specific functions exists in 9 projects. Regrettably, the majority of Novi Sad's smart initiatives lack the incorporation of proven technologies in their execution. A noticeable dearth of artificial intelligence and cloud com-

**Table 1.** Smart initiatives, projects, and practices observed during research in Novi Sad.

Nº	The name of the smart project	Nº	The name of the smart project
1.	Bicycle counting stations	21.	Smart environmental activism
2.	Bike sharing system	22.	Smart garbage bins
3.	Children tourist guides	23.	Smart cultural district
4.	E-government	24.	A smart reporting system
5.	eTourist system	25.	Smart taxi transport
6.	Information about the accessibility	26.	Smart parking
7.	Public city transport on Internet maps	27.	Smart public lighting management
8.	Combining transportation	28.	Smart waste management
9.	Communication with Chinese tourists	29.	Smart traffic
10.	Vehicle access control	30.	Personal city assistants
11.	Local quality labels	31.	Geospatial data portal
12.	Local currency	32.	Open data portal
13.	Murals - open-air gallery	33.	Accessibility to the beach
14.	Air quality monitoring	34.	Accessibility for all
15.	Smart bus stops	35.	Electric car chargers
16.	Smart fortress	36.	Automated recycling machines
17.	Smart street	37.	A radar speed signs
18.	Smart city cards	38.	Tourist mobile apps
19.	Smart benches and trees	39.	Carbon neutrality
20.	Smart telephone booths	40.	WiFi for all

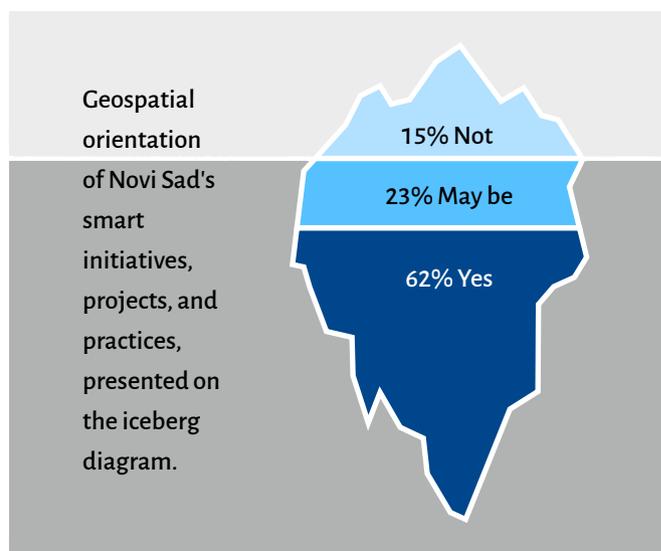
puting is evident, hinting that the city’s smart projects may not fully realize their potential for innovation and efficiency.

During the assessment and categorization of smart projects, special emphasis is placed on their geospatial dimensions. The initial consideration involves defining the project’s spatial scope, followed by an evaluation of its geospatial alignment. Additionally, the inquiry delves into the urban information model layer that these smart projects align with, as outlined by Harrison and Donnelly (2011). Examination encompasses primary and secondary data types associated with each smart project, along with quantifying the extent of georeferenced data. The investigation also identifies the geodata topic underpinning the smart project data, while establishing the corresponding level of geospatial literacy according to Tao’s classification (Tao, 2013). The geospatial orientation of smart projects is perhaps the most significant feature on which data was collected for Novi Sad smart projects. There is a possibility or it is necessary to geospatially enable smart projects in Novi Sad (Roche, 2014).

Based on the data from the formed database of characteristics, 62% of smart projects are geospatially oriented, collect, process, and display geospatial data (geospatially and temporally referenced) and use geospatial technologies, most often GIS and GPS, while 23% of projects, there

is the possibility of introducing geospatial elements and technology, which can be seen in the iceberg diagram on Figure 2.

About half of smart projects use, or can use, time referenced data. 7 researched smart projects do not operate with user data at all. That’s almost three-quarters of projects that base their functioning on point geospatial data,



**Figure 2.** Geospatial orientation of Novi Sad smart initiatives, projects, and practices, presented on an iceberg diagram

and the data itself is almost equally often predominantly single, sets or databases. The predominant geometry of geospatial Novi Sad smart projects are points, and the data is placed in georeferenced databases. The most common geospatial services are services for finding and viewing data. Additional geodata services are less frequently represented, so that 22 projects do not use additional services. According to geospatial thematic categories, the

most represented projects are in the category of society. For smart projects in Novi Sad, there is still plenty of room for progress on the scale of geospatial literacy. Geospatial literacy grows during the progress of development phases in cities and smart destinations, while among Novi Sad smart projects, the most represented with 85% are projects that possess the 2nd level of geospatial literacy (Tao, 2013), electronic maps, 2D geodatabases, and GIS.

## Theoretical contribution

Although geospatial aspects are not in the foreground when considering the concept of smart tourist destinations, nevertheless, there is a considerable amount of research that supports the claim and forms a theoretical framework that geospatial aspects are important for smart tourist destinations. Geospatial technologies, as one of the ICTs, are crucial for providing a technological basis, a platform that forms the backbone of a smart environment of smart tourism destinations.

Most technologies for smart cities and smart tourist destinations are geospatially oriented, so smart cities and smart tourist destinations have a significant need for a geospatial approach in the process of planning, implementation, development, and management. Geospatial enablement, accessibility, openness, and literacy increase the quality of life of residents and the competitiveness of a smart tourist destination.

Geospatial technologies are key to providing a technological platform that forms the backbone of smart cities and smart tourism destinations. Positioning and guid-

ance are of irreplaceable importance for all smart places, smart tourism destinations, and smart cities, as they involve locating and tracking. The smart city and smart place model is based on 2D digital maps and 3D digital city models, 4D geospatial-temporal databases, and points of interest. The integration of global positioning system (GPS) technology can provide accurate information about environmental locations for analysis for further environmental preservation. Indoor positioning system (IPS) and navigation based on it have a significant application in tourism in spaces such as museums, galleries, etc. Furthermore, integrating video with GIS can be a very useful technology in the fight against crime. The text highlights that remote sensors and smart infrastructure can generate large amounts of data that need to be processed and analyzed, and geospatial, temporal, and contextual information are critical components of this analysis. Therefore, geospatial technologies and information play a crucial role in enabling smart cities and smart tourism destinations.

## Practical recommendations

Geospatial elements and georeferences are an integral part of analyses, plans, and reports of cities around the world and these documents clearly show that the need for geospatial analysis, research, and geospatial approach, methods, and tools is increasing (Stankov et al., 2012; 2016). On the other hand, geospatial aspects are rarely mentioned in expert and government reports concerning smart cities and smart tourism destinations.

GIS systems can serve as centralized information systems or platforms that integrate all aspects of the process in smart tourism destinations that want to be truly smart, including stakeholders, technologies, standards, and data, and can also integrate videos and visualize large data sets (Filimonau et al., 2022). For the planning and management of smart tourism destinations,

it is necessary to use a wide range of modern technologies, among which geospatial technologies and data are a specially important factor. Contextually adapted geospatial services can be especially important (Radojević et al., 2020).

The City of Novi Sad has great opportunities for the implementation of smart initiatives, solutions, projects, and practices that can have a tourist application (Pavlučković et al., 2020; Radojević, 2021). Judging by current practice, Novi Sad is moving faster towards a functional smart city than towards a smart tourism destination, which does not mean that it will reach that goal sooner. In any case, it would be useful for the City of Novi Sad to create its official and publicly available cadastre or catalogue of smart initiatives, projects, and practices.

## Limitation and Further research

The basic limitation of this article, which concerns the number and completeness of data of the researched smart projects in Novi Sad could be overcome when the City of Novi Sad creates its official catalogue of smart initiatives, projects, and practices.

The direction of further research could be aimed at building a conceptual model that would alleviate the problem of collecting and scaling all types of data collected through smart city infrastructure at smart tourism desti-

nations, which could be used to optimize services and increase competitiveness. Also, very significant future research could take into consideration the technological progress and development of the latest information-communication and geospatial technologies.

Regarding the territory where smart initiatives, solutions, projects, and practices were implemented, future research could include some other cities with a larger number of inhabitants or certain entire countries.

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