Reinventing tourism cities: Examining technologies, applications, and city branding in leading smart cities

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Abstract

Cities have become engines of economic development. Numerous cities have positively affected the living conditions of residents and visitors by using technological and innovative service delivery tools called *smart city technologies and applications*. These technologies and applications can be seen at government and private buildings, city facilities, information and communication technology infrastructure, and personal services. They have a net-positive impact on the environment and natural resources by reducing harmful emissions and the excessive and unnecessary use of energy, water, gas, public and private transport vehicles, and more. Cities have used these technologies and applications to brand themselves as having efficient, sustainable, and powerful economies, security, tidiness, planning of urban facilities, enhanced civic imagery, and a high quality of life. This branding, in turn, makes a city more attractive to target audiences. In this paper, smart city technologies and applications in the world's leading smart cities were examined. Thereafter, common and city-specific applications were listed. Finally, suggestions were put forward for tourism cities to realize sustainable economic development by means of tourism and become attractive destinations for existing and prospective visitors.

Keywords: tourism city, destination city, city branding, smart city, smart city application, smart destination

Introduction

Researchers have been addressing the question of how to sustain urban growth and development for decades (Caragliu, Del Bo, & Nijkamp, 2009). One of the most reasonable answers can be a city's attractivity, which makes people happy. New technologies and tools have also become a

current issue for cities as they strive to produce effective ideas for improving the quality of life in their production, consumption, security, information, logistics, and so on.

This study contributes to the development of tourism cities through smart city technologies and applications which make the cities livable, secure, healthy, more experience-oriented, workable, and preferable for both visitors and residents. This study contributes to the current smart city technologies and applications discussion by itemizing the technologies and applications with the aim of developing efficient, manageable, sustainable, attractive, unique, and competitive tourism city or destination city brands.

After the industrial revolution turned cities into engines of economic growth, complex, dynamic, and intense economic activities have lowered living conditions for many residents in the cities. From that point of view, achieving socio-economic and sustainable prosperity without negatively affecting quality of life has been expected from residents of these cities. This is also important today as cities utilize tourism to help develop city economies. Consequently, using technological and innovative service delivery tools and efforts like sensors, big data, Internet of Things (IoT), artificial intelligence (AI), GPS tracking, augmented reality (AR), virtual reality (VR), and mobile applications can be seen as a reasonable way to develop city economies by tourism. Lehr (2018) identifies these tools and efforts as smart city technologies and applications.

As residents experience the greater use of smart city technologies and applications, new advantages and opportunities emerge for the microeconomic actors of city economics. Smart city technologies and applications have contributed to the economic development of cities by increasing efficiency and helping to properly allocate limited resources for production (e.g., labor, capital, natural resources, and entrepreneurship) thereby increasing quality of life for residents, visitors, and other inhabitants. These technologies and applications have a net-positive impact on the environment by saving energy, water, and gas; and reducing harmful emissions by encouraging use of environmentally-friendly transportation methods and vehicles like cycling and hybrid or electric vehicles. For a city's branding efforts, an efficient, productive, sustainable, and powerful city economy, security, degree of tidiness, and planning of urban facilities, and enhanced civic imagery have made cities more attractive to its target audience (e.g., tourists, visitors, skilled people, new investors, and new university students.)

Literature Review

Smart City Concept

As world-wide attention toward the *smart city* concept has increases over the past two decades, it has emerged as an important strategic issue for many city planners. A smart city emphasizes the increasing importance of information and communication technologies (ICTs) into a common framework, which also encompasses the issues facing modern urban development. A smart city also addresses *quality of life* by profiling city competitiveness based on social and environmental capital (Caragliu et al., 2009).

Juniper Research, a UK-based market research firm, conducted a study to determine the smartest cities in the world (Buntz, 2016). The findings from their report, titled *World's 5 Smartest Cities*, indicated the following cities at the top of their list:

1. Singapore
2. Barcelona
3. London
4. San Francisco
5. Oslo

The researchers at Juniper arrived at this conclusion by ranking cities on an array of factors such as the adoption of smart grid technologies, the use of intelligent lighting, the availability of city apps, the use of information technology to improve traffic, the convenience of Wi-Fi access points, and smartphone integration throughout the city (Buntz, 2016). The study also reviewed software applications including traffic apps and city information apps which leverage open data sources. They applied higher-weighted values to transport and energy, determing them as the most important elements in smart cities. To evaluate transportation, the researchers considered public transportation options, subtracting points for cities with high levels of private vehicle ownership. To evaluate the efforts to improve traffic, they assessed the efforts of city planners to curb congestion changes, implement dynamic traffic lights, utilize road sensors and smart parking. Finally, regarding energy consumption, the analysts looked at policies the cities were taking, specifically the city's smart grid, smart meter rollout, and which policies the local government had made for sourcing sustainable energy (Buntz, 2016).

In 2017, a German consultancy, Roland Berger, published research that examined the smart strategies of 87 cities around the globe. This study focused primarily on cities from Europe and Africa with regional centers ranging from less than half a million to megacities of more than 20 million. They examined the official smart city strategies and other strategic policies to discover how these cities were approaching this construct. The research revealed that most smart city strategies still have room for improvement; even as more and more cities are taking a strategic approach to becoming a smart city. Often, the cities lacked connected, end-to-end thinking. According to Roland Berger (2017), an ideal smart city strategy covers six interrelated action fields, comprising a host of subcategories and solutions: (a) government, (b) buildings, (c) health, (d) mobility, (e) education, and (f) energy and environment. The Smart City Strategy Index developed by Roland Berger (2017) contains three dimensions: (a) action fields, (b) strategic planning, and (c) IT infrastructure. See Table 1 for their listing of the world's 15 smartest cities in 2017.

Table 1. Roland Berger's (2017) Ranking of the 15 Smartest Cities in the World for 2017

1. Vienna (Austria)	6. New York (USA)	11. Hong Kong (China)
2. Chicago (USA)	7. Paramatta (Australia)	12. Tokyo (Japan)
3. **Singapore**	8. Seoul (South Korea)	13. Bristol (UK)
4. **London** (UK)	9. **Barcelona** (Spain)	14. Rio de Janeiro (Brazil)
5. Santander (Spain)	10. Denver (USA)	15. Seattle (UK)

Source: Adapted from Roland Berger (2017)
Note: Citiefs n bold coincide with the ranking reported by Juniper Research, as reported in Buntz (2016)

Also, in 2017 and under the direction of professors Pascual Berrone and Joan Enric Ricart, the Institute of Higher Business Studies (IESE Business School) Center for Globalization and Strategy published the fourth edition of the Cities in Motion Index. Berrone and Ricart (2017) compiled the indexby analyzing 79 indicators across 10 different dimensions of urban life: (a) economy, (b) technology, (c) human capital, (d) social cohesion, (e) international outreach, (f) environment, (g)

mobility and transportation, (h) urban planning, (i) public administration, and (j) governance. Findings showed that European and North American cities led nearly every dimension measured. One exception was technology, where Taipei reigned (IESE Business School, 2017). See Table 2 for their 2017 rankings of the 20 smartest cities in the world

Table 2. Berrone and Ricart's (2017) Ranking of the 20 Smartest Cities in the World

1. New York City (USA)	6. Washington D.C. (USA)	11. Toronto (Canada)	16. Sydney (Australia)
2. London (UK)	**7. Seoul (South Korea)**	**12. Chicago (USA)**	17. Geneva(Switzerland)
3. Paris (France)	**8. Tokyo (Japan)**	13. Zurich (Switzerland)	18. Los Angeles (USA)
4. Boston (USA)	9. Berlin (Germany)	14. Melbourne (Australia)	19. Munich (Germany)
5. San Francisco (USA	**10. Amsterdam (Netherlands)**	**15. Vienna (Austria)**	20. Baltimore (USA)

Source: Adapted from Berrone and Ricart (2017)
Note: Cities in bold coincide with Table 5.

Although the findings indicate several significant commonalities (e.g., Singapore, London, Barcelona, New York, London, Paris, Seoul, Tokyo, Amsterdam, Chicago, and Vienna) from all the studies reviewed, confusion remains regarding a common operational definition of the smart city concept.

Accordingly, smart city can be defined as a city where innovation in technology, telecommunication, networking, computation, sustainability and ecological design come together and create a responsible, intuitive, social, high quality, clean, and advanced experience for its citizens and visitors while establishing a wise management of natural resources (Abdoullaev, 2011; Colldahl, Sonya, & Kelemen, 2013; Couzineau-Zegwaard, Barabel, & Meier, 2013; Merli & Bonollo, 2014; Nijman, 2011; Vaquero & Saiz-Alvarez, 2016). The concept of a smart city often highlights the advantages of generating greater economic, energy, governance, and mobility efficiency. However, *knowledge cities* build on this concept by putting human beings explicitly at their center, and focusing on greater inclusion, pluralism, participation, education, diversity, creativity, and human well-being (Broadband Commission for Sustainable Development, 2016).

In this respect, a smart city is not simply a *wired city* (Paskaleva, 2011) or a technologically well-appointed *geek*. Progressive smart cities must start with people (human capital) rather than solely relying on IT automatically to transform and improve cities (Hollands, 2008). Paquet (2001) and Hollands (2008) agreed that the most important consideration to determine the success of a city remains the citizens of the city and their interactions with each other. From this point of view, smart cities can be progressive because they use digital technologies not to hardwire themselves but to be socially-inclusive, foster good governance, and create better services, which improve the quality of life for its citizens while keeping an outlook on long-term sustainability and competitiveness (Paskaleva, 2011). Of course, improving the quality of life serves both visitors and tourists alike.

A smart city has learned to integrate IoT, AI, machine learning, information and ICTs, and engineering technologies to make the life of its citizens more practical, manageable, easier, and smarter. A smart city maintains a network of interconnected sensors that collect data for the benefit of its residents. This includes automating municipal processes and services, automating entire infrastructures (transportation, parking, street lighting, water, energy, waste management, etc.) and using the data to solve, control, and prevent issuesthat impede upon the citizens' quality of life. The smartness of the city depends on smart city technologies such as the quantity and quality of

sensors and analysts, and other technologies that process the massive volumes of live data provided by the sensors (Skelia, 2017). Developing smart tourism city or destination city requires that all these criteria be taken into consideration.

Smart City Technologies

The smart city application requires candidate cities to interact with various technological networks and devices. A smart city applicant may send data over public networks such as the Internet, cellular networks, networks that belong to different providers, or self-organized wireless sensor networks. The devices used in these networks vary (e.g., a large cloud and network server, customer equipment, and small sensor nodes; Krimmling & Peter, 2014). These technologies continue to develop into next-generation wireless technologies such as Li-Fi, 5G, LoRa and Network Slicing (Carritech Telecommunications, 2017). Table 3 identifies various smart city technologies that comply with current expectations for smart city applicants.

Table 3. Examples of Smart City Technologies

Smart City Technologies		
3D Geo-locating	data centers	IoP (Internet of People)
3G	data management systems	IoS (Internet of Services)
4G	data visualisation	IoT (Internet of Things)
5G	digital fabrication	Li-Fi (LED)
advanced analytics	digital modeling	LoRa (IoT Network Platform)
artificial intelligence (AI)	disruptive technologies	network infrastructure
augmented reality (AR)	distributed architectures	network slicing
big data	drones	open data access
blockchain data bases	geoinformation	robotics
business Intelligence	global positioning data (GPS) track	sensors and connectivity
Cameras	global positioning data (GPS)tTracking	service integration
city platform	hardware development	smart card
cloud (city platform)	ICTs	smartphone penetration
collaboration technologies (NGOs, municipalities, universities, developers, citizens, etc.)	information technology	software development
computer networking	infrastructure development	telecommunications
crowdsourcing technologies	Internet (e.g., high speed, broadband)	virtual reality (VR)
Dashboards	interoperability	Wi-Fi access points

Smart City Applications and Action Areas

A smart city is expected to perform smart applications and solutions (Benli & Gezer, 2016; Kinnear, 2016; Lewis, 2016; Roland Berger, 2017; Skelia, 2017; SmartAppCity, 2017; Smart City Expo World Congress, 2017). Smart city applications utilize various action fields (topics, characteristics, or areas) and key dimensions related to the resources being assessed. Table 4 provides a comparison of the various labels used by the four reports previously discussed.

Table 4. Comparison of Action Areas Utilized in Recently Published Smart City Applications

Descriptor	6 Characteristics	10 Key Dimensions	6 Action Fields	8 Topics
Key Dimensions	• economy (competitiveness) • people (social and human capital) • governance (participation) • mobility (transport and ICT) • environmental (natural resources) • living (quality of life)	• human capital • social cohesion • economy • public management • governance • environment • mobility and transportation • urban planning • international outreach • technology	• government • buildings • health • mobility • education • energy and environment	• governance • mobility • safe cities • economy • sustainability • circular economy • society • data and technology
Source	Adapted from Giffinger et al. (2007)	Adapted from Berrone and Ricart (2017)	Adapted from Roland Berger (2017)	Adapted from Smart City Expo World Congress (2017)

Smart City and Tourism: Smart Tourism City, Destination City, or Smart Destination

Reasons for the increasingly frantic pace of life for most citizens vary. They could include economic necessity, routine responsibilities, or a personal drive to improve one's quality of life. Similarly, a city which actively seeks to increase the number of tourists who visit each year needs to make smart decisions to support the incoming (and existing) population. Cities that have successfully integrated the requirements of the smart city application have positively affected tourist services, tourist mobility, touristic shopping, safety and security of all inhabitants, and quality of life for everyone involved. Simultaneously, these smart cities facilitate improved access to miscellaneous daily necessities of everyone in the cities. However, special precautions still need to be taken, particularly in those cities currently most visited. Managing both predictable and unpredictable situations (e.g., natural hazards, terror attacks, accidents, traffic jams, etc.) is imperative.

Cities that intend to maintain economic development through tourism have benefited from planning and managing the city based on practical practices that have been applied by world cities demonstrating both smart city qualities and touristic qualities. Table 1, Table 2, and Table 3 presented lists of smart cities around the world—with slight variations in methodology. Table 5 presents a similar listing of cities around the world, but this list is based specifically on touristic qualities. Hedrick-Wong and Choong (2016) reported on the world's most visited cities and published their findings in Mastercard's *Destination Cities Index Report–2016*. Cities listed on both the top global destination cities and the smartest cities are bolded for easy identification.

Table 5. Top 20 Global Destination Cities by International Overnight Visitors-2016

Destination City (Overnight Visitors)			
1. Bangkok (21.47 mn)	**6. Singapore (12.11 mn)**	**11. Hong Kong (8.37 mn)**	16. Rome (7.12 mn)
2. London (19.88 mn)	7. Kuala Lumpur (12.02 mn)	**12. Barcelona (8.20 mn)**	17. Osaka (7.02 mn)
3. Paris (18.03 mn)	8. Istanbul (11.95 mn)	**13. Amsterdam (8.00 mn)**	**18. Vienna (6.69 mn)**
4. Dubai (15.27 mn)	**9. Tokyo (11.70 mn)**	14. Milan (7.65 mn)	19. Shanghai (6.12 mn)
5. New York (12.75 mn)	**10. Seoul (10.20 mn)**	15. Taipei (7.35 mn)	20. Prague (5.81 mn)

Source: Adapted from Hedrick-Wong and Choong (2016)

Methodology

Sample

A pragmatic method was adopted to determine which smart city applications should be used in leading tourism cities. Consequently, the Destination Cities Index by Mastercard Report-2016, prepared by Hedrick-Wong and Choong, best aligns with this way of thinking. To determine the leading smart tourism cities among world's most visited cities, the Global Destination Cities Index by Mastercard research report was utilized. This research report published the 20 most visited world cities. We then compared these cities against various lists of the world's smartest cities. Those reports included Roland Berger's (2017) Smart city, smart strategy; Juniper Research's World's 5 smartest cities list shared by Buntz (2016); and IESE Cities in Motion Index 2017 report prepared by Berrone and Ricart (2017) from IESE Business School.

Table 6. Comparison of Smart Cities With Desitination Cities in Visitor Numbers, Smartness, and City Branding

Destination City Ranking: Overnight Visitors (million)	Destination City Ranking: Smartness	Destination City Ranking: Best City Brands
1. Bangkok (21.47)	**1. Vienna**	**1. London**
2. London (19.88)	2. Chicago	**2. Singapore**
3. Paris (18.03)	**3. Singapore**	**3. New York**
4. Dubai (15.27)	**4. London**	**4. Paris**
5. New York (12.75)	5. Santander	5. Sidney
6. Singapore (12.11)	**6. New York**	**6. Amsterdam**
7. Kuala Lumpur (12.02)	7. Paramatta	7. Los Angeles
8. Istanbul (11.95)	**8. Seoul**	**8. Tokyo**
9. Tokyo (11.70)	**9. Barcelona**	9. San Francisco
10. Seoul (10.20)	10. Denver	10.Toronto
11. Hong Kong (8.37)	**11. Hong Kong**	11.Melbourne
12. Barcelona (8.20)	**12. Tokyo**	12. Madrid
13. Amsterdam (8.00)	13. Bristol	13. Berlin
14. Milan (7.65)	14. Rio de Janeiro	14. San Diego
15. Taipei (7.35)	15. Seattle	15. Moscow
16. Rome (7.12)	**16. Paris**	16. Munich
17. Osaka (7.02)	**17. Amsterdam**	**17. Vienna**
18. Vienna (6.69)		**32. Barcelona**
19. Shanghai (6.12)		**34. Hong Kong**
20. Prague (5.81)		**42. Seoul**

After comparing the list of the 20 most visited cities (see Table 5) as determined by Mastercard's Global Destination Cities Index report with the lists from the following three reports: (a) the 20 smartest cities, published by Juniper Research World's 5 Smartest Cities (Buntz, 2016); (b) Roland Berger's (2017) Smart ity, Smart Strategy report; and (c) IESE Business School's (2017) Cities in Motion Index-2017, we determined 10 cities to identify as *the most visited smart cities*. These cities are bolded in Table 6 and are presented here in appropriate ranking order:

1. London   6. Seoul
2. Paris   7. Hong Kong
3. New YorkCity   8. Barcelona
4. Singapore   9. Amsterdam
5. Tokyo   10. Vienna

Comparing the ranking of these cities in the 2017 World's Best City Brands list by the Resonance Consultancy (2017) as shown in the third column of Table 6, we found that higher levels of smartness results in increasing numbers of tourists attracted and higher levels of branding.

Data Collection

Data for the study was retrieved by analyzing secondary data sources. Smart city applications used in the sample cities were listed. In the data collection phase, qualitative research methods were used. Datawas collected by using content analysis. The research question was employed to derive data systematically from related materials. Tables were used to specify contents in clusters.

Data Source

Journal articles, websites, books, and secondary statistics about sample cities (e.g., London, Paris, New York, Singapore, Tokyo, Seoul, Hong Kong, Barcelona, Amsterdam, and Vienna) were used as data sources for this research.

Empirical Model

This is an exploratory study. In the study, a *scanning model* within the qualitative analysis was the preferred tool. With qualitative analysis, contents related to *smart city applications* were retrieved from the materials. Afterwards, *tourism-related practices* and *city branding related practices* were analyzed. The following research question was utilized to retrieve needed data systematically:

- Which smart city applications are utilized in the city destination specific to tourism and city branding?

Findings

In this section, world's leading smart cities listed in the Data Source section were examined against the aspects present in the smart city applications. Common and city-specific applications were listed. This section also discusses the use of smart city applications for tourism and city branding aspects.

After studying *Smart City Applications and Action Areas* in relation to tourism and city branding, five action areas can be characterized. They are as follows:

- governance
- mobility
- quality of public sphere
- sustainable environment and resources
- developing entrepreneurship and international economy

Tourists and visitors travel to a destination city for leisure, business, or vacation purposes. When they visit a destination city, they experience at least the following aspects: (a) safety and security, (b) dining, (c) shopping, (d) lodging, and (e) a transport service or public transportation. Moreover, when people travel, they expect their experiences to be both flawless and tailormade. As a result,

cities that apply technology to simplify services and connect people with their passion points can become true destination cities and realize the benefits of increased visitors and greater income (Menendez, 2017). In this context, smart applications facilitate and enable the delivery of specific aspects of tourism services (e.g., safety and security, dining, shopping, lodging, and public transportation).

Table 7. Action Areas for Smart Tourism Cities

Governance	Political strategies and perspectives, destination management, building awareness, education-lifelong learning, participation in decision-making, public and social services, city promotion, e-government, transparency, effectiveness, quality, and sound guidance of state intervention, city-to-city cooperation, public-public cooperation, cooperation platforms, open data, open innovation, service integration, tax policy, new management, and organization models.
Mobility	Local accessibility; (inter)national accessibility; availability of ICT-infrastructure; sustainable, innovative, and safe transport systems; facilitating movement through cities and access to public services; road and route infrastructure; the vehicle fleet, public transportation, metro, cycling, air transportation, externalities both need to commute; and because of the need for an outlet for production, intelligent traffic management systems; smart services for public transport; smart urban logistics; electric vehicle; freight; logistics optimization; integration platforms; mobility as a service; non-motorized mobility; parking; pedestrian strategy; policy framework; real-time data; shared transportation; transport hubs; transportation networks; connected and self-driving vehicles; intelligent transport systems; multimodal transport system; and walkable sustainable urban mobility.
Quality of Public Sphere	Individual safety and security, residents support, diversity, women rights, care for elderly people, immigrants, peace, social cohesion, health and hygiene, accommodation quality, cultural facilities, sub-structure, super-structure, city cosmetics, natural hazards management plans, emergency action plans, cybersecurity, disaster recovery, and touristic attractivity.
Sustainable Environment and Resources	Attractivity of natural conditions; environmental protection against environment, water, and air pollution; sustainable resource management; recycling; smart grid; smart lighting; water and waste management; green building; smart building; housing; alternative energy production and zero waste.
Developing Entrepreneurship and International Economy	Innovative spirit, entrepreneurship, economic image and trademarks, productivity, flexibility of labour market, international embeddedness, ability to transform, promoting economic development of a territory, local economic development plans, transition plans, cluster generation, innovation, new business model, cooperation model, financing, investing, public procurement, user value, public value, shared value, sharing economy, social economy, startup, public-private-people partnership, securing a privileged place in the world, maintaining global impact involvingimprovement of the city brand, international recognition through strategic tourism plans, attracting of foreign investment, representation abroad, building, and putting forward the differences.

City branding is defined as the use of marketing communications tools and, when applied, serves to enhance the quality of life, giving the city uniqueness in the minds of residents, tourists, travelers, and businesses. By utilising city branding practices, a city enhances the quality of life and spreads information about its unique values, motto, theme, plot, feeling, tone, mission, current culture, vision, and any of its other tangible and intangible qualities to its target audiences by

collaborating with its stakeholders. Branding itself helps a destination city to compete in the global tourism market in attracting the people who want to live, visit, and work there. In this context, smart applications to facilitate or enable delivering the city branding functions (e.g., enhancing the quality of life and spreading information about its unique values, motto, plot, mission, current culture, vision, and its other qualities) are useful.

Smart city applications used in sample smart tourism cities are listed below. Smart city applications are marked with (T) if related to *tourism*; as (B) if related to *city branding*, and as (T&B) if it is related to both tourism and city branding.

Governance

- (B) digital public administration, including monitoring stream of data about city (Amsterdam, Vienna)
- (B) real-time decision-making systems (Barcelona, Vienna)
- (B) participatory governance; citizen participation (Vienna)
- (T&B) e-services (Vienna)
- (B) urban education platforms
- (B) digital learning formats (Vienna)
- (B) developing digital skills to eliminate young unemployment (e.g., Tech City Stars-London, Vienna)

Mobility

- (T&B) Smart traffic (congestion) monitoring systems (Amsterdam)
- (T&B) Real-time traffic and route management by means of social media (e.g., London, Amsterdam)
- (T&B) Smart traffic lights (optimized green light usage-Barcelona, Amsterdam)
- (T&B) Smart/Mobile/Contactless payment systems (e.g., Oystercard-London, Barcelona, Vienna)
- (T&B) Smart Bus stop
- (B) Smart EV Charging Station for Car (Amsterdam, Barcelona)
- (T) Transport Info/Journey Planning (Amsterdam)
- (T&B) Smart and efficient services for public transport (BusGuru-London, Barcelona, Vienna)
- (T&B) Transport/Ride/City Bike-sharing programs (Bike Like a Local-Amsterdam, Vienna)
- (T&B) Smart parking (e.g., Streetline, ParkMe-Amsterdam)
- (T) City Street Guide

Quality of Public Sphere

- (B) Integrated health information systems (Vienna)
- (T&B) Ambient assisted living (Vienna)
- (B) Broadband for all citizens
- (T&B) Real-time information, news (Amsterdam, Vienna)

- (T) Reservation and e-Administration
- (T&B) Dynamic Kiosks (e.g., UrbanFlow-Helsinki, Vienna)
- (T&B) Touchscreens
- (T&B) Wi-Fi spot on bus stop (Amsterdam, New York)
- (T&B) Aging infrastructure (Vienna)
- (T&B) Improving the urban experience for local residents and travelers (Appening-Amsterdam, Vienna)
- (T&B) Smart water dispenser (for people, dogs, cats, birds)
- (T) Online Tourist Info
- (T&B) Smart Museums and Parks (e.g., SF Rec and Park, Amsterdam)
- (B) Shared Decision-Making-Collaboration (e.g., Civocracy-Amsterdam)
- (T&B) Crisis response system (e.g., crime, storm, terrorist attack etc.)
- (T&B) Speed-sensitive Smart road blocker (for terrorist attacks)
- (B) Lisence plate recognition systems (determining stolen cars and garage entrance as well)
- (T) Security for people (e.g., Powow, Drive Carefully-Amsterdam, Vienna)
- (T) Security for Things (FindMyBicycle-Amsterdam)
- (T) Smart Neighbourhood Safety (Buur-Amsterdam, Vienna)
- (T) Real-time Suggestions (Amsterdam)

Sustainable Environment and Resources

- (B) Solar and wind energy production and sharing (Vienna)
- (B) Stand-by Energy Saving (Crownstone-Amsterdam, Vienna)
- (B) Smart distribution grids (Amsterdam, Vienna)
- (T) Smart street lighting (Barcelona, Amsterdam, Vienna)
- (T) Highlighting Sites (Vienna, New York)
- (B) Smart electric metering (Amsterdam, Vienna)
- (T) Charging Bench/station (e.g., solar-powered Strawberry Tree-Serbia; SolaRoad, Steroa-Amsterdam, Vienna)
- (B) Smart water demand management (Amsterdam, Newyork, Vienna)
- (B) Smart water metering (Amsterdam, Vienna)
- (B) Electronic water payment systems (Amsterdam)
- (B) Water recycling system (Vienna)
- (B) Smart bin/rubbish Collection (e.g., Enevo, ECUBELabs, Barcelona, Vienna)
- (B) Smart waste management (Amsterdam, Vienna)
- (B) Smart sewage management (New York, Vienna)
- (B) Solid waste decomposition and recycling (e.g., London, Amsterdam, Vienna)
- (B) Smart irrigation for city landscaping (Amsterdam, Vienna)
- (T&B) Earthquake warning system
- (T&B) Noise monitoring (e.g., VisorAcustic)
- (B) Pollution measuring (e.g., TZOA, Amsterdam, Vienna)
- (T&B) Climate monitoring (e.g., Everimpact for greenhouse emission, Amsterdam, Vienna)

- (B) Connected facility management (Amsterdam, Vienna)
- (T) Smart home (Amsterdam)
- (T&B) Smart and green construction (Amsterdam, Vienna)
- (B) Gallery for city infrastructure services (Barcelona, Vienna)
- (T&B) Street cooling with big pipes (Masdar)

Developing Entrepreneurship and International Economy

- (B) Geoposition and publishing usage for trade
- (B) Business Intelligence (Monitor, analyze and interpret users' behaviors)
- (T&B) Shopping/Dailly Deals
- (T&B) Events
- (B) Effective usage of city production resources (Vienna)
- (B) Encouraging Innovations (Vienna)

Conclusions

This section summarizes the outcome of the research regarding its aim and identifies strategic tools and efforts in developing smart tourism and destination cities that are sustainable, manageable, privileged, competitive, socially-inclusive, and more tourist and visitor experience-oriented.

In summary, a destination city needs to offer safety and security, dining, shopping, lodging, and public transportation services in a seamless manner from the standpoint of tourism. Particularly, safety and security issues are becoming much more essential for city planners. Recent terrorist attacks in major destination cities spotlight the need to develop and apply new smart city applications.

In addition, a destination city needs to consider city branding that intends to be different from its rivals. These destination cities must also be able to enhance the quality of life for all inhabitants and dissiminate information about its unique values, motto, theme, plot, feeling tone, mission, current culture, vision, and any other tangible and intangible qualities to its target audiences by collaborating with its stakeholders. City branding is a multifaceted responsibility. highlighted by Table 6, which indicates the relationship between the smartness level of the city, the tourist numbers attracted to the city, and the brand ranking for a city. By accomplishing these goals, a city can benefit considerably from smart city applications.

Important issues to consider also emerged from the paper. Principally, the smartness of the city relies primarily on collaboration between the city's residents, authorities, and infrastructure management (Skelia, 2017). Awareness, education, and long-term oriented thinking also are also crucial in implementing smart city technologies and applications in collaboration with city stakeholders.

Smart city applications based on disruptive technologies are quickly evolving. These technologies can change the practices of destination cities, producing entirely new products and services.

The mayors or the city officials of the destination cities should (a) keep their organizational strategies updated in the face of continuously-evolving technologies, (b) ensure that their

organizations continue to look ahead, and (c) use technologies to improve internal performance. In this regard, these cities are advised to employ a Chief Digital Officer (CDO), as Roland Berger (2017) had previously proposed. The CDO would be responsible for the implementation, direction, and operation of not only IT issues within the city, but also the smart city applications.

In choosing and using smart city technologies and applications, those mayors or city officials need to plan immensely complicated scenarios against competition and risks that the city might face. Cities also need to keep their stakeholders' abilities up to date, ensuring they remain informed of current benefits of technologies.

Advanced technologies like the IoT can improve infrastructure management, and visitors and tourists will benefit from this improved infrastructure. Functional, aesthetic, and promoted city components help build powerful, attractive, and bright city brands for people who want to visit, live, and work in the destination city.

Because of time constraints, this research is based on secondary data resources and the published reports of the 10 most visited cities. Some practical smart city applications are listed in the Findings section, clustered in action areas related to tourism and city branding. Using primary data resources and enlarging the sample size woud create the opportunity to obtain more prosperous current and potential practices, as well as ideas that lead to smart city applications forging the way of reinventing tourism and destination cities.

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