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A Technology-Based Innovation Adoption and Implementation Analysis of European Smart Tourism Projects: Towards a Smart Actionable Classification Model (SACM)

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Abstract: Similar to the concept of "Smart Cities", "Smart Tourism" has undoubtedly become a promising field of research, and "the" buzzword in the last five years. But how much of this is "smart washing", and how much progress has really been made? We focus on the adoption and implementation of technological innovations to analyze the publicly available descriptions of Smart Tourism projects implemented in Europe according to the stringent technological criteria of contemporary Smart Tourism definitions. The results show that the vast majority of projects branded as "smart" predominantly pursue environmental sustainability goals, but do not feature advanced technology that meets the Smart Actionable attribute criteria, and do not address social sustainability issues to the same extent as the environmental ones.

Keywords: Smart Tourism; Smart Cities; taxonomy; Smart Tourism projects; sustainability; innovation; technology; Europe; Smart Actionable Classification Model; SACM

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Citation: Križaj, D.; Bratec, M.; Kopić, P.; Rogelja, T. A Technology-Based Innovation Adoption and Implementation Analysis of European Smart Tourism Projects: Towards a Smart Actionable Classification Model (SACM). *Sustainability* **2021**, *13*, 10279. https://doi.org/10.3390/su131810279

Academic Editor: J. Andres Coca-Stefaniak

Received: 7 August 2021
Accepted: 3 September 2021
Published: 14 September 2021

1. Introduction

Smart Tourism followed in the footsteps of the earlier concept of sustainable tourism and quickly established itself as the reference adjective when discussing tourism in politics, economics, and academia. In the latter, the debate has been lively, and although there are many different conceptualizations, academics seem to agree that Smart Tourism is based on the use of novel technologies that improve the quality of visitor and local experiences, while enabling destinations to take steps towards achieving their sustainability goals. However, as it happened in the past with the term "sustainable", the adjective "smart" seems to be heavily misused when describing the various transformations that tourist destinations and cities are currently facing. Mostly, it dominates the marketing discourse, with many destinations trying to use this "smart" concept because it gives them a competitive advantage over other tourist destinations based on uniqueness and differentiation [1].

However, the reality of developing smart solutions within these destinations is mostly still in its infancy [2]. Therefore, with a somewhat skeptical academic spirit rooted in the innovation adoption perspective [3–5], the plan for this paper emerged out of the following research questions:

1. What is really being adopted in tourism destinations that call themselves smart?
2. Do most of the projects that are branded as smart have the content that qualifies them as smart, or are we talking about a "large proportion of false smart positives"?

More specifically, we, in detail, analyze:

(a) What is the real content of the Smart Tourism projects currently implemented within Europe and supported by substantial EU (European Union) funding?
(b) What are the characteristics of the Smart Projects and what kind of technology solutions are used in them?

(c) Can we really see the rapid technological progress in tourism services that the marketers of Smart Destinations promise?
(d) What do the currently implemented projects tell us about the future of Smart Tourism and Smart Destinations?

2. Theory

The term Smart Tourism has recently gained prominence, especially as a strategic tool for sustainable tourism development. For example, under the general framework of Smart City initiatives, the European Commission [6] has identified travel information and communication as one of the strategic objectives to improve human mobility and transportation [7]. According to Buhalis and Amarangganna [8], tourism destinations following the Smart Tourism developing concept take advantage of:

1. Environments embedded in technology.
2. Responsive processes at micro and macro levels.
3. End-user devices at multiple touchpoints.
4. Engaged stakeholders dynamically using the platform as a neural system.

The ultimate goal is to use the system to enhance the tourism experience and increase the effectiveness of resource management to maximize both destination competitiveness and consumer satisfaction while demonstrating sustainability over time. Buhalis and Amarangganna [8] further elaborate that creating Smart Tourism Destinations from scratch requires a leader who engages constructively with locals to ensure community participation and also to monitor the plan regularly. To achieve this, destinations must undertake open access through integrated, publicly controlled operating systems to provide unrestricted data to all citizens and avoid provider monopolies [9]. Xiang, Tussayadiah, and Buhalis [10] assert that Smart Tourism Destinations in general have emerged from the concept of Smart City. This postulates a new urban development strategy based on the use of information and communications technologies (ICTs) in diverse key areas such as economy, environment, mobility, and governance as a tool to transform urban infrastructure and services [11,12].

Lopez de Avila [13] further defines the Smart Tourism Destination as an innovative destination built on infrastructure with cutting-edge technology that ensures sustainable development of tourism areas, facilitates visitor interaction with, and integration into, their environment, enhances the quality of the destination experience, and improves the quality of life of residents. Boes, Buhalis, and Inversini [14] (p. 110) suggest that:

> "(. . .) *based on Smart Cities research and methodology, a Smart Tourism Destination successfully implements smartness fostered by open innovation, supported by investment in human and social capital, and sustained by participatory governance to develop the collective competitiveness of tourism destinations to improve social, economic and environmental well-being for all stakeholders. Interoperability and ubiquitous computing ensure that everyone is connected and processes are integrated to create value through dynamic co-creation, sustainable resources and dynamic personalization and adaptation to the context. All providers and intermediaries, the public sector, and consumers and various interested parties are interconnected and dynamically co-create value for everyone connected in the ecosystem*."

From a slightly different perspective, Xiang and Fesenmaier [15] claim that recent technological advances such as cloud computing, widespread use of sensors and Global Positioning System (GPS), virtual and augmented reality (VR and AR), and the full adoption of social media and mobile technologies have driven the emergence of smartness in tourism. Therefore, the conceptualization of destinations has evolved, and the Smart Tourism Destination has positioned itself as an adaptation of the concept of destination to the revolution of the latest ICTs [16] and has emerged as a new type of destination management approach [17].

In such a management approach, several expectations exist, namely in use of (a) mobile technologies [7], (b) data sharing for personalized experiences [8,18], and (c) smart technologies for enhanced experiences [19,20]. However, recent empirical research [21] looking at Smart Tourism Destinations also adds a more critical note to the understanding of the concept in practice, highlighting the existence of a gap between the theoretical expectations of Smart Tourism Destinations, the hype generated, and the real response of the tourism demand and supply. The tone of the research and its importance is often overly optimistic in asserting its potential [22]. However, this is understandable as, not so long ago, there was a perception that technology was undermining tourism planning and management efforts, and now Smart Tourism is finally providing an opportunity for tourism managers to sit down with city planners and allow them to attract investment in tourism infrastructure [23]. Given its novelty as a concept, which has been met with an extremely positive response from policymakers, it is also understandable that most of the work to date has been devoted to developing the concept further, with less emphasis on its empirical testing, even more so in a European context [24].

In its idea, Smart Tourism aims to develop information and communication infrastructures and capabilities to improve management/administration, facilitate service/product innovation, enhance the tourism experience, and ultimately increase the competitiveness of tourism businesses and destinations [25–27]. According to Gretzel [28], Smart Tourism can be divided into the following "key components": (a) effective use of advanced technology, (b) mobility/accessibility, (c) sustainability, and (d) knowledge development/innovation.

Ultimately, Gretzel's and Jamal's recent publication [23] further points to the role of governance, which should be able to ensure that Smart Tourism initiatives pursue the kind of tourism that primarily seeks long-term sustainability as the core of its strategic thinking, including the wellbeing of the destination's residents [29]. Boes, Buhalis, and Inversini [14] seem to agree with this when they discuss the notion of smartness in the context of implementing ICT to improve processes while focusing on the social challenges imposed by urbanism [30]. This focus on the implication of cutting-edge technology for the amelioration of current global societal challenges that collectively create economic, sociocultural, and environmental prosperity, coupled with shared political values for the multitude of stakeholders involved [31], links Smart Tourism to the concept of social innovation in tourism. This can be defined as the driver for linking destination communities with businesses, with the aim of creating economic benefits and livelihoods to meet social needs and achieve economic sustainability through business models that create value for customers by sharing knowledge and intellectual property in a kind of broader stakeholder collaboration that extends across the destination [32]. Based on the above, it seems clear that proper Smart Tourism projects must have advanced technology at their core, while at the same time having sustainable development goals as their main objective, and thus can set important new boundaries and approaches in the field of social innovation.

It seems clear that Smart Tourism can be addressed from two very different perspectives, the information technology (IT)/operational one, when it comes to its development and the provision of a system of technological solutions [33], and the dominant marketing perspective, which seeks to demonstrate the benefits of its development and focuses on the positive impact it could have on the tourism of the future for various stakeholders involved. An orientation that has been lacking to date, and which demonstrates the potential to bring the two perspectives somewhat closer together, is the one espoused by innovation management [22]. Williams et al. [22] claim that the body of knowledge of innovation management could overcome some of the implementation difficulties of Smart Tourism initiatives in practice, while Buonincontri and Mircera [34] state the importance of the innovation approach to deploy the technology for the enhancement of experiences within Smart Destinations. Of course, there are many facets of Smart Tourism research, as it is a rather interdisciplinary field of research at the intersection of urban planning, tourism, informatics, and sustainable development. Due to this diversity, definitions are still vague, and diverse streams exist, postulating different contents. The relatively recent literature review, the first of its kind, conducted by Mehraliyev, Choi, and Koseoglu [35], shows that the most prominent topics addressed within Smart Tourism are conceptual or case study-based Smart Tourism Destination studies, with the management of innovation, technology, and information at the core of the field. Two other categories worth mentioning are studies linking Smart Tourism to regional development and sustainability, and studies aiming to link Smart Tourism Destinations to issues of travel planning systems in Smart Cities [36,37]. While tourism remains slow in terms of the intensity of innovative behavior of its businesses [38], it may prove beneficial to understand the progress made by Smart City projects that actually require broader stakeholder collaboration involving many more innovation-minded technology providers. Viewing Smart Tourism through the prism of social innovation [39] could help determine whether Smart Tourism is at the stage where it is recognized as a trend, or whether it has also reached the second stage where it is also being implemented [40,41] in the form of using technology in a smart, actionable way [42,43].

While the academic literature seems to be dominated by conceptualizations, and only recently has made progress in terms of development of proper Smart Tourism indicator systems [44], the professional literature is dominated by dubious lists and indices of Smart Cities and Smart Tourism Destinations that attempt to develop various systems of rankings based on complex sets of quantitative indicators [45–47], or focus on highlighting examples of best practice projects and solutions without clearly stating the criteria for their selection, as in the case of the European Capital from Smart Tourism initiative. While such lists help to identify cities and destinations pioneering smart transitions, it is difficult to judge between the pure marketing appeal of appearing on such a list for a city and the consistent strategic orientation of the destination's departments public relations to appear on such lists as part of their promotional activities, or their actual systemic and strategic orientation towards the development of integral Smart Tourism solutions. The question therefore arises as to what the actual content of Smart Tourism projects is and whether we need either (1) a redefinition of the "smart" term, or (2) a classification of different types of actionable "smartness" in terms of their stage of innovation (i.e., smartness merely as a perceived trend or already implemented through implementable smart technology) in the context of the growing Smart Tourism phenomenon.

The calls for a better conceptualization of Smart Tourism are also evident and necessary from the literature [19,23], as "an imprecise understanding of Smart Tourism as a development tool (both in conceptual and practical terms) can lead to ambiguity in its use in tourism strategies for destinations" [22] (p. 8). Due to the ambiguity mentioned above, the concept of Smart Tourism risks becoming a policy buzzword [44,48], similar to the use of the term Smart Projects in the broader and more established Smart City literature. In a recent study by Perboli and Rosano [49], a fundamental problem identified is the lack of a structured and repeatable method by recognized bodies for categorizing Smart City projects and collecting related information on outcomes and lessons learned. In developing the taxonomy to overcome such difficulties in the evaluation of Smart City projects, Perboli and Rosano [49] identify the following obstacles:

- A variety of different objectives in projects due to the different stakeholders and political forces involved.
- Focus on immediate sensationalism and marketing appeal, rather than long-term strategic development orientation as a result of the private actors involved seeking immediate return on investment (ROI).
- Technology focus in the development phase that falls short when it comes to proper plans for deploying the innovation and concrete business plans and test preparations for real-life launches after the pilot phase is over.

Inspired by their claims, we postulate that the lack of transparency about what qualifies as smart among tourism projects is even more significant than within the general Smart City taxonomy. Therefore, borrowing and adapting the approach of Perboli and Rosano [49,50], in order to move the research beyond its conceptual nature/focus, we set out to conduct a content analysis of tourism projects in European cities. Our aim is to understand which tourism projects with which key "ingredients" are currently implemented in reality and promoted as smart, in order to ultimately assess whether Smart Tourism is currently the perceived, or rather also implemented, trend within European efforts for innovation and digital transformation of the sector.

3. Methodology

To the best of our knowledge, no elaborate classification studies have been conducted in the field of Smart Tourism projects or initiatives, so questions remain as to how much successful operationalization of technological, *sustainable and socially aware* innovation can truly be found within the field. Most of the current body of knowledge focuses on defining conceptual models or frameworks, theorizing, and discussing various Smart City projects, strategies, and initiatives, and usually does not engage in a distinctive content analysis of what Smart Tourism projects actually adopt, implement, and achieve. Examples of such work include an inventory of Smart City initiatives [51], the application of text network analysis in exploring key drivers of Smart City practices [52], and conducting semi-structured interviews with experts working on European Smart City projects [53].

Other empirical case studies, mainly from the broader field of Smart Cities and not directly from Smart Tourism, focus on the differences between the theoretical vision and the empirical implementation of Smart Cities, the definition of prioritization of smart initiatives based on qualitative data analysis [54], or purely examining differences in understanding of the Smart City phenomenon between municipalities using a quantitative survey to create a typology of different Smart City understandings [55]. More in-depth, complex, or statistical analyses can be found in (a) the exploration of strategic principles that cities should consider in order to successfully design and implement Smart City development strategies [56], (b) in exploring principal component analysis of indicators to evaluate the Smart City development model [57], or (c) capturing individual and multiple opinions of decision-makers using surveys to evaluate Smart City projects using zSlice type-2 fuzzy sets [58].

An insightful approach to the classification of Smart City projects was carried out by Perboli et al. [59]. The aim of their taxonomic classification was to provide an overview of the content of Smart City initiatives. At the same time, they set out to better understand the success factors of past projects, extract and analyze new trends, and give an idea of the potential impact of each project. To create their taxonomy, the authors used several criteria that attempt to capture different aspects of the Smart City concept. The criteria were then grouped into categories and each category was assigned to one of three axes: *Description*, *Business Model*, and *Purpose*, which were used for various multidimensional aggregations.

The *Description* axis identifies the project's context, and it is composed of four categories: objectives, tools, project initiator, and stakeholders. The first category, "objectives", consists of major fields of activity in relation to the term "Smart City": *water, e-governance, buildings, CO_2 emissions, energy, security, social innovation,* and *transportation.* Secondly, "tools", or, as renamed in their later study, "key enabling technologies" [49], are intelligently implemented new technologies which are the most widely used tools for achieving Smart City objectives: *cloud computing, database, decision support systems (DSS), ICT, innovative sensors, legal and financial tools, other new technologies, portable smart devices,* and *smart grids*.

In the third category, "project initiator", Smart City projects are initiated and promoted by both the government and the private sector, or they are implemented in a mixed management between private and public entities. In the fourth category, Perboli et al. [59] identified five important "stakeholders": the city—as almost always an active member, the government—a public institution may be involved in problem analysis and promoting the implementation of promising solutions, small and medium-sized enterprises (SMEs)—interested in improving their efficiency and gaining a competitive advantage over rivals, universities—to develop and create innovative tools and ideas, and consumers/citizens—who may be directly involved in the testing procedures or indirectly involved in the project as end-users of the project product or service [59].

As mentioned, the concept of Smart Tourism emerged from the concept of Smart City [11,12], with [10] highlighting that a Smart Tourism Destination successfully implements smartness based on Smart Cities research and methodologies. Furthermore, the concept of Smart Cities supported the application of ICT in the context of urbanization. The massive growth of cities and the complexity of managing systemwide digitization have made technology essential for both competitiveness and the growth, efficiency, and prosperity of dense urban environments. In the concept of Smart Tourism (where the city as a unit of observation is replaced by a tourism destination), technologies remain at the core of Buhalis' [60] definition of smart systems in tourism:

> *"Smart systems use a wide range of networks, connected devices, sensors and algorithms for big data delivery across the Internet of Things."*

This definition became the technology categorization backbone of our Smart Tourism projects study to identify if, and how, technology was integrated in a smart actionable way [42,43] via these **Smart Actionable** attributes: (1) **networked/connected devices** and applications, (2) coordinated by **intelligent algorithms**, (3) based on collected and analyzed information at a **Big Data** level.

Our research objective was to take a rough sounding and find out what is being carried out in European cities in the area of practical implementation of Smart Tourism projects. The projects had to be labeled as tourism projects, already implemented within the last 5 years, or still taking place in 2020. Data collection took place over the period of 4 months from July to October 2020 in three phases.

For the initial search, the Google search engine was used to query the online presence of relevant projects. We considered either the various lists of Smart Cities in the world that are limited to Europe (e.g., Statista) or cities that tend to call themselves Smart Destinations. We used basic keyword phrases that referred to Smart City, Smart Tourism, and Smart Destination projects and the respective cities (e.g., "Smart City project in Barcelona", "Smart Destination project in Barcelona", "Smart Tourism project in Barcelona", "EU Smart City projects"). Second, we conducted a thorough review of the main national, municipal, and city websites of the proclaimed Smart Cities that could reveal specific strategic guidelines, policies, and outcomes of Smart City development programs. Third, we reviewed the Community Research and Development Information Service (CORDIS) and Keep.eu project databases to expand the list of possible project outcomes using the same search terms as in the first phase. Based on the above, we came across 352 potentially relevant projects.

The selection criteria for including the projects in the further study were as follows:

1. The online description must contain sufficient information for further analysis of the observed project attributes: funding, duration, partners, goals, achievements, ICT and Smart Actionable types, location, agents and technologies used.
2. Projects that develop or distribute only a single app or device (or several, but not connected into a coherent system) were not considered.

The second criterion turned out to be the decisive one. According to Buhalis [60], smartness uses the interconnectivity and interoperability of integrated technologies to redesign processes and data to produce innovative services, products, and processes with the goal of maximizing value for all stakeholders. Based on this selective filter, the final list of projects shrank to just 35. The results suggest that the vast majority of projects currently being promoted as smart do not meet the Smart Actionable attributes criteria, which emphasize "integrated and actionable smartness". We believe this is a strong preliminary finding that is worth highlighting, and confirms the notion present in the current literature [22,23] that there is a big discrepancy between the buzz that smartness creates in tourism and its actual implementation at a destination level.

The identified 35 projects were then content-analyzed and manually coded and grouped based on the information provided (funding, duration, partners, goals, achievements, ICT and Smart Actionable types, location, actors, and technologies used). Given the ambiguous definitions of Smart Tourism and the conceptualization of Smart Cities, we adopted the systematic taxonomy presented above by Perboli et al. [49,50,59] and adapted it to the purpose of our research. With our guiding question about the content of Smart Tourism projects in Europe together with their characteristics and the type of technology solutions used, we aimed to achieve our research objectives in three steps:

1. Content analysis of Smart Tourism project descriptions. This was performed by examining their goals, objectives, results, achievements, communication, and dissemination, and by categorizing the findings following the taxonomy classification of Perboli et al. [49,50,59].
2. Based on Buhalis' characterization of smart systems used in the definition of Smart Tourism [60], we made an additional thorough categorization of ICT and Smart Actionable types in our analysis of Smart Projects.
3. Identifying the sustainability orientation of filtered Smart Projects. This allows us to find out whether the individual project claims its contribution to sustainability goals in general, for social issues, or for environmental concerns.

4. Results

As outlined in the methodology chapter, of the 352 potentially relevant projects identified as smart and tourism-related, we identified 35 projects whose publicly available description included Smart Actionable attributes. These projects were implemented in 13 European countries, the cities where we identified Smart Projects are listed in Table 1.

The projects mostly took place in the capitals of the countries. The average duration of the projects was 3 years (max. 6, min. 1) and the average project funding was EUR 13,476,370 (max. EUR 50,000,000, min. EUR 71,429). Most projects (15) were funded by the EU research and innovation funding program Horizon 2020, followed by Interreg programs (5). The total funding amount for these projects was EUR 363,861,989. Most of the identified countries and cities coincide with the leading European countries and cities [60] considered as pioneers in the use of immersive Smart City technologies.

The studies by Perboli et al. [49,59] highlight the lack of a structured and repeatable method for categorizing Smart City projects and the need to move research beyond its conceptual nature. With our goals aligned, our first research objective was to classify and compare our collected data with the existing classification of Perboli et al. and their 2014 and 2020 research. Below, several diagrams show this comparison of Perboli et al.'s Smart City project studies (abbreviated SCP), with our study of Smart Tourism projects (STP).

For a better comparison of SCP and STP, here are some facts about the taxonomy of Perboli et al. [59], which was tested on a sample of 28 Smart City projects for a total of 24 participating countries. It was based on Italian and European projects, with the following status: only publicly available information was used, including project and city websites, published papers and presentations, and government communications. Only projects already funded by National or European Calls and still active or being implemented by 2013 were considered. In 2020, Perboli et al. [49] extended their research and used the classification taxonomy in North America and repeated the study in Europe. They collected the information on projects from journals, conference proceedings, project performance, and local authority reports.

Table 1. Projects' tech type and Smart Actionable type attributes.

ID	Country	City	Title	TECH TYPES				Smart Actionable Attributes		
				Sensors	**Mobile App**	**IoT**	**Other**	**Big Data**	**Networked/ Connected**	**Intelligent Algorithms**
				15	**12**	**12**	**/**	**16**	**18**	**10**
1	Austria	Vienna	SMILE—Einfach Mobil		X					
2	Austria	Vienna	Traffic Lights, That Think and Communicate	X				X	X	X
3	England	London	Digital Greenwich (Air Quality Proof of Concept)	X		X		X	X	
4	England	London	Digital Greenwich (GATE-WAY)	X			autonomous e-vehicle			
5	England	London	Digital Greenwich (MOVE_UK)	X			5G, autonomous vehicle		X	X
6	England, Italy, Portugal	London, Milan, Lisbon	Sharing Cities Project	X	X	X	computing, e-logistics, smart lamp posts, smart parking		X	
7	Finland	Helsinki	AI accelerating Cities Transition to Carbon Neutrality			X	5G, edge computing	X		
8	Finland	Helsinki	Mobility Urban Values	X	X		open data	X	X	
9	Finland	Helsinki	Smart Dispatcher for Secure and Controlled Sharing of Distributed Personal and Industrial Data			X		X		
10	Finland	Helsinki	Visionary, Participatory Planning and Integrated Management for Resilient Cities				MR, AR, VR		X	
11	France	Paris	Bluetooth-enabled Benches	X	X	X	5G, cloud, computing, Bluetooth, ecosystem of connected devices		X	
12	Germany	Berlin	Berlin Central Station LoRaWAN Gateway			X		X	X	
13	Germany	Berlin	BERLIN E-BUS				e-display			
14	Germany	Berlin	Chargomat		X					
15	Germany	Berlin	NEUE MOBILITAT BERLIN				vehicle sharing stations			
16	Germany	Hamburg	Bidirektionale Multimodale Vernetzung			X	open communication interface, road traffic control systems	X	X	
17	Italy	Turin	Holistic Approach for Providing Spatial and Transport Planning Tools and Evidence to Metropolitan and Regional Authorities	X			AI, integrated activity based mobile system, software-agnostic	X	X	X
18	Italy	Turin	Smart Mobility, Media and E-health for Tourists and Citizens				5G, AI, VR, AR, app, autonomous e-vehicle, machine learning	X	X	X
19	Italy	Venice	Granting Accessible Tourism for Everyone		X		AI, VR, AR		X	X
20	Italy	Venice	Smart and Inclusive Solutions for a Better Life in Urban Districts	X	X		electric driverless autonomous shuttles	X	X	
21	Netherlands	Amsterdam	Yellowbox Project		X		Bluetooth			
22	Netherlands, France	Amsterdam, Grenoble	City Zen Project	X					X	X
23	Norway	Oslo	CityTree	X		X				
24	Norway	Oslo	Intelligent Management of Processes, Ethics and Technology for Urban Safety			X	AI	X		

Table 1. *Cont.*

ID	Country	City	Title	TECH TYPES				Smart Actionable Attributes		
				Sensors	**Mobile App**	**IoT**	**Other**	**Big Data**	**Networked/ Connected**	**Intelligent Algorithms**
				15	**12**	**12**	**/**	**16**	**18**	**10**
25	Portugal	Lisbon	Big and Open Data for a Sustainable Heritage Management Towards Mass Tourism Impact		X	X	AI, open data, computation, smart card, smart mobile devices	X	X	
26	Portugal	Lisbon	Locations	X	X		interactive screens, panels, totems; hybrid and electric vehicles		X	
27	Portugal	Lisbon	Using ICT for Co-Creation of Inclusive Public Places	X	X		VR, web app, vocal sensors, tracing presence and route of Bluetooth devices.	X		
28	Slovenia	Ljubljana	Bicike(LJ)				bike sharing stations			
29			URBAN-e		X					
30	Spain	Barcelona	Open Data for European Open Innovation				open data	X		
31	Spain, Italy, UK	San Sebastian, Florence, Bristol	REnaissance of PLaces with Innovative Citizenship And TEchnologies	X		X	open data, WiFi, FI-WARE, led technology		X	
32	Sweden	Stockholm	Grow Smarter	X		X	open data, WiFi, energy management system (EMS), smart control system, smart lighting, smart waste collection, turning waste into energy		X	X
33	Switzerland	Zürich	SoBigData Research Infrastructure				AI	X		X
34	Switzerland	Zürich	SoBigData++: European Integrated Infrastructure for Social Mining and Big Data Analytics				AI, supercomputing	X		X
35	Switzerland	Zürich	Unified Digital Booking Platform Promoting Local Tourist Services				AI, software platform			X

Note: Background color: These are newly defined categories that overlap with their elements. The background color is necessary for better transparency and differentiation.

Figure 1 shows that most of the objectives in the STPs we identified using Perboli's taxonomy are related to transport (58% of projects) and CO_2 emissions (40%), and the fewest are related to security (11%) and water (no cases detected in STPs). Comparing the objectives in SCP in Europe (2014) and the US (2020) with STP in Europe (2020), we see many differences, the biggest being in CO_2 emissions, energy, and safety. Surprisingly, only 11% of SCPs in Europe were concerned with CO_2 emissions in 2014, compared to 52% in the US and 40% in the European STP. Energy was the biggest concern in European SCP projects at 64%, compared to only 20% of STPs. More than a third of SCPs in the US addressed safety (36%), while significantly fewer projects in European SCPs (7%) and STPs (11%) addressed this objective. Similar goals between SCPs in the US and European STPs were found in the categories of transportation (60% vs. 58%), social innovation (36% vs. 26%), e-governance (24% vs. 20%), and buildings (20% vs. 17%).

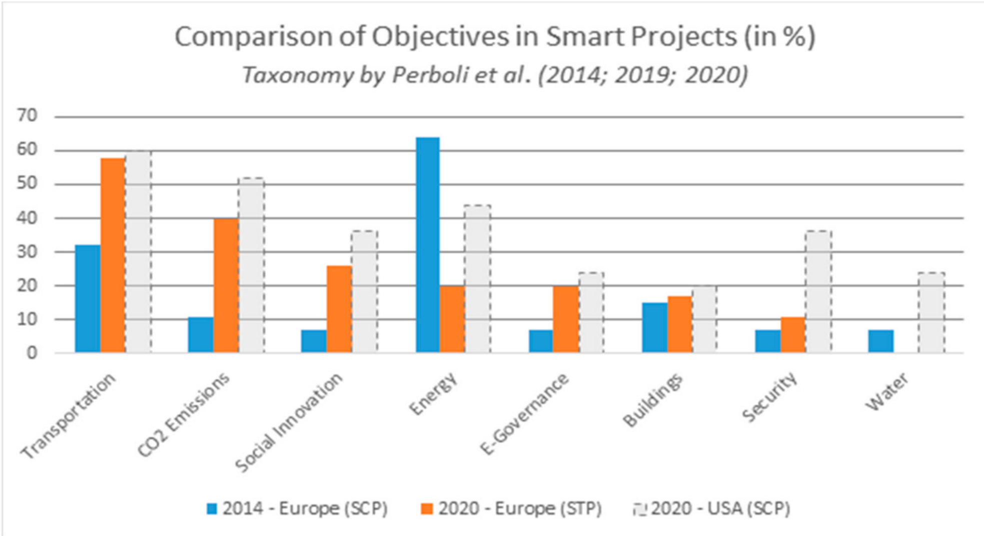

Figure 1. Objectives in Smart City and Smart Tourism projects.

Our analysis of the tools or key enabling technologies in Smart Projects in Figure 2 shows that most STPs fall into the ICT (69%), database (58%), and innovative sensors (53%) categories. The STPs we analyze most often use the rather ambiguous category ICT, which means that the exact typology of the technology used is not really disclosed, raising concerns about whether such projects can really be classified as smart in the sense of the current understanding of smartness as derived from Buhalis' definition [60]. The same applies to the term decision support systems (DSS), which refers to interactive software-based systems that help decision-makers identify and solve problems and make decisions. The categories smart grids and legal and financial tools were the least represented (both at 3%).

A further comparison of SCPs from Europe, Canada, and the US with European STPs in 2020 shows similar use of technologies in ICT and the innovative sensors category. Compared to SCPs from Europe and North America, STPs show a relatively high proportion of projects using cloud computing and database (both more than SCPs from Canada and SCPs from Europe), confirming either the information-intensive nature of tourism or our strict positive preselection of cases.

Smart City/Tourism initiatives may involve different parties, each with their own role and objectives (Figure 3). As far as STPs in Europe are concerned, cities play an active role in 86% of the projects, followed by the administration (74%) and consumers/citizens (74%). Public researchers or universities play the least important role in STPs. Comparing the stakeholders involved in SCP and STP between Europe and North America, we can see that consumers/citizens are the least involved in STP compared to the other stakeholders, as well as small and medium enterprises. It is interesting to see that the administration was the most involved party in STP among the Smart Projects. We can highlight again the low participation of universities in STP with only 14%, whereas this rate rises to 84% for European SCP.

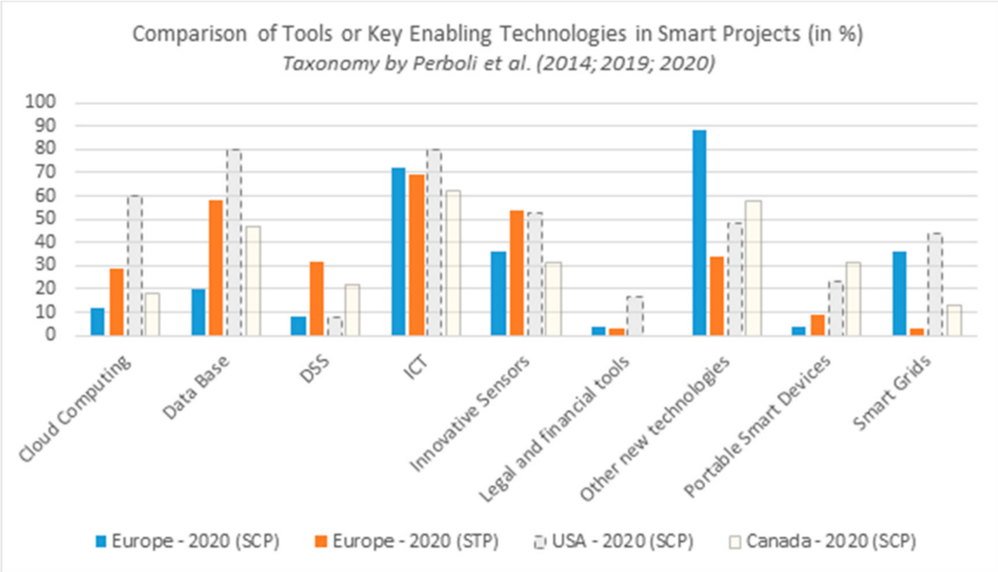

Figure 2. Tools in Smart City and Smart Tourism projects.

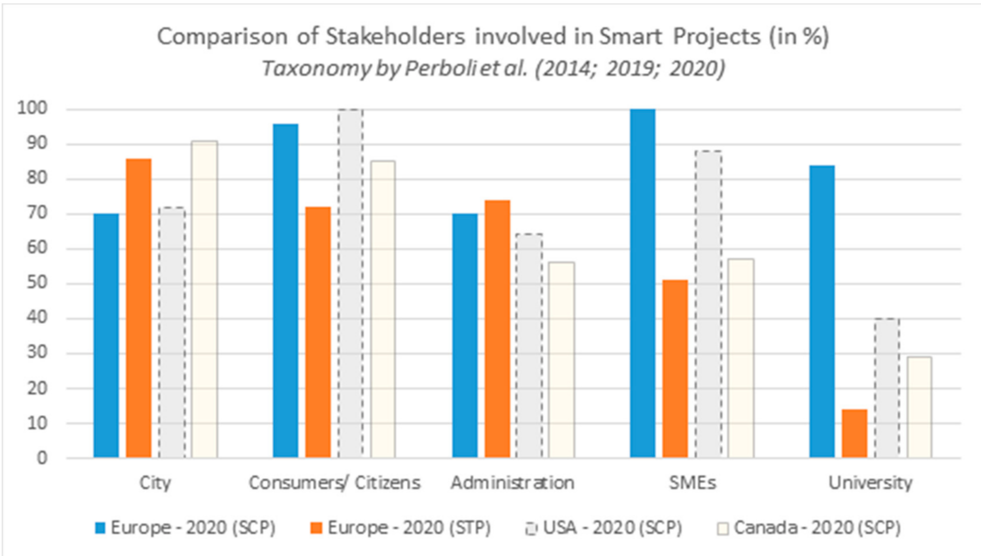

Figure 3. Stakeholders involved in Smart City and Smart Tourism projects.

We would like to note here that we believe that the current taxonomy, as proposed by Perboli et al. [49], severely lacks a distinction and classification of the advanced technologies that have been deployed and upgraded in recent years to achieve the goals of Smart City projects. While this may have been acceptable at the beginning of the smartness discourse, the dynamic evolution of ICTs in recent years needs to be better taken into account if we are to strive for a more robust and contemporary taxonomy capable of properly distinguishing Smart City and Smart Tourism projects. More specifically, and as we have already done in our research, more advanced technologies should be exposed in the categories of key enabling technologies in Smart Projects to better distinguish the technologies applied in Smart City projects, of which open data, artificial intelligence (or machine learning) and extended reality first come to mind.

To gain such additional insights into categorization, we introduced another layer of ICT and Smart Actionable attributes into Perboli's key enabling technologies classification [49]. First, we added the tech type, which was used to code each ICT technology mentioned. We were able to identify the four most frequently adopted tech type categories, shown in Table 1, while the other less-frequently adopted tech type categories (more than 40) are counted in the "other" column (e.g., VR, AR, e-display, machine learning, Bluetooth, etc.). When coding the project information, it seemed that each analyzed Smart Tourism project most likely uses some kind of basic and widely adopted technology such as Bluetooth, WiFi, etc., but due to its obviousness, it is rarely mentioned in the project description. Therefore, we listed only the tech types that were explicitly mentioned in the project descriptions. The four most frequently mentioned tech types in projects were Big Data (16), sensors (15), mobile apps (12), and Internet of Things (IoT) (12).

In the next step, we extended Perboli's approach with the use of Smart Actionable attributes presented in the Methodology chapter. The first attribute, Big Data, already appeared in the coding of tech type. For the other two, networked/connected devices and smart algorithms, we extended our Table 1 to show whether an individual project under study met these characteristics. The classification shows 18 projects marked as networked/connected and 10 projects marked to include intelligent algorithms. The criterion for ranking projects within these two remaining Smart Actionable variables was as follows:

a. Networked/connected: We use this attribute to characterize projects in which there are multiple interconnected technological solutions that communicate with each other, complement each other, and influence what happens in the system with their actions and outputs. Let us consider the example of a garage house sensor that reports the number of vacancies via the application. In this case, it would only be a networked/connected solution if this system was connected to another system outside and, together with it, would influence certain events in the destination or services for residents and tourists. In the isolated project, such a "smart garage" concept, which only informs about the occupancy of parking spaces in one or more locations in the city, would not be a positive finding for our research.
b. Intelligent algorithms: The attribute has been assigned to a project when it employs any ICT-based intelligence that senses its environment and performs actions that maximize its chance of successfully achieving its goals. The term "intelligent algorithms" is often used to describe the behavior of technologies that mimic cognitive functions associated with the human mind, such as "learning" and "problem solving." These include autonomous vehicles, for example. Through various algorithms, they constantly calculate and estimate various probabilities, e.g., for running, stopping, etc. (depending on weather, vehicle speed, road occupancy, etc.). This data is extracted from various sources (including roadside) and databases via high-speed Internet.

Using the official descriptions of the projects studied and their tech type and Smart Actionable type coding, we were able to manually classify the 35 study units into the following groups:

Group S1—Networked/Connected and Big Data (BigdNetw): The first group consists of projects (9) that have been assigned the networked/connected and Big Data attributes. The attribute intelligent algorithms is negligible in this group. The tech types that are most represented in this group are sensors (5), networks (4), and IoT (4). From the results, it can be concluded that projects belonging to this group deal with large amounts of networked and connected data, which represents a typical smart systems feature.

Group S2—Networked/Connected and Intelligent Algorithms (NetwIntell): The projects in the second group (8), unlike the first group, are fully connected only by the networked/connected attribute. The attribute intelligent algorithms is less frequent in this group (4), and the category Big Data is not present at all. We can conclude that this group of projects uses networked and connected data, but not in large quantities. The individual technology types that are most prevalent in this group are sensors (6) and mobile applications (4). An interesting finding from this group is that, despite the fact that the projects most commonly use sensors, the data collected does not appear to be rich enough to place the projects in the Big Data category.

Group S3—Big Data (Bigd): The third group consists of projects that in all cases are only associated with the Big Data attribute (7). Only two projects in this group fall into the intelligent algorithms category and none is described as networked/connected. The tech types in this group are quite diverse, but we can list the two most representative: IoT (3) and artificial intelligence (AI) (3). An important and somewhat unusual finding that this group suggests is the latter: although the projects fall into the Big Data domain and some even include AI and IoT, they do not address networked/connected goals and mostly do not apply intelligent algorithms in data processing.

Group S4—Convincing, Not Smart Actionable: The fourth group consists of projects (11) that have not been assigned to any Smart Actionable type. This group also uses significantly fewer individual tech types (compared to the first three). The most represented technology types are mobile applications (4) and sensors (3). This group makes it clear that while these projects are presented and advertised as smart (and convinced us to consider them the first time around), they do not (upon further research needed to accurately assign meaningful attributes that constitute the project description) warrant these standards and guidelines. When the number of projects in this group is expressed as a percentage (compared to all in the analysis), such projects accounted for as much as 31%.

In summary, based on the technologies and features used, the aspect of "smartness" is most prevalent in the projects of groups S1 and S2 (17 projects). In most cases, these projects justify Buhalis' [58] definition and the use of a wide range of networks, connected devices, sensors, and algorithms to provide Big Data throughout the IoT. On the other hand, a large proportion of the projects in the analysis did not adopt advanced or networked technologies that would justify the use of the term "smart" according to this, and the cited, studies.

Sustainability orientation—Similarly, as we wanted to gain additional insights in the area of technology (compared to the taxonomy of Perboli et al. [47,57]), we conducted an additional analysis of the stated objectives in the identified Smart Tourism projects for the area of sustainability. In the descriptions, we identified the three most frequent attributes of this type: sustainable, social, or environmental. Table 2 shows the frequency of occurrence of each attribute.

Table 2. Sustainability orientation.

ID	Country	City	Title	Sustainable	Environmental	Social
1	Austria	Vienna	SMILE—Einfach Mobil			
2	Austria	Vienna	Traffic Lights, That Think and Communicate	X	X	
3	England	London	Digital Greenwich (Air Quality Proof of Concept)	X	X	
4	England	London	Digital Greenwich (GATE-WAY)			
5	England	London	Digital Greenwich (MOVE_UK)			
6	England, Italy, Portugal	London, Milan, Lisbon	Sharing Cities Project	X	X	X
7	Finland	Helsinki	AI Accelerating Cities Transition to Carbon Neutrality	X	X	
8	Finland	Helsinki	Mobility Urban Values	X	X	
9	Finland	Helsinki	Smart Dispatcher For Secure and Controlled Sharing of Distributed Personal and Industrial Data			
10	Finland	Helsinki	Visionary, Participatory Planning and Integrated Management for Resilient Cities			X

Table 2. *Cont.*

The social aspect of the Smart City projects and their technology used is most poorly represented (7 projects, 20%), as opposed to the sustainable (22 projects, above 60%) and environmental aspects (10 projects, slightly less than 30%). There is a possibility that some social projects are among those marked only sustainable. However, already, these results show a relatively lower representation of social orientation compared to the environment. This fact is not particularly encouraging, since in the years when the analyzed projects were developed, there was already a possible awareness of the current negative social impacts of tourism in most destinations. More on such technological and sustainable considerations follows in the Discussion.

5. Discussion and Model Proposal

This study attempted to conduct an in-depth content analysis of the goals pursued and the technologies used in several European Smart Tourism hotspots. To the best of our knowledge, such a study has not been conducted before. With our taxonomic focus upgraded from Smart City research [49,59], and by adhering to the most recent conceptual definition of Smart Tourism provided by Buhalis [60], the study bridges the fields of Smart Tourism and the broader and more developed Smart City research. It is also taxonomically anchored in the latter, taking it a step further than the mostly conceptual or case-study-based research that predominates in the field Smart Tourism, and which has even been called self-referential [61].

In order to better distinguish between conventional and advanced, interconnected technology, which has undergone extensive development and acceptance in recent years, we placed a special focus on Smart Actionable attributes of the projects analyzed. Our work differed from most methods used in other studies that rely on the construction of conceptual models, frameworks, or indicator systems based on the evaluation of Smart City or Smart Tourism goals, statements, strategies, and initiatives. The presented study goes a step further and tries to understand which technological innovations exactly were adopted and how they contribute to projects' smartness. From what we could perceive in the selected projects, four smart technology trends can be identified. The first of the four groups, which share similar Smart Actionable type attributes, was dominated by connectivity and Big Data. The second group was dominated by connectivity and intelligent algorithms. The third group was focusing only on Big Data, and the fourth group represents convincingly advertised "smart" projects with mainly well-represented technology that does not exploit the Smart Actionable possibilities.

In our initial online resource search, we encountered the vast majority of projects that were touted as "smart" but did not address any of the newer aspects of ICT infrastructure, such as interconnectivity and interoperability of integrated technologies. They were therefore excluded from our study, leaving only 35 projects, which we analyzed in detail and assigned to the four groups mentioned above. This confirms our preliminary findings that there is a lot of hype and little substance (e.g., smart washing) regarding Smart Tourism projects. This problem stems in part from the fact that there are different, everchanging definitions and meanings of the term Smart Tourism. Subsequently, different stakeholders and entities (institutions, different branches of academia, civil society, different business departments, etc.) adopt different meanings and set different priorities based on their viewpoints and schools of thought. In general, it can be concluded that "smartness" is currently a trend that tourism planners are aware of and often mention, but to a large extent do not yet properly implement in their strategic development projects.

To reduce ambiguities, and for a more effective comparability of projects in which we observe technology-related smartness, we propose, based on the findings of our research, a classification and terminological approach in the form of the Smart Actionable Classification Model (SACM), presented in Table 3. In addition to analyzing the introduced technological solutions using the TECH TYPES classification, we propose the use of three SMART ACTIONABLE ATTRIBUTES that check whether the projects meet the Smart Tourism conditions adapted from Buhalis [60]. As our results already show, there are different

SACM types of projects that use these three attributes in different relationships. Future research can use the proposed model to analyze the different types of SACM projects in more detail and verify whether such classification corresponds to the situation on the ground and the R&D needs.

Table 3. Smart Actionable Classification Model (SACM).

Tech Types	Smart Actionable Attributes:	Big Data	Networked/ Connected	Intelligent Algorithms	SACM Types
software, hardware, protocols, . . .	→	X			Bigd (S-B)
			X		Netw (S-N)
				X	Intell (S-I)
		X	X		BigdNetw (S-BN)
			X	X	NetwIntell (S-NI)
		X		X	BigdIntell (S-BI)
		X	X	X	BigdNetwIntell (S-BNI)
					Convincing; yet not smart actionable (S-0)

According to our filtered and analyzed Smart Tourism projects, we further argue that the aspect of social innovation (one of the key contemporary aspects when it comes to tourism) and its connection with technological solutions is still underrepresented, albeit at a slightly lower level than in Smart City projects [49]. A telling example is the result of the systematic literature review on Smart Tourism, where the authors did not find a single study from the residents' perspective [2]. Projects addressing environmental sustainability goals continue to be the dominant group. Comparing the results of our studied Smart Tourism projects with the Smart City projects of Perboli et al. [59], it can be seen that the main areas of interest, research, and innovation are mostly maintained and similar, confirming that Smart City development certainly has a direct impact on Smart Tourism development. The Smart City projects are mainly concerned with smart solutions in energy and transportation, except for the aspects of CO_2 reduction and social innovation, which are slightly more representative in our study. The water aspect was not identified at all in our analysis.

At the intersection between the social and technological levels of our debate, we found the term "open data" mentioned several times in the projects we examined, while it is absent from Perboli's category scheme [49,59]. This tech type should be highlighted and emphasized because, according to Buhalis and Amaranggana [8], it enables true data openness for all stakeholders in Smart Tourism Destinations. This will encourage them to participate in various smart initiatives and projects, thus creating a basis for further smart and socially aware innovation. Tourism authorities should ensure that all information generated by any new application development is made openly available without unreasonable additional costs.

Our study is not free of limitations, which the reader, as always, should be aware of when evaluating the results. The research was limited to Europe and therefore cannot be readily applied globally. Even within Europe, there are certainly some other, or newer, Smart City projects that could provide and demonstrate better solutions and insights, but the information on them was either not published, not promoted as Smart Tourism projects, or insufficiently published and therefore did not provide us with enough information to further classify and analyze them according to our approach. In addition, some of the projects analyzed did not contain all the information we were looking for (funding, grants, duration, outcomes, etc.). It often happens that the communication about the projects is marketing-oriented and does not allow accurate insights (e.g., into the technologies used), so we classified only the technologies that were clearly mentioned and described in the official project data. Our research approach was limited to the leading Smart Cities or Smart Tourism locations in European countries; therefore, the sample size and coverage are limited, which may have led to the omission of some other potentially relevant cases. Some project descriptions and results were not available in languages that could be interpreted by the researchers and were therefore omitted, while some projects are still in progress, so not all data are yet available.

6. Conclusions

Taking into account the above considerations and limitations, the present study offers new insights into the phenomenon Smart Tourism. Our operational and innovation adoption-based approach adds a critical and structured light to the field as it is trying to further reveal what is the actual technological content of Smart Tourism projects. This is still one of the first steps for Smart Tourism research to evolve and become aware of the challenges of its high-quality technology-based and sustainable implementation through EU-funded projects. Moreover, comparing the data with the taxonomic classification of similar studies can help in analyzing new trends in the use of smart technologies for different objectives and relate them to the involvement of multiple stakeholders and project initiators.

The presented analysis and proposed Smart Actionable Classification Model (SACM) should serve as an additional stimulus for other researchers to dig deeper than the surface of declared smartness in order to develop clear criteria for what can be categorized as a building block of Smart Tourism concept and what cannot. Various stakeholders and decision-makers can benefit from our analysis, which provides a thorough view of the concept of Smart Tourism, as we draw data from announced-as-Smart Projects and identify the current and future trends, the type and purpose of the technology used, and elementary information such as the average duration of the project and the amount of money spent or invested.

We believe that future researchers and practitioners can use our findings to better understand the true (several) meaning(s) of the term "smart" and gain new insights into adoption of a variety of smart-related conventional and advanced technologies. In our view, and that of the authors cited, an understanding of advanced technologies and their adoption in emerging sustainable and socially conscious business models is essential to such debates, which can take very different directions. To name just two orientations, the term "smart" can refer either to the systemic implementation of smart technological building blocks or to ubiquitous smart solutions that are intelligently and sustainably designed by smart humans. Together with further terminology clarifications and verification of the SACM model, the next research steps can follow and extend the presented exploratory research method with more advanced tools along with larger datasets, using presented and updated research frameworks. It will be crucial to see and compare whether the focus areas of Smart City/Tourism projects will change in the future, or whether the focus will change and/or diversify in European countries and in different segments of the same society/community.

In the light of the research presented and from the perspective of human technological evolution, it could be said that we are in a phase of transition from a non-smart to a smart technology-enabled society. It seems that smart technological implementation was discussed earlier than it actually happened, which is often the case with earlier waves (or bubbles) of technology. However, we must not forget that many waves of technology have been communicated in a similar way, but then have not happened. Given the abundance of artificially intelligent and networked technology solutions, there is probably no reason to fear that a smart technology wave will not restructure and reconnect human society in the not-too-distant future, but it is not advisable to prematurely tout solutions as (technologically) smart that actually are not, and mainly remain at the awareness rather than at the implementation stage of smartness trend.

There is certainly a need to continue to find a balanced approach to actively promote and support the further design, development, testing, and deployment of smart technological solutions for the benefit of humanity and its natural and urban habitats, including the translation and mediation of meanings between different segments of human society.

Author Contributions: Conceptualization, D.K. and M.B.; methodology, D.K., M.B., P.K. and T.R.; formal Analysis, D.K., M.B., P.K. and T.R.; investigation, M.B., P.K. and T.R.; resources, M.B., P.K. and T.R.; data curation, P.K. and T.R.; writing—original draft preparation, D.K. and M.B.; writing—review and editing, D.K., M.B., P.K. and T.R.; visualization, P.K. and T.R.; supervision, D.K.; project administration, D.K. and M.B.; funding acquisition, D.K. and P.K. All authors have read and agreed to the published version of the manuscript.

Funding: This research and the APC was funded by HORIZON 2020, grant number: 870753, project title: Cities as mobility hubs: tackling social exclusion through 'smart' citizen engagement (SMARTDEST).

Data Availability Statement: https://keep.eu/ (accessed on 2 September 2021). Keep.eu serves all professional audiences in need of aggregated data regarding projects and beneficiaries of European Union cross-border, transnational and interregional cooperation programs among the member States, and between member States and neighboring or pre-accession countries. The Interact Program with the support of the European Commission and the remaining Interreg, Interreg IPA cross-border, ENPI/ENI, and IPA-IPA cross-border programs, built this database and maintains it, as part of its mission. The database covers the 2000–2006, 2007–2013 and 2014–2020 periods. https://cordis.europa.eu/ (accessed on 2 September 2021). The Community Research and Development Information Service (CORDIS) is the European Commission's primary source of results from the projects funded by the EU's framework programs for research and innovation (FP1 to Horizon 2020). CORDIS has a rich and structured public repository with all project information held by the European Commission such as project factsheets, participants, reports, deliverables and links to open-access publications.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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