The Application of ICT and Smart Technologies in Polish Museums—Towards Smart Tourism

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Abstract: The concept of Smart Tourism is rapidly developing alongside Smart Cities, with increasing numbers of ICT solutions being applied for the convenience of travelers as well as for gathering information, which has become a valuable resource. The vast progress in the development of Information Technologies has also impacted the needs and expectations of tourists. However, various branches of tourism are adopting this concept at a different pace, and thus a growing development gap might emerge. Cases from all over the world show that museums are not immune to this, and it is important for their future to meet these expectations. Therefore, the main objective of this study was to investigate the use of modern technologies in Polish museums and assess their readiness for adopting Smart Tourism. For this purpose, a nationwide online survey was conducted with a sample size of 218 museums (from 500 unique entities in total). The results show that the issue of Smart Tourism in Polish museums is ambiguous. The results reveal that, currently, the status of Smart Tourism adoption in museums is quite low, and significant gaps in some areas are shown; at the same time, other areas revealed a high potential for the future application of Smart Tourism.

1. Introduction

The world that we live in is constantly changing, and as time passes, societies are having to face new challenges. In the last decades, the main challenges have been climate change, urbanization and globalization. As Komnios [1] noticed, the fact that increasing amounts of the world population live in urban areas creates a pressure to create cites that are suited for the needs of future society. This is reflected in how cities are currently being developed and planned, with a strong emphasis being placed on innovation and on intelligent and knowledge-intensive solutions. Urban areas are expected to fully utilize the benefits of the synergies coming from combining the technologies, knowledge and skills found in various societies and organizations. This requires an undisturbed flow of information and knowledge, meaning that adequate (smart) environments and spaces need to be in place and interlinked with each other, creating a complex network of inter-organizational, social, institutional and environmental connections. This need can be seen as the origin of the Smart City paradigm, which has emerged at the turn of the millennium in various sciences.

The concept of Smart Tourism has emerged from the Smart City paradigm and is an essential part of every tourist destination that adopts it. ICTs are the main component of every smart concept [2]. The rapid development of the Internet and the related Information Technologies and innovations affect and reconfigure all sectors of the economy, including tourism, which needs to adapt to the new standards by creating smart, individual offers to technology users [3–8]. As cities increasingly embrace the smartness concept, tourism is also following this path. This sets the expectations and needs of modern tourists at a new level, and museum visitors are not an exception to this. This is because technological progress has not only affected business possibilities but has also impacted the needs

and expectations of tourists, who seek the customization of products and expect to influence product creation [9–13]. In multiple sources, ICTs have been highlighted for their contribution to improving tourists' experiences, providing benefits to the industry and having a positive effect on the quality of life of local communities in tourist destinations [14–17], meaning that Smart Tourism can improve a destination's competitiveness [18]. The main advantages of using technology for tourists are saving time, allowing the better planning of a trip, allowing purchases to made with satisfying terms and convenient conditions, allowing information to be found at a site and making the travel experience more practical and functional [18–24]. On the other hand, all the traffic, information and digital footprints left by travelers on the Internet form a part of Big Data, which can be analyzed to provide tourist destinations with valuable knowledge on the behavioral patterns, habits and needs of tourists, allowing the creation of more targeted and individualized products with higher sales chances [23,25–29]. Moreover, as a 2020 study by Cuesta-Valiño et al. [30] showed, the smartness concept in tourism can be utilized to tackle issues that expand beyond economic matters by addressing the problems of the cultural differences of travelers and their resulting needs and expectations, making this concept a sustainability domain as well.

The studies on technology use in tourism seem to be perspective-oriented, and an imbalance of studies regarding one perspective in comparison to another can be noticed. In 2019, a team of researchers [31] published a detailed literature review of over 130 papers on the topic of mobile technologies and applications in Smart Tourism published between 2012 and 2017. The main findings showed that most of the research focused on the customer perspective (their attitudes and intentions, their experience and co-creation and their adoption of smartphones for traveling). Very little research was done regarding the provider experience, and when this was considered, the studies focused on ICT solutions on the level of an entire tourist destination or the adoption of particularly selected technologies or mobile applications and the stock market. While tourists benefit from conveniences provided by technological solutions (by offering fast services, more means of reliable communication and streamlined connectivity, trips can be planned more easily and quickly and on more transparent conditions, which increases tourists' satisfaction and allows the providers to better meet the needs and expectations of customers), the same study revealed that stakeholders still do not fully recognize and appreciate the importance of ICTs (foremost, mobile technologies) and the benefits they can provide. This reveals an interesting gap in the field of Smart Tourism research concerning comprehensive studies on entire branches of tourist service providers and their experiences, use histories and attitudes towards technology.

Therefore, the main goal of the present study was to explore this gap regarding the museum branch and recognize the degree to which modern technologies are used in museums across the entire country of Poland. This allows us to determine the readiness of Polish museums to embrace the Smart Tourism concept, or in other words, to show the already existing Smart Tourism potential and expose possible issues that have to be overcome in the future to take advantage to this to the full extent. This also allows us to determine if the previously mentioned statement that stakeholders do not fully recognize and appreciate the potential of ICTs also applies to museums.

2. Smart Tourism and Smart Technologies

2.1. The Smart City Concept

The development of technology and the digitalization of data have impacted most social and economic organizations by introducing the smartness concept. This has improved general quality of life, as well as enhancing economic performance [2]. The Smart City concept grew on this basis, and the improved resource use and pollution reduction resulting from this concept has led to the more focused concepts of the Smart Village, Smart Tourism and finally Smart Tourism Destinations [32,33].

Some researchers [34,35] argue that the term Smart City is an evocative slogan that lacks a precisely defined core. This may lead sometimes to the abuse of this term by governments, politicians or

organizations to realize their agenda by simply labeling it under this term. The same deficiency in the commonly agreed definition of a Smart City often leads to explaining this term rather than using the six distinct characteristics of a Smart City [35–37]:

1. Smart Economy, which is understood as an innovative and flexible economy that is integrated with international markets and that transforms easily.
2. Smart Mobility, which relates to the wide use and access to ICTs, the use of safe and sustainable transportation and local accessibility.
3. Smart Governance, which refers to governance that includes the society in decision-making processes, with transparent systems and accessible public systems. This characteristic relates also to the quality of political strategies.
4. Smart Environment, which refers to low or no pollution, the sustainable use of resources and the attractiveness of the natural environment.
5. Smart Living, which reflects the quality of life in a given city and may be expressed in the availability of cultural and educational services, public safety, the accessibility of tourist attractions, the health of the environment and the unity of society.
6. Smart People, which is understood as the quality of human–social capital, tolerance, flexibility, creativity, participation in social life and the level of cosmopolitanism.

Other researchers have proposed definitions for Smart Cities in the course of their research, taking into account the aspect of the concept that they were analyzing; an example is the work of Valano [35], who concluded that a Smart City (SC) is "an urban imaginary combining the concept of 'green cities' with technological futurism and giving a name to techno-centric visions of the city of tomorrow. At the same time, the Smart City is a framework for policies supporting technological and ecological urban transitions, a political technology that is currently spreading across Europe and fertilizing national and local political agendas." He also named two main dangers that come from this concept, which are shared by other researchers as well [34,38,39]: the first one is that, as with any other new urban vision, the concept requires some degree of restructuring, which eventually leads to the exclusion of some current subjects in favor of others—the same is true for people, where some will benefit at the price of the marginalization of others; the second one is that the SC concept is heavily technologically orientated, reducing the vision of a future city into a technology-centric idea, which may limit the opportunities for possible alternatives that might emerge.

As Battino and Lampreu [2] have noted, the development of smart concepts has to be evened out between cities that have enjoyed the advantage of early digitalization and less-developed areas. Otherwise, the advantages provided by technology will lead to an increasing gap between those areas and intensify the problems of already neglected and depopulating areas [2]. One can assume that the same might apply to tourism from another perspective, namely various tourism branches or sectors. If some sectors, services or branches follow the smart concepts trend and develop towards it, they might overwhelm others that did not keep up with the pace. This might be the case when one tourism sector is dominated by private companies and another is mainly the domain of public entities (such as museums) whose development is less affected by market stimuli such as competition and more dependent on local regulations and funding policies. It is important to keep up with the development pace; otherwise, the underestimation and inactive response to technological opportunities by tourist suppliers will lead to severe consequences [40].

2.2. The Smart Tourism Concept

Smart Tourism, as with the Smart City, is a concept that has many definitions, and researchers approach it differently depending on their field and discipline; however, even if the boundaries may seem blurry sometimes, some characteristics that define the concept can be distinguished [36,41]:

-   It uses the Internet and network infrastructure to improve economic effectiveness and introduce policies that support social, cultural and urban growth.

- It emphasizes the creation of attractive business spaces that incorporate social needs in their services.
- It engages high-tech and creative industries.
- It focuses on the relational and social capital in the development of cities.
- It recognizes sustainable development as a strategic aspect of Smart City development.

For this research, Smart Tourism can be defined as a subset of the Smart City concept; as with Smart Cities, its aim is to improve the quality of life of its residents. Smart Tourist Destinations (STD) concentrate on the needs of travelers by improving the functioning of systems, business processes, governments and authorities, as well as other entities from the public and private sectors [42]. Tourists now rely less on travel agencies and organized trips in favor of individually planned tours. The development of the Internet and mobile technologies, as well as the popularization of Smart Tourism, has strengthened and aided this trend. This also affects the habits and expectations of tourists towards destinations, meaning that they support the information sources that modern tourists want to use [43].

The concept of Smart Tourism can be also treated as an evolution of previous technology applications in tourism rather than a completely new concept [44], meaning that Smart Tourism can be seen as a more advanced form of eTourism [45]. Both of these concepts come down to the use of ICTs for development in tourism, but Smart Tourism places more emphasis on collecting, integrating and utilizing data gathered from infrastructure and user devices to provide an improved and more personalized tourism experience [46]. In other words, Smart Tourism is a concept that focuses on turning data and information into knowledge that can be used for the benefits of destinations, residents and tourists [47].

One can go even further, as Buhalis [48] did in one of his recent publications, sharing an interesting vision of how tourism supported by technology can enter a new stage: Ambient Intelligence Tourism (AIT). AIT seems to be the next step in the evolution of tourism (preceded by eTourism and then Smart Tourism) and is driven by a range of technologies: IoT, 5G networks, the Internet of Everything, RFID, mobile devices and smart wearables and their applications, cryptocurrencies, beacon networking, machine learning, artificial intelligence, pervasive computing and gamification. These various technologies contribute to a growing and fast-developing infrastructure that connects all stakeholders. This network provides a fluid and multidimensional interaction between the physical and digital worlds. The AIT is the source of intelligence in current and future tourism ecosystems, making them sensitive but also flexible and adaptive to changes. The future cooperation of stakeholders in tourism seems to be increasingly dependent on technological innovations; at the same time, if those innovations are used adequately, it will make it easier to establish collaboration.

Regardless of the possible development paths, ICTs have introduced significant and inevitable changes to tourism, bringing the business to the realm of online solutions [49], which has enhanced the tourist experience and created new smart travel services (in the forms of various apps and platforms which help users to get information, share opinions, find hotels, restaurants and attractions and to travel through a destination). Simply put, Smart Tourism is the set of all information services surrounding tourists in the touring process (therefore, it is not only limited to the services provided on site while touring, but it also includes the pre and post-tour processes) [50]. It can also be defined as the development process of tourism that incorporates ICT solutions to eTourism and old-style tourism [46,51]. As stated by Pradhan et al. [52], keeping up with changes in technology is a key task for all tourism stakeholders (as well as tourists themselves) because of the rapid change and fast development of information technology.

In conclusion, it is worth noting that there are five crucial components of Smart Tourism [53]: transportation, gastronomy, accommodation, ancillary services and attraction. The basis for a Smart Tourism experience is the whole smart business ecosystem, built on data sharing between stakeholders (especially on the private–public plane). For Smart Tourism to develop all of the mentioned components, it needs to be supported by intelligent services within a Smart City and provide the necessary

functionality for tourists at any time. The reliability of this functionality is directly linked to technological development and ICT application.

2.3. The Role of ICTs in Smart Tourism and for Smart Tourists

As previously stated, Smart Tourism emerged from the combination of tourism and ICT or, as other sources mention, from tourism and smart technologies [54,55]. Smart Tourism can be also considered as an entire ecosystem [55,56] consisting of smart tourists, smart technologies and smart businesses. S. Shen et al. [40] listed different forms of smart technologies that find application in smart tourism, including the following:

- The Internet of Things;
- Cloud computing;
- Artificial intelligence;
- Mobile communication technologies;
- Mobile devices and apps;
- Big Data;
- Virtual reality;
- Augmented reality;
- Intelligent chat robots;
- Wearable devices;
- Beacon networking.

Celdrán-Bernabeu et al. [41] mapped how key technologies and key elements of the touristic system have changed over time, from traditional tourism and through eTourism to today's Smart Tourism concept. Regarding key technologies, computer servers dominated in the era between the 1950s and 1990s. After this, eTourism emerged on the basis of the rapid development of web technologies and the increasing availability of the Internet. This laid ground for modern Smart Tourism, which originates back to the beginning of the new millennium and is based on technologies such as Big Data, mobile technologies, the Internet of Things, cloud services and sensors. The key elements of touristic systems have evolved from the global distribution and reserve systems, which later have been replaced by brokers, information sharing via the Internet and direct transactions (B2B, B2C and C2C).

Ivars-Baidal et al. [57] in another work have also studied the importance of particular ICTs in tourism. According to their findings, the first technologies (with 2–5 years until they reveal their full impact or use) with the highest influence for tourism (according to the majority of the experts that participated in the study) are real-time databases, local connectivity, mobile communications payments and 5G, Near Field Communication (NFC) payments, Bluetooth, wearables, Augmented Reality and unmanned aerial vehicles (UAVs). Some of the experts also listed technologies such as Big Data, IoT or Virtual Reality in this context.

The key role that technology plays in the Smart City and Smart Tourism concepts is not without its downsides and limitations. Sometimes, it has been criticized for privileging technological tycoons, raising citizens' concerns regarding their privacy and the dependency on technology, as well as for pushing public services into the private sector [35,57].

It is obvious that various technologies now play different roles in tourism and impact tourists' behavior and change the functioning of a destination. Smartphones are now standard and are a necessity in tourism, representing the main platform for interaction between tourists and their destinations both in the real and virtual world [58]. They have taken word to mouth (WTM) promotion and expanded it into the electronic world (eWTM) [59,60], making it even more impactful for the value of a tourist experience at all travel stages (pre-travel, on-travel and post-travel) [61–65]. The popularity and importance of online reviews in tourism have been growing both for tourists and service providers [66]. Online platforms such as TripAdvisor and similar apps have placed tourists in the role of the co-creators of a touristic product by shaping an image for other customers [67,68].

Through technological development, tourists are no longer consumers but rather "adprosumers" [69] (they advertise, produce and consume a good). Information that can be extracted from such a large data set can be of use from the sustainability perspective for planning, developing, marketing and operating touristic products that are advantageous both for the quality of residents' life and tourist visits [46,50,70,71].

Smart technologies play different roles in each of the previously mentioned travel cycle stages [40]. In the pre-visit stage, they are used for gathering information about attractions, finding places and services, getting opinions and feedback from different sources and finally shaping plans for the tour. Therefore, smart technologies impact the tourists' experience by affecting how they search for and plan their visit, increasing their interests in the destination, reducing decision risks and providing a better overall understanding of the journey. In the on-site phase, the use of smart technologies includes mobile communications and transactions, the storing of memories or moments in the forms of recordings or images, making on-site short-term decisions and supplementing the visitors' knowledge by reading detailed online comments or reviews about a point of interest the tourist is about to seek out. Thus, in terms of tourists' experience, technologies influence how a visitor navigates and communicates, providing additional convenience, saving time and making the whole experience more flexible and more enjoyable, as well as affecting the form of how memories are made and kept. Finally, at the post-visit stage, smart technologies are used to share memories and gathered knowledge and also for tourists to write their own reviews (therefore providing others with the same advice the tourists received at previous stages). On this basis, it can be stated that smart technologies also influence how experiences are shared and memories are recollected and how the evaluation process runs [40].

Smart technologies do not only affect the (smart) tourists' experience, but they also help tourists to impact others' behavior to be more responsible and sustainable. This was proved in a study by Shen et al. [72], who found evidence that social networking sites are effective tools for developing sustainable and responsible behaviors from Smart Tourists at all three previously mentioned stages of the travel cycle (the influence is the strongest for the first two stages).

Tourists who embrace technological solutions can be seen as a separate subgroup of all tourists and referred to as Smart Tourists. Characteristics of Smart Tourists that distinguish them from other tourist groups can be found in research on this topic [13,44,45]:

1. Their use of smart devices is more integrated during their whole trip.
2. They share their experiences during their trip through social media (in the form of live streams or real-time updates).
3. They use websites and mobile apps to get the most up-to-date information, both during and before their trip.
4. They experience the least inconvenience related to language and mobility while being more familiar with their destination environment.
5. They are reported to have the highest additional consumption during a trip, while at the same time reporting the smallest income and spending budget in comparison to other groups.
6. They are more prone to be positively influenced by social media, so they act more responsibly and sustainably during their trip.

It is worth mentioning at this point that, even if the previously mentioned research works have proven that data gathering and its analysis serve the purpose of sustainable development and that tourists are increasingly dependent on technology and expect the newest solutions to be supported in touristic destinations, there is also another side of this aspect that has to be addressed, namely privacy issues and risk factors. As a study published in 2018 [73] has shown, there is no single model of technology users among tourists. The authors identified four clusters of different tourist types that differ in terms of their technology use and risk perception on the use of smartphones while traveling:

1. Not frequent travelers that use technology mainly for entertainment and do not see themselves as highly technology-oriented, but are concerned with data privacy and rather use technology for trip planning rather than for on-site information searching.

2. Senior travelers, who travel more frequently than the previous group and are more concerned with privacy issues than the first cluster. This group also uses technology mainly for entertainment, but is less dependent on it and has a neutral attitude towards the use of smart technologies in tourism.

3. Generation X tourists, who are technologically highly aware and travel frequently. Even if this group expresses awareness of privacy risks from technology use in travels, they use it not only for entertainment but also for information finding while on a trip and use technology intensively at a destination.

4. Technology-oriented young intensive travelers, who are not concerned with data privacy issues. This group is dominated by young millennials, mostly men, who use smart technologies at a destination more intensively than any other group while being least concerned with potential risks.

Another study [52] on the preconception of risk related to technology use by tourists has shown that, in general, the perceived benefits of smart devices outweigh the potential risks. Smart technologies have been proven to aid tourists in terms of cost-saving (while planning, browsing, booking or deciding on a tour), getting information while traveling and making the whole experience more convenient. The main worries for smart technology-using tourists are distrust towards the security of technology regarding location tracking, sensitive information privacy and financial transaction security. On the other hand, a study on ICT in tourism by Ramos-Soler et al. [74] shares a different perspective on the reception of technology by senior tourists: the authors of the mentioned study underline the concept that ICTs and applications are key tools for sustainability in tourism, especially at World Cultural Heritage Sites. Their study proved that these tools are essential for senior travelers and that they have a positive impact on their traveling experience.

2.4. Current Findings on ICT Use in Museums

As mentioned in the introduction, most of the research on ICT use in Smart Tourism has focused on the clients' perspective, and the service providers' point of view seems to be less frequently raised, let alone research that focuses on a specific branch, such as museums. However, some work in this field has already been undertaken, mainly by analyzing selected cases of museums that apply various ICTs or by reviewing a single technology and its benefits to museums.

From the perspective of Smart Tourism application in museums, all of the previously mentioned technologies can be of importance and use. Some studies focus on particular technologies, such as Near Field Communication (NFC), because museums—especially public ones—are often hosts of various meetings, conferences, incentives and most of all exhibitions. Findings from research in Columbia have shown that, in the modern world, NFC technology can be advantageous both for the organizers and participants of such events in tourism [75].

Smart technologies and the Internet of Things (IoT) in particular are not only useful solutions for tourists or valuable information sources about their behavior but can be also applied in museums to maintain perfect display conditions for valuable exhibits. A study from Naples shows that smart sensors can monitor the environment and provide information about the health status of cultural objects inside the museum [76].

Another technological solution that might find a broad application in smart museums is audio-guides. However, a study [77] that was dedicated to reviewing audio-guides in the era of Smart Tourism found that the use of audio-guides is still unexpectedly low. The study identified four major reasons for this: (1) firstly, in many cases, the environment is not audio-guide friendly, with too many noises and people who may disturb the listeners; (2) the use of audio-guide devices is still not user-friendly enough for casual users, who get frustrated when they have to operate the device when entering every new exhibition or change locations and eventually give up on using it; (3) the

devices also hinder any social activity and interaction between tour participants, making the whole experience feel extremely isolated; and finally, (4) the narrative of an audio-guide lacks the elasticity and individuality of a tour guided by a person, who can adapt to the needs of individuals (many tourists do not seek long detailed educational content, but would rather get brief information in favor of more entertainment, taking pictures and simply embracing the ambiance of a place). This shows that the simple adoption of technology is not enough to achieve "smartness" in tourism but rather creates good conditions to do so; in combination with other technologies such as Augmented Reality and a more individual approach to customer needs, the mentioned issues can be overcome, as Boletsis and Chasanidou [78] have shown in their work.

Another study by Empler [79] was dedicated to ICTs in museums; this work took the form of a case study on five museum installations in Italy. The study focused on already applied ICTs in the selected museums. The findings of this study were that, in museums with low numbers of artifacts and exhibitions, technology offers an additional commutation layer for additional information and the interactive enrichment of the visiting experience, offering unique visualizations of spaces and events that would otherwise be left to the imagination of the visitors. The author named three main groups who benefit from these solutions: school children (who become more engaged and attracted by gamification in the studied sites), tourists for whom the visited site was not their first choice (because they were only familiar with the most famous, main museums in city) and scholars (referring to scientists who specialize in the field of the given museum's theme).

One can also find examples of studies regarding the needs and expectations of museum visitors regarding ICT use in such sites. One such example is the study by Owen et al. [80], which was conducted in five Cultural Heritage sites in the UK. The research indicated the underutilization of ICTs in the studied cases. However, it also showed that visitors strongly support advanced applications, such as AR, interactive museum installations, avatar applications and mobile media guides. The respondents in this particular study also indicated that the variety of technologies used in a site has more impact on their satisfaction rating than how they are used. The main objective of such technology providers is to present the expected benefits that come from using technology to the visitor, because tourists have to decide what they will spend their limited time on and will not trade it off for something without knowing its possible advantages. As another example, in the study by Rey and Casado-Niera [81], the authors studied perceptions and expectations regarding the use of ICTs in museums based on a survey that was conducted on 115 participants. The study showed that many tourists are not fully aware of the possibilities and advances that ICTs offer. It is expected that ICTs will not be used as a replacement for traditional information carriers, but rather as tools that can enhance the visitors' experience by supplementing the already existing information and offering a cognitive and sensory addition to the experience. The expectations included also that ICTs would take a role that supports contact, information sharing and carrying out cultural activities. These observations are supported by a different study from Indonesia showing that if a museum falls behind the trend of introducing new technologies, it quickly loses its visitors because it gets perceived as boring, ancient and unmaintained [82] or not personalized enough for individual visitors [83].

Finally, it is worth underlining the fact that Smart Tourism does not only benefit tourists and tourist service providers but has a significant role in the sustainable development of the whole destination. Smart Tourism adopts the perspective that tourists generate information that can be used to track their activity and that this information can be utilized not only to improve their experience but also to help develop plans for the future in terms of better tourist distribution and the protection of the local society and natural resources [84]. Big Data is only one of many ICTs that can be useful for this; the Internet of Things, data mining, cloud computing and other modern technologies have expanded tourism to a new dimension, and they play now an important role in sustainable growth [85] as a development driver for tourism and society [33,70]. Many researchers confirm that Smart Tourism contributes to the creation of innovation and technology development and aids sustainability [70,86,87].

To conclude the theoretical section of this paper, it can be stated that the use of ICTs is inevitable in Smart Tourism, and the literature is full of different conceptions regarding its role and which particular technologies are key to its success. A large amount of research has been done analyzing the benefits of Smart Tourism application in tourist destinations, as well as on the potential benefits for tourists that ICTs can provide. Studies that focus on the service providers are rare, and works that focus on an entire branch, such as museums, are even scarcer. As presented in this section, the studies that do concentrate on museums are mainly case studies of specific institutions or are dedicated to a selected technology. This observation led the author of this publication to explore this field in more depth, adopting a more comprehensive approach and conducting research on all museums in a country (selecting their native country of Poland for the best communication possibilities with the researched entities and the best familiarity with their environment, as gathered from previous studies). The aim of this work was to recognize the cross-section of ICT use in the entire sector and the museum managers' attitudes towards adopting ICTs and the Smart Tourism concept. Museums seem to be an interesting choice because the most important and most recognizable (and therefore most visited) examples are public entities; therefore, they also reflect the national approach and policies of a given country to this concept.

3. Materials and Methods

According to the register of Polish museums published by the Ministry of Culture and National Heritage [88], there were 879 registered museum entities in the whole of Poland in April 2020. However, the list includes not only museums that are already operational, but also museums that are still in preparation or being organized. The list also contains departments of a parent entity (if a museum has one or more branches in different locations but are run by the same parent organization, each of them has a separate record on the list). Therefore, for this research, the list was narrowed down to active museums and only to the main parent units if a museum had multiple departments (thus, a record was excluded if it related to a museum that was marked as "in preparation" or as a branch of a main museum on the list). With those restrictions, the final list counted 500 entities.

For 2 months, from the beginning of May 2020 until the end of June 2020, an invitation to participate in the research and three reminding messages (with a 2-week interval) were sent via email (because of the COVID-19 restrictions) to the 500 museums. The respondents were asked to fill out an online form (using Google forms) that included 28 questions which provided the overall characteristics of a museum, listed the technologies used in it and provided an insight into the awareness of Smart Tourism and the application of technological solutions in that given museum. The questionnaire did not contain any questions about the museum's name and precise location to ensure anonymity. The research was anonymous because of the desire to obtain reliable information that was not burdened with the emotional factor of museums wanting to present themselves as better than their competitors. Figure 1 presents the described research process in a synthesized diagram form.
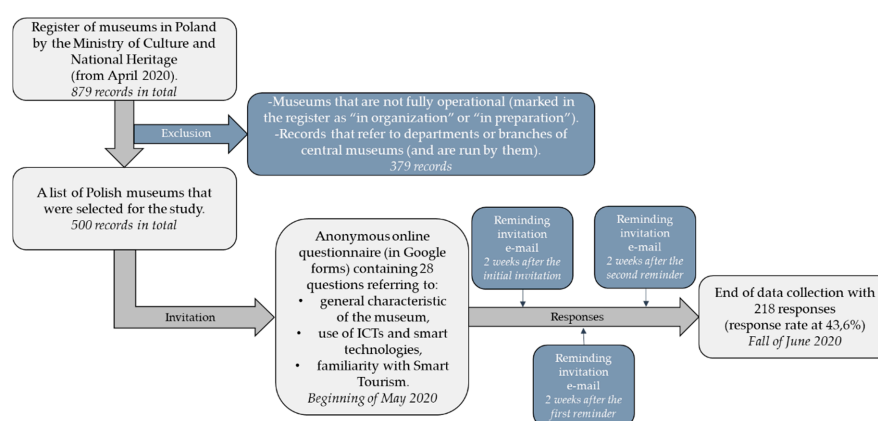

Figure 1. Research subject selection and data collection diagram.

Since the intention of the author was to keep the confidence interval below 5% at a confidence level of 95%, the sample size had to extend to over 217 respondents. This goal was reached at the end of June, when the 218th filled form was sent back to the author, and the data collection process was ended.

The collected data were analyzed and visualized using the R programing language and RStudio open software.

4. Research Results and Analysis

4.1. General Characteristics of the Research Sample

As mentioned above, 218 museums from across Poland participated in the presented research. The majority of the responses came from public museums (83.94%). The remaining answers came from private museums (10.09%) and the voluntary sector (5.05%), and two entities were marked as mixed (public–private) ownership (0.92%). The researched population differs from this proportion to a certain extent. The private sector makes up 32.02% of the 500 unique museums from the Ministerial list (and public entities make up the remaining 67.98%).

In Figure 2, one can see the spatial distribution of museums participating in the research, divided into voivodeships (administrative regions of Poland). Panel (a) shows the share of museums from a given voivodeship participating in the study, and in panel (b), the share of museums from a given voivodeship in the research sample is shown.
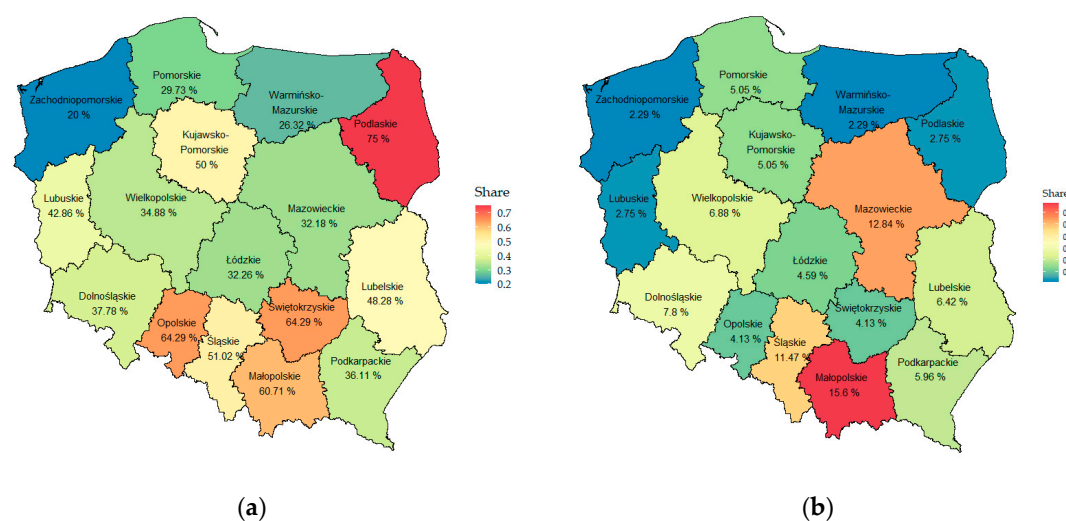

(**a**) (**b**)

Figure 2. The share of museums participating in the study, presented (**a**) as the percentage of all registered museums in a given voivodeship and (**b**) as a percentage of the total number of museums taking part in the research.

It can be seen that museums located in southern and eastern voivodeships showed the highest research participation turnout (with Podlaskie voivodeship museums reaching the highest response rate of 75%, and Zachodnioporskie exhibiting the lowest, at 20%). Additionally, the museums from southern and central Poland made up the majority of the research sample (with Małopolskie voivodeship having the highest share of 15.6%).

The first questions in the research form provided basic data that allowed the general characteristics of Polish museums to be obtained. One of the main parameters that describe these entities is the number of tourists visiting a museum annually. The participants were asked for the total number of tourists visiting their object in the previous year (2019). The main descriptive statistics for this variable are shown in Table 1.

Table 1. Descriptive statistics for the variable describing the number of tourists visiting Polish museums in 2019.

Statistic	Value
Min.	0
1st Quartile	7500
Median	20,000
Mean	84,768
3rd Quartile	64,427
Max.	2,320,000

As can be seen, the mean value is quite high, extending beyond the third quartile. This is because of the small number of museums with an extraordinarily high number of annual visitors in comparison to other museums; e.g., the internationally recognized museum in the former Auschwitz concentration camp (the maximum value probably comes from this site, but it is worth mentioning that the research forms were anonymous, so there is no certainty).

In Figure 3, the distribution of the annual tourist number is shown, varied by the sector of ownership (the mixed sector was omitted, since it contained only two observations, and for better clarity, the outlying values were also left out).
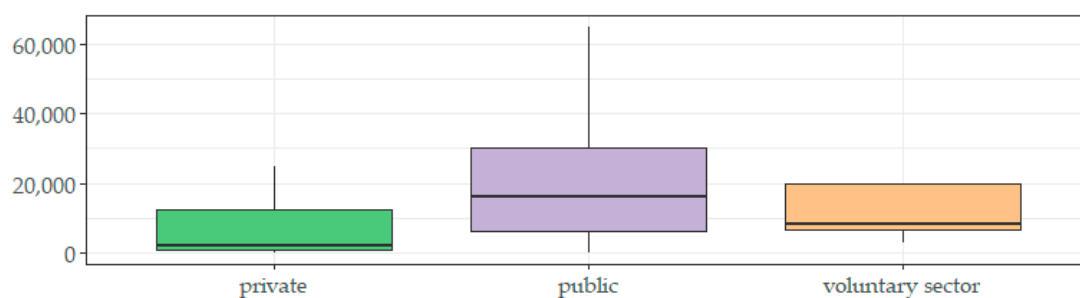
Figure 3. The annual number of tourists in Polish museums, varied by the type of ownership sector.

It can be seen that the number of tourists visiting public museums is much more varied than in the case of private museums or those from the voluntary sector. The value of the first quartile for the public sector is significantly higher than the median for the private sector and almost matches the median of the voluntary sector. One might assume that the reason for this may be the fact that many public museums offer free entry once a week, and because of the public funding, the entry tickets are often also cheaper during the rest of the week in comparison to private museums. Figure 4 shows this by illustrating the distribution of entry prices to museums from all three sectors, and Table 2 contains the descriptive statistics of this variable.
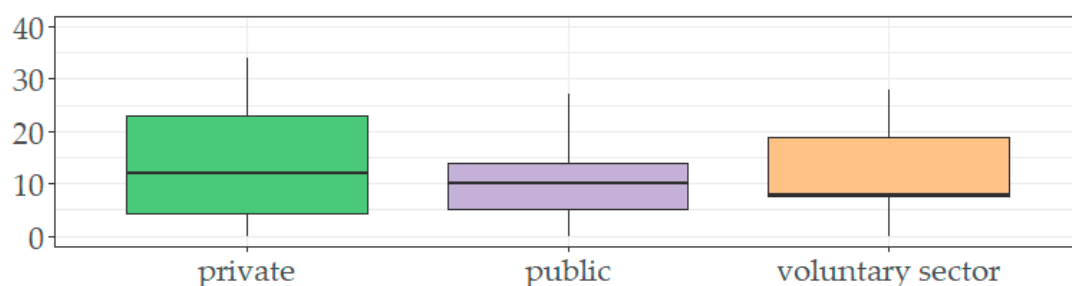

Figure 4. The entry ticket price to Polish museums (in PLN), varied by the type of ownership sector.

Table 2. Descriptive statistics for the variable showing the entrance fee in Polish museums.

Statistic	Value
Min.	0.0
1st Qu.	5.0
Median	10.0
Mean	11.4
3rd Qu.	15.0
Max.	70.0

The ticket price range for the museums in the public sector is visibly smaller than in the other two sectors. It is also worth mentioning that the shown prices are in Polish Złoty (PLN) (1 PLN ≈ 0.25 USD/0.22 EUR (by exchange rates from the beginning of July 2020)). Additionally, it should be noted that the respondents were asked to name the price for their most commonly chosen tour in case there were multiple variants available.

However, the assumed dependency between price and annual tourist count has been negated by a statistical test. The Pearson's correlation coefficient between those two variables indicates a moderate positive correlation (PCC = 0.59 and p-value $< 2.2 \times 10^{-16}$), meaning that the more popular a museum is, the higher the price (which is understandable and economically justified). Therefore, the reason for such a large number of people visiting public museums must be something other than their relatively low price; it is probably related to the quality of the exhibits and their better fit to the taste of mass visitors.

The last chosen general characteristic of Polish museums was their theme or discipline. Most entities (59.6%) from the research sample selected only one kind of theme that their museum focuses on; the remaining 40.4% can be tagged as interdisciplinary museums. In Figure 5, how often every kind of museum was selected by the respondents is shown.
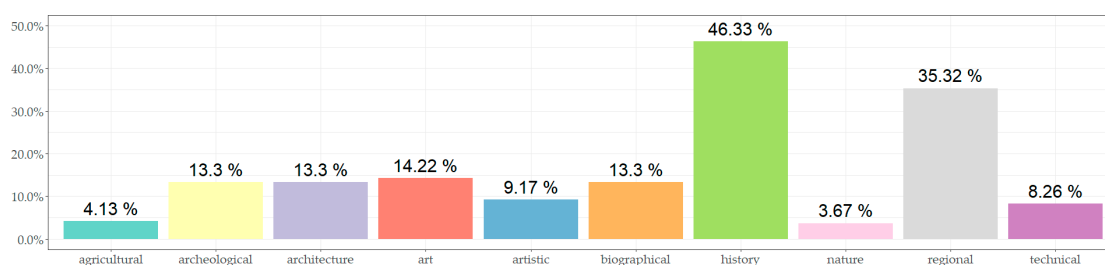
Figure 5. The share of selected kinds of museum selected by the research participants.

As can be observed in the plot above, almost half of the museums declared that history is their main domain, while over a third of the research sample represented regional museums. The least represented kinds of museum were nature and agricultural museums.

4.2. Smart Tourism in Polish Museums

The main objective of this study was to recognize the development stage of the Smart Tourism concept in Polish museums. To do so, it was important to approach this problem both directly and indirectly; the direct approach refers to the awareness of Smart Tourism solutions and their purposeful application in museums, while the indirect approach relates to the recognition of solutions that are used in Polish museums and are—or could be—used in Smart Tourism but are not recognized as such by the museum officials.

The direct approach was simple and straightforward. The representatives were asked if they were familiar with the Smart Tourism term (and if they were, they had to declare their attitude towards it). The share of responses to this question is depicted in Figure 6.
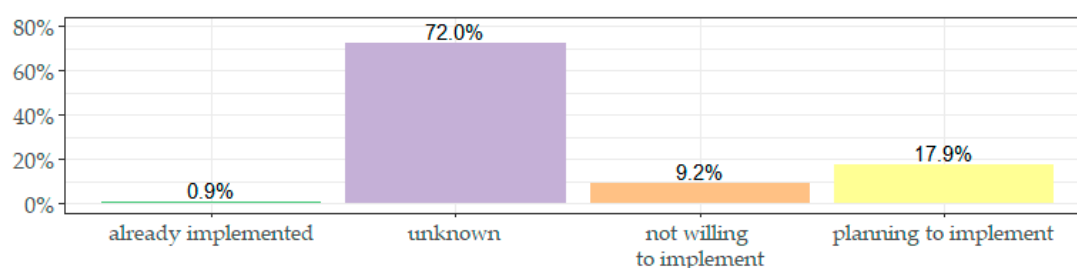
Figure 6. The recognition of Smart Tourism in Polish museums.

The collected data show that most (72%) of the museums in Poland were unfamiliar with the idea of Smart Tourism. Nearly a tenth (9.2%) declared that they knew the concept but were not planning to implement it, and only 17.9% were planning to do so in the future. Only a marginal fraction (0.9%) claimed that they had already realized this function. There was no significant difference in the distribution of the answers to this question in museums from various ownership sectors, kinds of museums or in museums run by different levels of administration.

Based on the data above, one might say that the development stage of Smart Tourism in Polish museums is low, at least in the area of its deliberate use. The following questions that were asked in the research form were designed to identify areas in which Smart Tourism has been implemented without that intention and to reveal the potential to change this low level of development of Smart Tourism.

First, the respondents were asked to select all the available tour types in their entity and to identify how common tours that use modern technology to extend the traditional sightseeing experience are. Figure 7 contains the percentages showing how often a given sightseeing option was confirmed by the respondents.
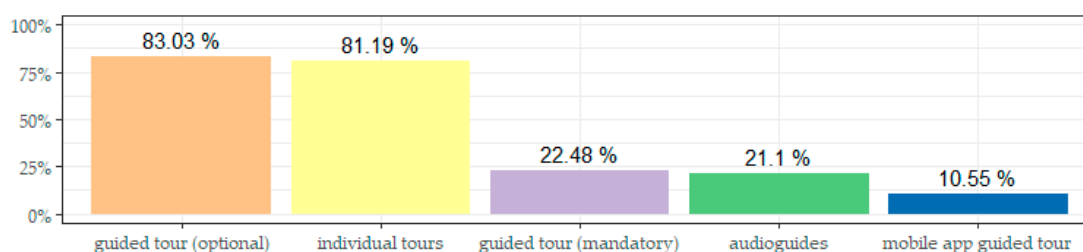

Figure 7. The forms of sightseeing available in Polish museums.

One can see that the majority of the researched museums used traditional forms of sightseeing, with over 80% of museums offering individual sightseeing or optionally guided tours. It may be argued that if 83.03% of museums offer guided tours as an option, the result of 22.48% of mandatory guided tours should be excluded; however, this might be explained by the fact that some museums offer various products (different routes or multiple locations), where some require a mandatory guide service and others do not. The fact that over a fifth (21.1%) of the researched entities offer audio guided tours and over a tenth (10.55%) incorporate tours that are guided through a mobile application should be noted as a positive input regarding Smart Tourism's development potential.

Furthermore, many researched sites declared that they were already planning to introduce more modern solutions to the visitors' experience. This is illustrated in Figure 8.
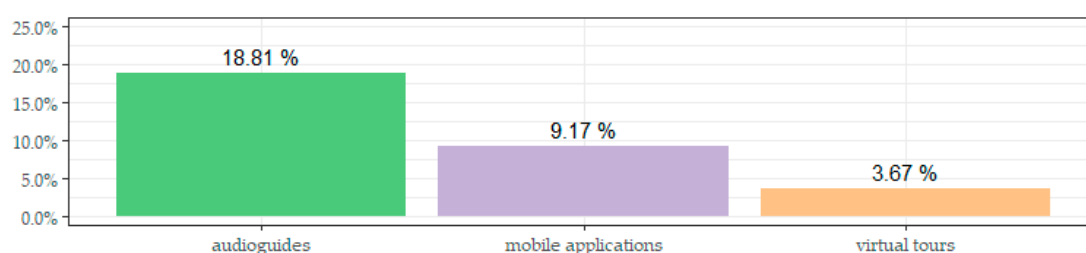
Figure 8. The forms of sightseeing that are planned for introduction in Polish museums.

Should these planned actions be realized, the total percentage of museums in Poland offering audio-guided tours would reach a decent share of approximately 40%, and the number of sites with the option of using mobile applications for guidance would double to a modest 20%.

One of the key aspects of Smart Tourism is to serve and support one of the main requirements of modern tourism—increasing a destination's attractiveness—and therefore to attract more tourists, both domestic and foreign. In this sense, the adaptation of a touristic entity to provide services in multiple languages might be considered to be another Smart Tourism development indicator. For this purpose, the study participants had to select the number of languages that were available for various sources of information about their site. Figure 9 presents the share of answers for each selected information source.
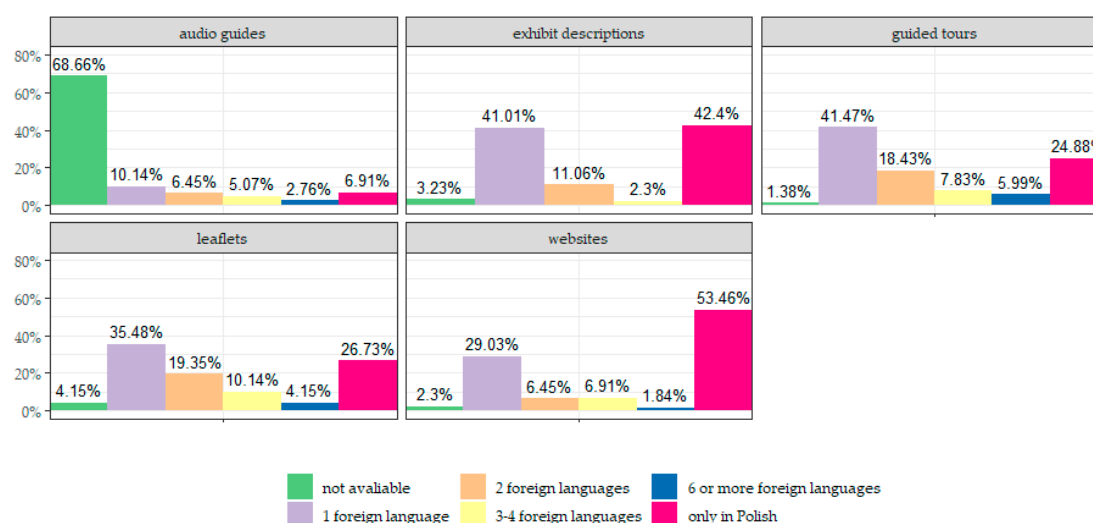

Figure 9. The number of available languages in selected information sources for museum visitors.

Interestingly, the collected data show that foreign languages are widely available in Polish museums, particularly in the case of guided tours. These tours are available in the Polish language exclusively in approximately only a quarter of the museums; the remaining majority of the researched entities offer these tours in at least one language other than Polish. Surprisingly, the websites are on the other end of the spectrum in this matter; over half (53.46%) of all museum websites are not available in languages other than Polish. This could be an area for relatively easy improvement in the future, especially because most of the researched sites have access to translation services and have already employed them for other materials, such as leaflets or information boards on the exhibits.

Continuing the subject of accessibility for foreigners and domestic visitors through modern media, the representatives of the researched museums were asked to name the mobile application in with their object is positioned. In Figure 10, the shares of museums using each selected mobile application are shown. The applications were selected based on one of the author's previous papers that was dedicated to the issue of mobile applications in tourism [89].
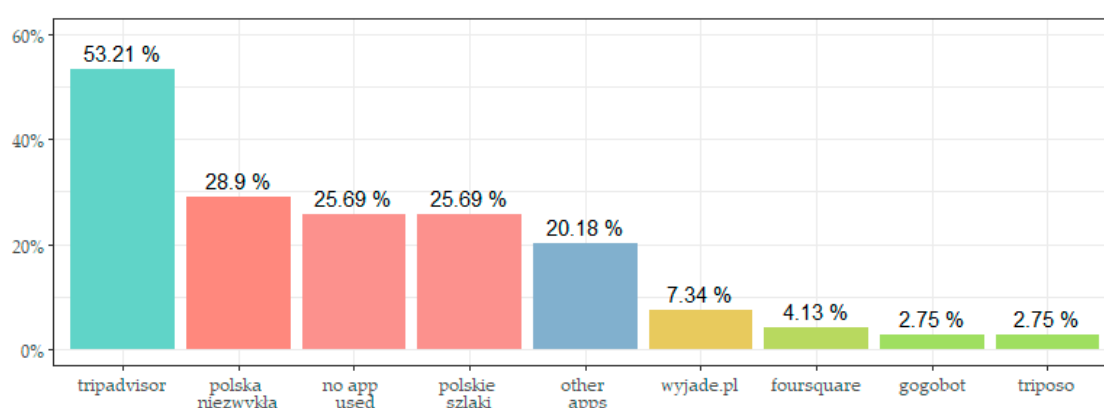
Figure 10. The presence of Polish museums in selected mobile applications.

Starting from the highest result, one may interpret the relatively high score of 53.21% of museums being registered on TripAdvisor as a positive result from the perspective of the potential of Smart Tourism in Polish museums. TripAdvisor is one of the most popular applications dedicated to tourists globally. Such a large share of museums using the service to make themselves easier to find for domestic and international tourists makes up to some extent for the lack of foreign languages on their websites. The second-highest score (28.9%) relates to "Polska Niezwykła," a Polish application with one of the richest databases of touristic sites in Poland [89]; unfortunately, this application supports only the Polish language. On the other hand, the fact that over a quarter (25.69%) of the museums do not use any mobile application to promote themselves leaves a significant unused potential that should be explored in the future. The fourth- and sixth-highest results also correspond to domestic applications, and the last three correspond to international apps (again, revealing a potential that has not yet been fully exploited). The bar named "other apps" refers to mobile applications that have been named by fewer than five respondents and were added together to form a single group.

The idea that the use of technology could be significantly improved in Polish museums is reinforced by further findings of this research. In the following question, the participants of the study were asked about the use of online systems for reservations on ticket sales. The answer distribution is pictured in Figure 11.
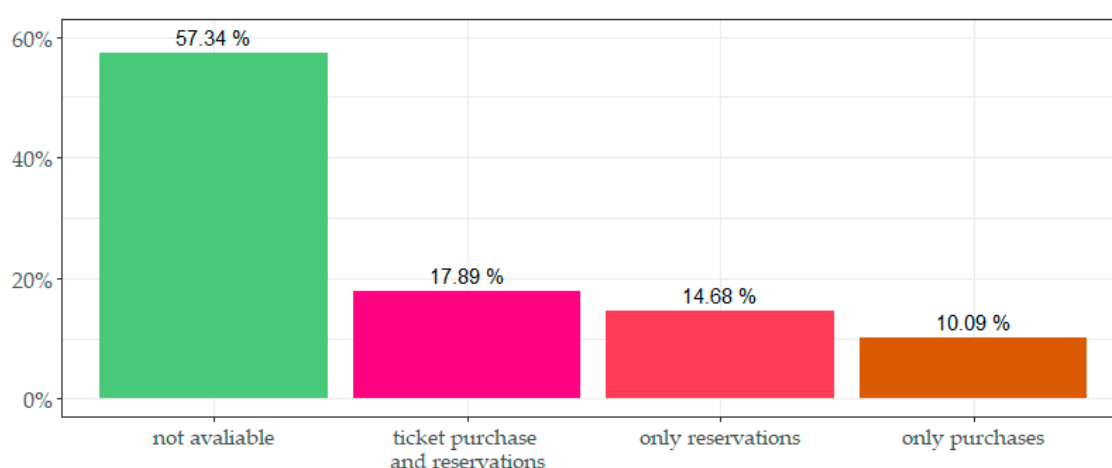

Figure 11. The availability of online tour purchases and reservations in Polish museums.

As shown above, more than half (57.34%) of museums in Poland do not use any online tools for ticket sales or reservations; these can only be made on-site or via a phone call. Less than a fifth (17.89%)

of the researched entities use online tools both for tour reservations and entry ticket sales, and the remaining quarter allow only one of those options—either reservations (14.68%) or purchases (10.09%).

Another important aspect of Smart Tourism is to not only use technological solutions to improve service quality and accessibility but also to use those inputs to collect and utilize data that could be used for future improvements as well as for other entities belonging to a larger structure, such as a Smart City. To explore this aspect in Polish museums, the research form included questions about the museum's approach to the collection of data (regarding clients, employees, finance, inventory, business partners, tour reservation history and tour sales). The respondents could choose one of the following options, for each kind of data: the data are archived, the data are kept only temporarily, the data are not collected, the data are collected and used to build a database or the data are only kept by the period required by law (i.e., for insurance or tax purposes). The results are visualized in Figure 12.
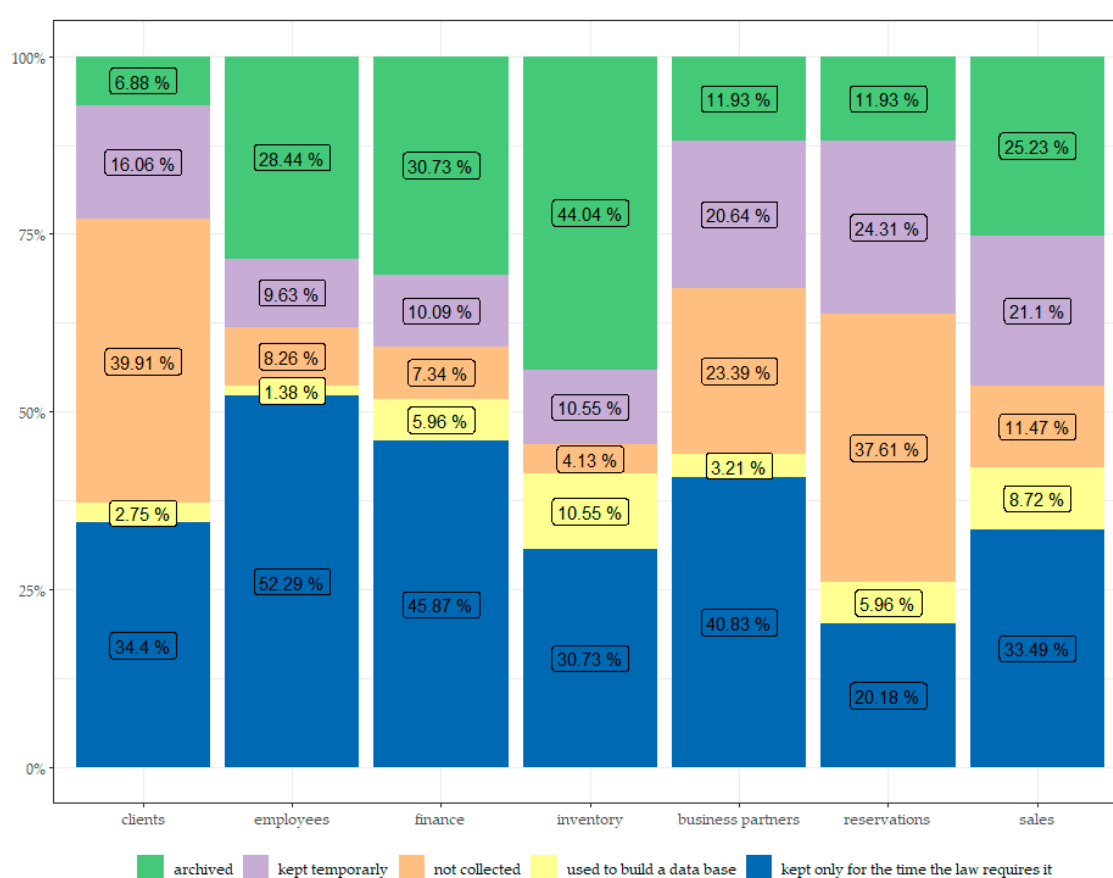

Figure 12. Data collection in Polish museums, varied by the subject that the data concern.

The attitude towards data collection in Polish museums varies depending on what the data concern. Surprisingly, the kind of data that is least recorded by the museums is about their clients (39.91% of all museums claim that they do not collect any data regarding their customers) and past reservations (37.61% of museums do not gather this information). It could also be considered unusual that the second-highest share of data, which is kept only because of legal restrictions, concerns business partners (40.83%, exceeded only by the 52.29% of data regarding employees). The information about a museum's inventory was named as the most frequently archived data (44.04%), as well as representing the highest share of the information used to build a database. The presented results might be interpreted as an indication of an outdated, old-fashioned approach to data exploitation in Polish museums. This is because the inventory data that are mostly archived and utilized in databases can be considered

the least useful for generating new knowledge; the data also do not lead to innovative solutions for providing services for tourists or giving related urban institutions information that could be used by them. The collection of these data is simply for the internal convenience of the museum in cataloging and keeping track of their exhibits. This thought is only reinforced by the results from a follow-up question that concerned the familiarity of museums with Big Data and its analysis. Figure 13 contains the results.
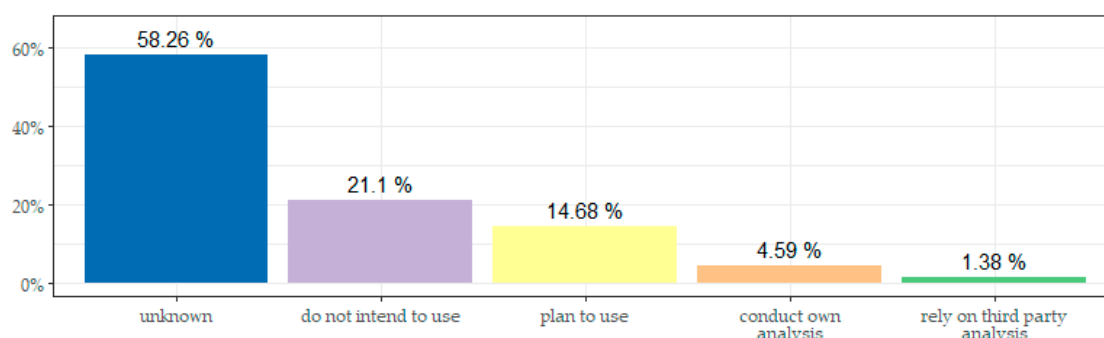

Figure 13. The recognition of Big Data and its use in Polish museums.

The majority (58.26%) of the researched museums are not familiar with the concept of Big Data, and the second biggest share (21.1%) of answers was for "we are familiar with it, but we do not use it and do not intend to do so in the future". Only a marginal (<6%) percentage of all researched museums claim to use Big Data and analyze it to improve their functionality, where 4.59% do their own research and 1.38% rely on analysis that is outsourced or prepared by parent institutions.

Smart Tourism does not only refer to the use of technology and information collection but also to the application of those means for a bigger cause—improving cooperation and achieving goals on a larger scale (within a Smart City, a region, a country or even larger scales). However, to do so, information, data and the knowledge gained from them need to be made accessible and be shared. Therefore, the research form included a question about the museum's attitude towards data sharing, and the results are shown in Figure 14.
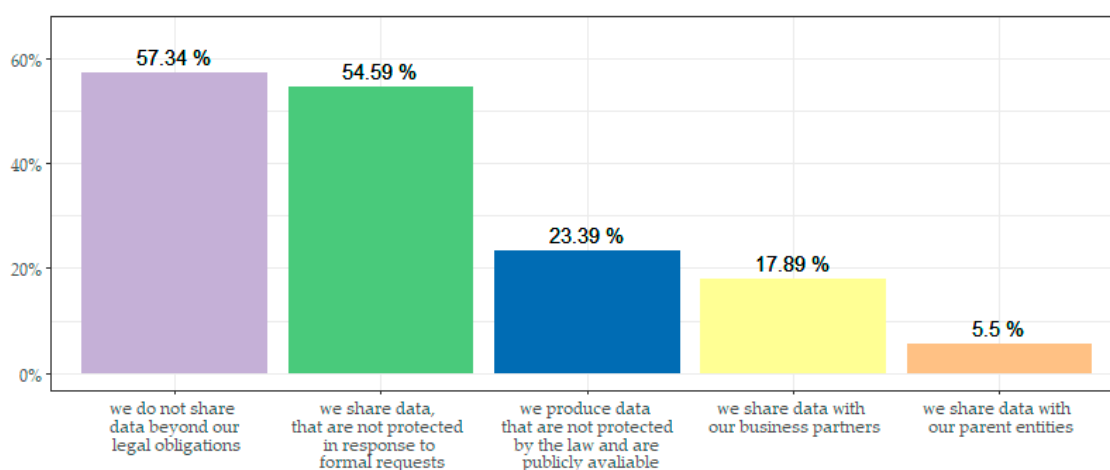

Figure 14. The attitude of Polish museums to data sharing.

The presented results show that the most common attitude towards data sharing is rather conservative, where over half (57.34%) of the museum representatives claimed that they do not share any information beyond legal obligations (resulting from contracts and law) on their own initiative. On the other hand, over half (54.59%) of the researched entities are willing to share information in

response to formal requests (i.e., from government units, researchers or statistical offices). Interestingly, even if the majority of the research sample was made up of public museums, only 5.5% of them agree to share data with parent institutions (i.e., the city hall or Marshal's Office). This, with the addition of the 17.89% share for data sharing with business partners, may indicate a lack of initiative regarding Smart Tourism in the environment in which the museums function. As the results show, most of the museums are able and willing to share data (this is indicated by the high share for the answer "we share data in response to requests"), but the surrounding environment (local and national policies, public and business entities) is simply not oriented to gathering and utilizing data yet and therefore does not demand it.

Knowing that most Polish museums are not familiar with the popular concept of Big Data, but also knowing that a significant portion of the information is being kept by them (in the form of temporary storage, archive or even a database), the next question asked in the research form was specifically about the use of databases by business partners, clients, contractors and suppliers that cooperate with the investigated museums. The received answers may appear to be somehow inconsistent with the previous answers, as shown in Figure 15.
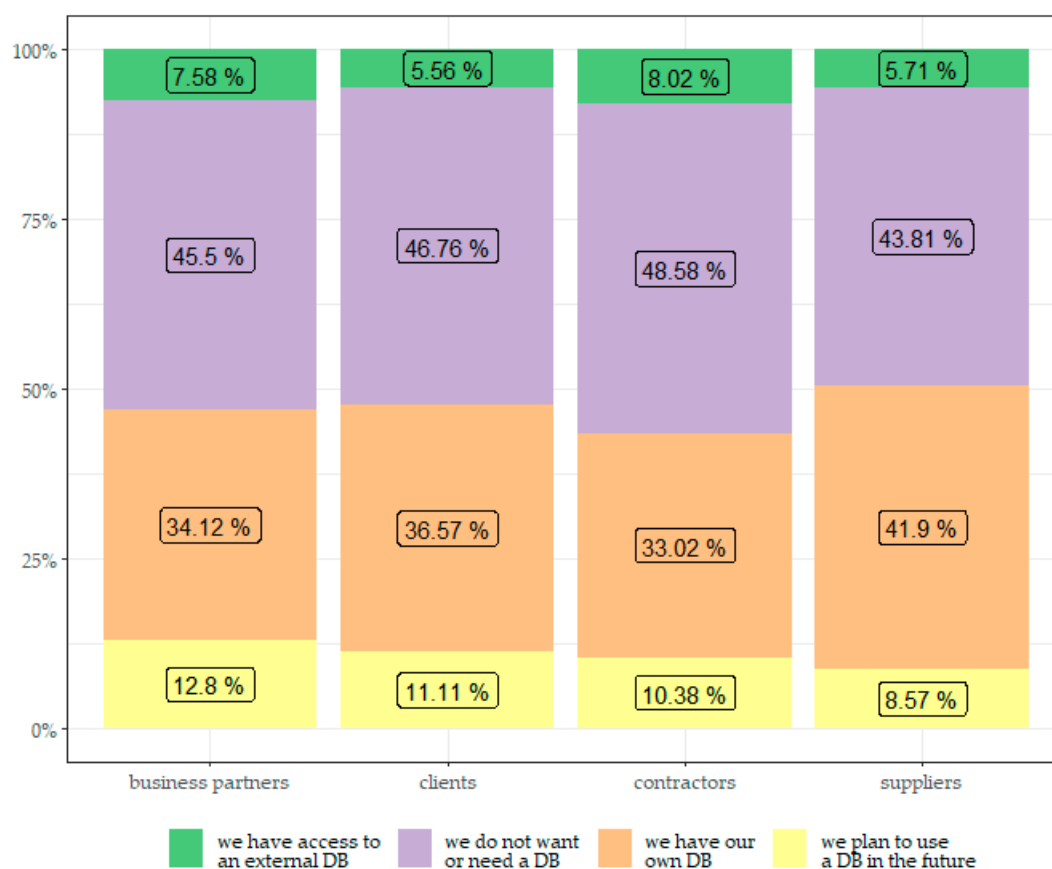

Figure 15. The use of databases in Polish museums, varied by subject. DB: database.

It should be noted that, even if the highest share of all database subject categories corresponded to the statement that a given museum does not need a database, all the other answers indicate a higher level of database use (over 40% in all categories when combining the use of a museum's own and external databases) than might arise from the previously discussed results (from Figure 11 especially). A probable explanation for this that provides consistency to the logic of those answers might be that the museums use databases to store information that in previous questions were marked as only being kept temporarily or only for the time required by law. If so, this might be another field for improvement

in the future: the awareness of the importance of data gathering and processing could be increased through a better understanding of and orientation toward Smart Tourism.

To complete the investigation on the use of Smart Tourism-oriented technology in Polish museums, the final three questions concerned technologies used for communications, divided into the use of (1) social media, (2) means of communication and (3) modern technologies used in the everyday functioning of a museum. The social media question referred to the assessment of the frequency of use of a given medium by the museum to inform customers about its activity. The respondents could use an ordinal scale (from never to constantly) to assess the frequency of use of 11 globally recognizable social media platforms (Facebook, Instagram, LinkedIn, Pinterest, Reddit, Snapchat, TikTok, Tumblr, Twitter, WeChat and YouTube), as well as naming others if they used a medium not included on the list. From those 11 selected social media platforms, seven were not used by most of the researched entities (where 93% or more of the museums claimed they never used it). The distribution of given answers for the remaining four social media platforms is shown in Figure 16.
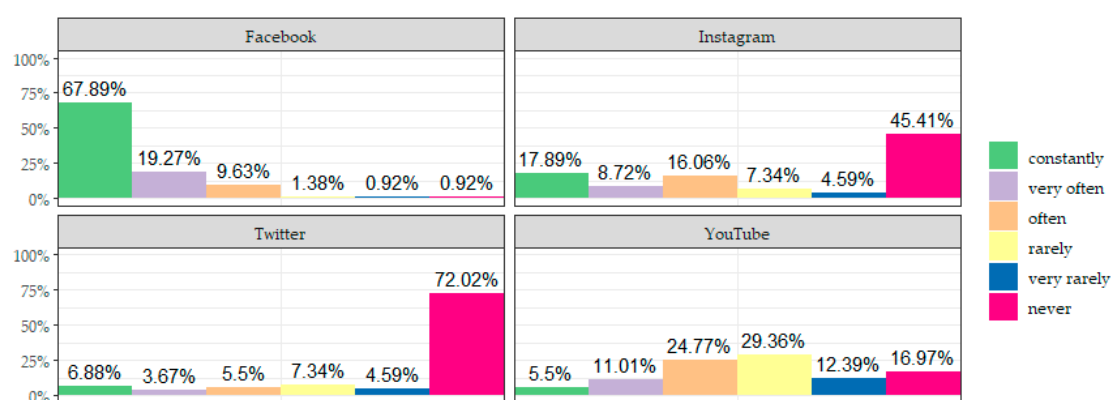

Figure 16. The use of social media by Polish museums.

It can be is seen that, apart from Facebook, social media platforms are used by the museums in Poland rather scarcely, with YouTube being the second most used by most of them. Given the fact that those two media platforms have been available for more than a decade, they do not attract the youngest audience, who have migrated to newer media platforms that are growing in popularity. Therefore, those should be seen as more representative of today's standard, which may quickly change in the future. The recommendation here would be to invest more interest into newer social media platforms to keep pace with "tomorrow's" customers and to awaken more interest in culture and history in today's youth by reaching out to them through media and content they find interesting and appealing today (the latest studies have shown that Facebook is aging with its users, and younger users, although present there, use other platforms such as Snapchat or Instagram more extensively [90,91].

To complement the previous question, the museum representatives were asked to select which means of communication are used within the institution and which are used when contacting customers or business partners. The respondents could choose between yes or no answers for each recipient group and each communication platform listed (12 in total). The share of positive answers for each option is shown in Figure 17.

The results show clearly that some communication media are preferred by the museums over others, regardless of the type of recipient. Phone calls (both cellular and landline) and e-mail are the most frequently used in contacts with clients, partners and within institutions. Additionally, short messages and the Facebook Messenger application are used by a significant share of museums, primarily, but not only, for internal communication. Surprisingly, although the study was conducted after the strictest COVID-19 restrictions in Poland had been introduced, the communication media that aid distance working (via videoconferencing) were selected only by a minority of respondents. The picture emerging from these results suggests that the museums' approach towards means of

communication is rather conservative, and they rely on traditional and standardized solutions. At the same time, they also indicate that there is a portion of employees who are familiar with alternative solutions but that those are kept for internal matters and not utilized for the external issues of the institution.
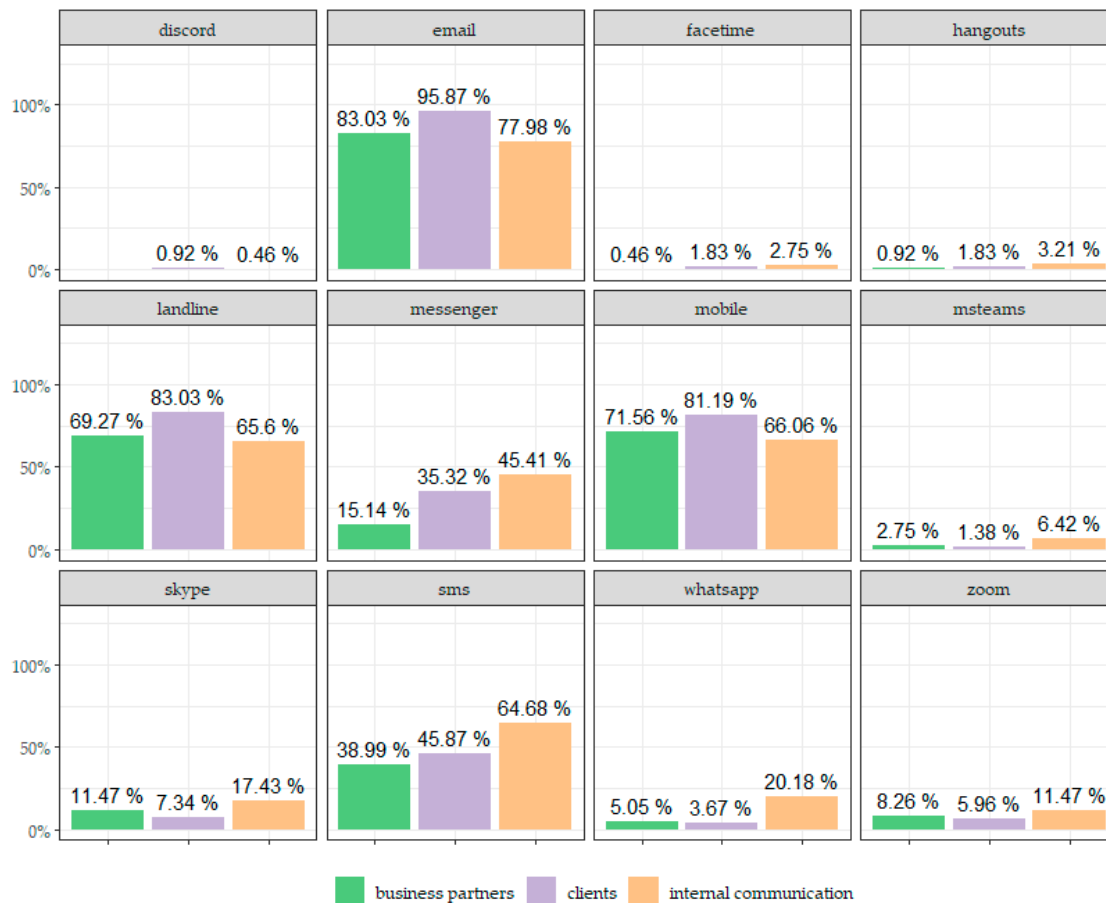

Figure 17. The means of communication used in Polish museums.

The closing question in the research form was designed to recognize the use of selected ICT technologies in Polish museums, concluding the investigation into the familiarity and application of Smart Tourism solutions in those cultural institutions. The share of answers describing the current state of use of seven selected technologies is shown in Figure 18.

It can be seen that the technology that is already used by the highest share (50%) of museums is virtual touring. This technology was selected as "already used" multiple times more frequently than any other listed technology (the second highest result was 15.14% for cloud computing). Moreover, 36.7% of museums decided they were interested in this technology and are planning to also introduce it in the future. Virtual tours were the second highest ranking (36.7%) technology planned for implementation, immediately behind the desire to design a dedicated mobile application for a given museum (37.16%). At this point, it is worth remembering that, according to the previous results, over half of the museums have websites available only in the Polish language and another third in only one foreign language (presumably English). Apart from virtual tours, other technologies listed in the form were selected by a comparable fraction of museums as solutions that are not used by them (ranging from 29.36% to 40.83%). Two of the listed technologies were selected as unknown by approximately half of the museums: the Internet of Things (53.21%) and NFC with RFID (48.17%). Those two technologies are often used in modern ICT and play a significant role in the smart concept (in Smart Homes, Smart Cities and consequentially in Smart Tourism). The high rate of unfamiliarity in this matter is yet another

indicator that museums in Poland could increase their Smart Tourism potential and are not fully ready to embrace this concept without several improvements (mentioned earlier when they emerged from the presented results). The main reason for this is probably not the lack of will on the side of the museums' management but rather a matter of regional and national policies that are still not fully oriented towards introducing Smart Tourism into Polish museum tourism; thus, the museums are not required to embrace those solutions.
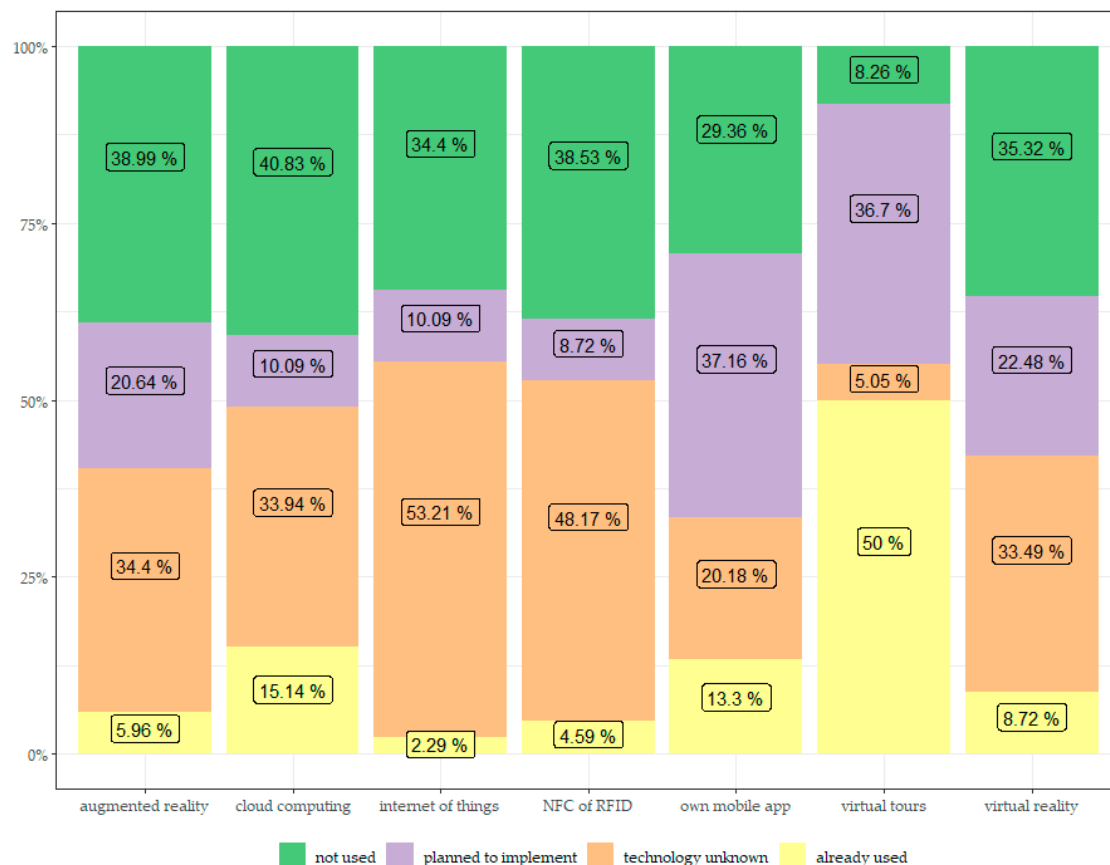

Figure 18. The recognition and use of various technologies in Polish museums.

5. Discussion and Conclusions

Based on the research results, the main observation that can be made is that Smart Tourism is a rather unknown concept to museums in Poland. However, the findings have also shown that there is some potential that would ease the introduction of this concept.

Traditional tours in Polish museums are the dominant form of sightseeing, but many museums have introduced technical solutions that support their operation. Many museums plan to develop in this area, especially by increasing the availability of audio-guided tours (if the museums fulfill their declarations, the availability of this solution should reach 40%) and designing their mobile applications (the expected availability would reach approximately 20%).

Concerning the handling of the needs of international tourists, the research has shown great differences in this matter depending on the given aspect of a museum's operation. Most of the museums offer guided tours in at least one language other than Polish; on the other hand, over half of the museums' websites are only available in Polish and therefore are not suited for foreigners to find information there directly. This paucity is however compensated to some extent by the fact that over half of the researched entities are registered in an internationally recognized service; i.e., TripAdvisor.

Similar diversity pertains to the use of technology in museums. A prominent majority of the institutions in Poland do not enable customers to buy or reserve tours via an online system. Additionally, data and information that are or could be gathered by museums are not utilized to their full potential; often, they are not stored or are only kept to fulfill legal obligations. In the most developed regions of the world that focus on sustainability and use technology to aid it, tourism is required to match and keep up with the development of a Smart City. The flow of data and information, as well as their understanding, analysis and effective use to gain benefits throughout this structure, form the basis of this smart system. However, to do so, the public sector must undertake awareness-raising actions and prepare courses on the use of appropriate data analysis tools for public institution workers. As the research results have shown, Big Data analysis and the building and using of databases are sparsely present in Polish museums. It is possibly even implied that museum management assumes that future tourism will not differ from how it is conducted today, and that the use of technology is only an oddity or an additional feature to their business, rather than the basis of future operation (this thought emerges from the fact that many museums are interested in creating mobile apps and creating virtual tours on their websites while there is simultaneously a low interest in the Internet of Things concept or the use of cloud computing and other crucial Smart Tourism solutions).

The museums' attitude towards social media and communication platforms seems also not to follow the newest trends, and they rather use traditional (in today's standards) solutions, focusing their Internet activity on Facebook and occasionally on YouTube. Reaching out and raising interest in culture for young generations of tourists might require opening up to other communication channels that reach them more effectively. The same might also apply to the expectations and needs of international tourists who come from wealthier and more developed countries, in which newer social media and communication platforms are more popular among a broader population. For example, foreign tourists might not want to risk expensive international phone calls to gain information or make a reservation for a museum tour, and the lack of an immediate response through e-mail communication might be discouraging for them. A solution to this might be for museums to use not only traditional phone services for their booking service but also online communicators alongside them (i.e., WhatsApp).

The presented observations can be used to formulate recommendations for museums and regional administrations, which would increase Smart Tourism's potential and allow for a full adaptation of the concept in the future. These recommendations are presented as follows.

1. Official museum websites would benefit from being translated into English (and maybe other languages), or at least parts of them containing basic information about the institution (opening time, contact, available kinds of tours and pricing).
2. The museums should continue to mark their presence in mobile applications and continue to expand the information about themselves in those media while also taking into consideration and concentrating more on the needs of both domestic and foreign tourists.
3. In the long-term perspective, the reservation and ticket sales systems should be modernized and become available via the Internet. In times when people can book a restaurant table or reserve an appointment in a barbershop through a dedicated service or a mobile app and official matters can be handled completely through a government website, one might expect the same functionality to be available in cultural institutions such as museums (which, as has been shown in the results, are mainly public entities).
4. It is important to raise awareness of how useful and valuable it is to gather, keep and analyze information. Even if, at first glance, Big Data might seem not to be of the highest importance, from the museum's perspective, it plays a key role in the whole "ecosystem" of a Smart City. Therefore, it is indirectly related to the operating of museums and in the end can provide benefits in the form of better infrastructure, more recognition and attracting more visitors. The gathered data could be also used to build databases that are of use for museums.
5. The museums' presentation and promotion of offers should expand to more social media platforms, especially those that are gaining global popularity. Furthermore, the contact options could be

supplemented by a wider spectrum of communication platforms—mainly online—that could be used both (1) to reach technology-oriented customers (2) and in times when the traditional functioning of a museum is disturbed (as in the case of the COVID-19 pandemic outbreak).

6. For the previous recommendations to be effective, it is important to consider Smart Tourism orientation in development plans for cities and regions by setting guidelines and requirements that have to be met. Without those, the intrinsic implementation of Smart Tourism solutions will remain dependent only on the intentions and goodwill of museum officials (and as the study has shown, there is no conviction of its importance for the future of museum tourism inside of those institutions).

One of the main contributions of this study to the field is a comprehensive summary of ICT and technology use in Polish museums, which may be representative for countries in a similar stage of development that already embrace new technologies in the public domain but in which the adaptation of the Smart Cities concept is limited to few major cities (and not to its full extent). It shows the cross-section of to which extent each technology is used on average in this particular branch of tourism. The study has also shown that museums' use of new technologies and ICTs is rather selective, with museums most of the time limiting themselves to technologies that are well-known and already solidly established in the mainstream while also viewing them as an optional oddity and as an additional attraction that does not represent the core of future services. Therefore, the study confirms that the hypothesis by Dorcic et al. [31] (that stakeholders do not fully recognize and appreciate the importance of ICTs and their benefits) also applies to museums.

The identified weaknesses and areas that need development should be solved and removed over time. A network approach on the city level (or even wider) to information and knowledge sharing would help in the area of effective data collection and utilization, as well as knowledge and information sharing, which was identified to be a weak spot in the studied entities. Additionally, a successful application of such network solutions would also aid in the process of the adoption of the Smart City concept (and consequently Smart Tourism), as it is one of its core elements [1,41,48]. Better funding programs and improved policies that support new technology being introduced into the public domain are also an important improvement that has to be made. Referring back to Pradhan [52], it is a key task for tourism stakeholders to keep up with technologies and introduce a variety of them, not only because they are key for further development but also, as Owen et al. [80] observed, if presented as advantageous for tourists and used in a variety of ways, they have a significant impact on tourists' satisfaction. One might also expect that, because of this effect, private museums will be the first to follow this path (their actions are not as limited by funding and law policies but driven by the free market, and therefore clients' satisfaction is key for their survival), and afterward, public entities will follow to meet the standards set by the private sector to stay competitive. The same effect is expected to occur in the area of museums meeting the needs and expectations of international travelers that were currently identified to be lacking. Additionally, the development of society and the further popularization of Smart Cities is also expected to be of help in this case, since it is based on the evolution of society; as the concept of Smart People increases in recognition, the public will become more tolerant, cosmopolitan and open to the needs of others [35–37].

The conducted research has some limitations. The main limitation is that the final research sample contained a greater proportion of public museums to private ones than in the general population that was researched. Therefore, the finding concerning private entities may not show the full picture of the Smart Tourism potential in this sector. The second limitation is that the study concerned only the internal state of the museums.

Future studies could supplement these findings by adding observations from the macro- and microenvironment of museums. City and regional policies, as well as national regulations and funding policies, could provide a wider perspective on the current state of Smart Tourism development in Poland. The presented results might also be useful in other studies on the same or related subjects in other countries, providing a reference point for comparisons and benchmarking.

References

1. Komninos, N. *The Age of Intelligent Cities: Smart Environments and Innovation-for-All Strategies*; Routledge: London, UK, 2014.
2. Battino, S.; Lampreu, S. The role of the sharing economy for a sustainable and innovative development of rural areas: A case study in Sardinia (Italy). *Sustainability* **2019**, *11*, 3004. [CrossRef]
3. Mathews, S.; Bianchi, C.; Perks, K.J.; Healy, M.; Wickramasekera, R. Internet marketing capabilities and international market growth. *Int. Bus Rev.* **2016**, *25*, 820–830. [CrossRef]
4. Ferrero, R.; Beattie, E.; Phoenix, J. Sensor city-A global innovation hub for sensor technology. *IEEE Instrum. Meas. Mag.* **2018**, *21*, 4–16. [CrossRef]
5. Law, R.; Buhalis, D.; Cobanoglu, C. Progress on information and communication technologies in hospitality and tourism. *Int. J. Contemp. Hosp. Manag.* **2014**, *26*, 727–750. [CrossRef]
6. Ghaderi, Z.; Hatamifar, P.; Henderson, J.C. Destination selection by smart tourists: The case of Isfahan, Iran. *Asia Pac. J. Tour. Res.* **2018**, *23*, 385–394. [CrossRef]
7. Semerádová, T.; Vávrová, J.N. Using a systemic approach to assess Internet marketing communication within hospitality industry. *Tour. Manag. Perspect.* **2016**, *20*, 276–289. [CrossRef]
8. Buhalis, D.; O'Connor, P. Information communication technology revolutionizing tourism. *Tour. Recreat. Res.* **2015**, *30*, 7–16.
9. Aurélien, D.; Desiré, R. An Evaluation of Destination Management Systems in Madagascar with Aspect of Tourism Sector. *Am. J. Ind. Bus. Manag. Sci. Res. Publ.* **2014**, *4*, 9. [CrossRef]
10. Alaei, A.R.; Becken, S.; Stantic, B. Sentiment Analysis in Tourism: Capitalizing on Big Data. *J. Travel Res.* **2019**, *58*, 175–191. [CrossRef]
11. Jovicic, D.Z. From the traditional understanding of tourism destination to the smart tourism destination. *Curr. Issues Tour.* **2019**, *22*, 276–282. [CrossRef]
12. Talón-Ballestero, P.; García-Muiña, F.E.; Rienda-Gómez, J.J.; González-Serrano, L. Repeat Consumer Behavior on Smart P2P Tourism Platforms. *Sustainability* **2019**, *11*, 7082. [CrossRef]
13. Femenia-Serra, F.; Perles-Ribes, J.F.; Ivars-Baidal, J.A. Smart destinations and tech-savvy millennial tourists: Hype versus reality. *Tour. Rev.* **2019**, *74*, 63–81. [CrossRef]
14. Gretzel, U.; Zhong, L.; Koo, C.; Cacho, A.; Mendes-Filho, L.; Estaregue, D.; Alves, C.; Moura, B.; Cacho, N.; Lopes, F. Mobile tourist guide supporting a smart city initiative: A Brazilian case study. *Int. J. Tour. Cities* **2016**, *2*, 164–183.
15. Lepkowska-White, E.; Parsons, A. Strategies for monitoring social media for small restaurants. *J. Foodserv. Bus. Res.* **2019**, *22*, 351–374. [CrossRef]
16. Wang, X.; Li, X.R.; Zhen, F.; Zhang, J. How smart is your tourist attraction? Measuring tourist preferences of smart tourism attractions via a FCEM-AHP and IPA approach. *Tour. Manag.* **2016**, *54*, 309–320.
17. Xiang, Z.; Magnini, V.P.; Fesenmaier, D.R. Information technology and consumer behavior in travel and tourism: Insights from travel planning using the internet. *J. Retail. Consum. Serv.* **2015**, *22*, 244–249. [CrossRef]
18. Koo, C.; Shin, S.; Gretzel, U.; Hunter, W.C.; Chung, N. Conceptualization of smart tourism destination competitiveness. *Asia Pac. J. Inf. Syst.* **2016**, *26*, 561–576. [CrossRef]
19. Xu, F.; Huang, S.; Li, S. Time, money, or convenience: What determines Chinese consumers' continuance usage intention and behavior of using tourism mobile apps? *Int. J. Cult. Tour. Hosp. Res.* **2019**, *13*, 288–302. [CrossRef]
20. Kim, M.J.; Chung, N.; Lee, C.K.; Preis, M.W. Motivations and Use Context in Mobile Tourism Shopping: Applying Contingency and Task-Technology Fit Theories. *Int. J. Tour. Res.* **2015**, *17*, 13–24. [CrossRef]
21. Wang, D.; Xiang, Z.; Fesenmaier, D.R. Smartphone use in everyday life and travel. *J. Travel Res.* **2016**, *55*, 52–63. [CrossRef]

22. Garcia-Madariaga, J.; Recuero Virto, N.; Blasco López, M.F.; Aldas Manzano, J. Optimizing website quality: The case of two superstar museum websites. *Int. J. Cult. Tour. Hosp. Res.* **2019**, *13*, 16–36. [CrossRef]

23. Dickinson, J.E.; Ghali, K.; Cherrett, T.; Speed, C.; Davies, N.; Norgate, S. Tourism and the smartphone app: Capabilities, emerging practice and scope in the travel domain. *Curr. Issues Tour.* **2014**, *1*, 84–101. [CrossRef]

24. Rasinger, J.; Fuchs, M.; Höpken, W. Information Search with Mobile Tourist Guides: A Survey of Usage Intention. *Inf. Technol. Tour.* **2007**, *9*, 177–194. [CrossRef]

25. Vecchio PDel Mele, G.; Ndou, V.; Secundo, G. Creating value from Social Big Data: Implications for Smart Tourism Destinations. *Inf. Process. Manag.* **2018**, *54*, 847–860. [CrossRef]

26. Del Chiappa, G.; Baggio, R. Knowledge transfer in smart tourism destinations: Analyzing the effects of a network structure. *J. Destin. Mark. Manag.* **2015**, *4*, 145–150. [CrossRef]

27. Pine, B.J.; Gilmore, J.H. Welcome to the experience economy. *Harv. Bus Rev.* **1998**, *76*, 97–105.

28. Neuhofer, B.; Buhalis, D.; Ladkin, A. Smart technologies for personalized experiences: A case study in the hospitality domain. *Electron. Mark.* **2015**, *17*, 243–254. [CrossRef]

29. Gomez-Oliva, A.; Alvarado-Uribe, J.; Parra-Meroño, M.C.; Jara, A.J. Transforming Communication Channels to the Co-Creation and Diffusion of Intangible Heritage in Smart Tourism Destination: Creation and Testing in Ceutí (Spain). *Sustainability* **2019**, *11*, 3848. [CrossRef]

30. Cuesta-Valiño, P.; Bolifa, F.; Núñez-Barriopedro, E. Sustainable, Smart and Muslim-Friendly Tourist Destinations. *Sustainability* **2020**, *12*, 1778. [CrossRef]

31. Dorcic, J.; Komsic, J.; Markovic, S. Mobile technologies and applications towards smart tourism–state of the art. *Tour. Rev.* **2019**. [CrossRef]

32. Guzal-Dec, D.; Zwolinska-Ligaj, M. The social field of smart villages concept: The case of peripheral region—Lublin province in Poland. In Proceedings of the 2018 International Conference Economic Science for Rural Development, Jelgava, Latvia, 9–11 May 2018; Volume 49, pp. 296–306.

33. Buhalis, D.; Amaranggana, A. Smart Tourism Destination. In *Information and Communication Technologies in Tourism*; Xiang, Z., Tussyadiah, I., Eds.; Springer International Publishing: Cham, Switzerland, 2014; pp. 553–564.

34. Hollands, R.G. Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? *City* **2008**, *12*, 303–320. [CrossRef]

35. Vanolo, A. Smartmentality: The smart city as disciplinary strategy. *Urban Stud.* **2014**, *51*, 883–898. [CrossRef]

36. Caragliu, A.; Del Bo, C.; Nijkamp, P. Smart Cities in Europe. *J. Urban Technol.* **2011**, *18*, 65–82. [CrossRef]

37. Lombardi, P.; Giordano, S.; Farouh, H.; Yousef, W. Modelling the smart city performance. *Innov. Eur. J. Soc. Sci. Res.* **2012**, *25*, 137–149. [CrossRef]

38. Harvey, D.; Harvey, F.D. *Spaces of Hope*; University of California Press: Berkeley, CA, USA, 2000; Volume 7.

39. Davis, M. Who Will Build The Ark? *New Left Rev.* **2010**, *61*, 29–46.

40. Shen, S.; Sotiriadis, M.; Zhang, Y. The Influence of Smart Technologies on Customer Journey in Tourist Attractions within the Smart Tourism Management Framework. *Sustainability* **2020**, *12*, 4157. [CrossRef]

41. Celdrán-Bernabeu, M.A.; Mazón, J.N.; Ivars-Baidal, J.A.; Vera-Rebollo, J.F. Smart tourism. A study on systematic mapping. *Cuad. Tur.* **2018**, *41*, 655–658. [CrossRef]

42. Khan, M.S.; Woo, M.; Nam, K.; Chathoth, P.K. Smart City and Smart Tourism: A Case of Dubai. *Sustainability* **2017**, *9*, 2279. [CrossRef]

43. Chung, H.C.; Chung, N.; Nam, Y. A Social Network Analysis of Tourist Movement Patterns in Blogs: Korean Backpackers in Europe. *Sustainability* **2017**, *9*, 2251. [CrossRef]

44. Kiatkawsin, K.; Sutherland, I.; Lee, S.K. Determinants of Smart Tourist Environmentally Responsible Behavior Using an Extended Norm-Activation Model. *Sustainability* **2020**, *12*, 4934. [CrossRef]

45. Femenia-Serra, F.; Neuhofer, B.; Ivars-Baidal, J.A. Towards a conceptualisation of smart tourists and their role within the smart destination scenario. *Serv. Ind. J.* **2019**, *39*, 109–133. [CrossRef]

46. Gretzel, U.; Sigala, M.; Xiang, Z.; Koo, C. Smart tourism: Foundations and developments. *Electron. Mark.* **2015**, *25*, 179–188. [CrossRef]

47. Vargas-Sánchez, A. Exploring the concept of smart tourist destination. *Enl. Tour. Pathmak. J.* **2016**, *6*, 178–196.

48. Buhalis, D. Technology in tourism-from information communication technologies to eTourism and smart tourism towards ambient intelligence tourism: A perspective article. *Tour. Rev.* **2019**, *75*, 267–272. [CrossRef]

49.	Colby, C.; Bell, K. The On-Demand Economy Is Growing, and Not Just for the Young and Wealthy. Available online: https://hbr.org/2016/04/the-on-demand-economy-is-growing-and-not-just-for-the-young-andwealthy (accessed on 15 June 2020).

50.	Li, Y.; Hu, C.; Huang, C.; Duan, L. The concept of smart tourism in the context of tourism information services. *Tour. Manag.* **2017**, *58*, 293–300. [CrossRef]

51.	Yoo, C.; Kwon, S.; Na, H.; Chang, B. Factors Affecting the Adoption of Gamified Smart Tourism Applications: An Integrative Approach. *Sustainability* **2017**, *9*, 2162. [CrossRef]

52.	Pradhan, M.K.; Oh, J.; Lee, H. Understanding Travelers' Behavior for Sustainable Smart Tourism: A Technology Readiness Perspective. *Sustainability* **2018**, *10*, 4259. [CrossRef]

53.	Lee, P.; Hunter, W.C.; Chung, N. Smart Tourism City: Developments and Transformations. *Sustainability* **2020**, *12*, 3958. [CrossRef]

54.	Koo, C.; Mendes-Filho, L.; Buhalis, D. Guest editorial: Smart tourism and competitive advantage for stakeholders. *Tour. Rev.* **2019**, *74*, 1–128. [CrossRef]

55.	Gretzel, U.; Zhong, L.; Koo, C. Application of smart tourism to cities. *Int. J. Tour. Cities* **2016**, *2*, 106–108. [CrossRef]

56.	Buonincontri, P.; Micera, R. The experience co-creation in smart tourism destinations: A multiple case analysis of European destinations. *Inf. Technol. Tour.* **2016**, *16*, 285–315. [CrossRef]

57.	Ivars-Baidal, J.A.; Celdrán-Bernabeu, M.A.; Mazón, J.N.; Perles-Ivars, Á.F. Smart destinations and the evolution of ICTs: A new scenario for destination management? *Curr. Issues Tour.* **2019**, *22*, 1581–1600. [CrossRef]

58.	Gómez Oliva, A.; Server Gómez, M.; Jara, A.J.; Parra-Meroño, M.C. Turismo inteligente y patrimonio cultural: Un sector a explorar en el desarrollo de las Smart Cities. *Int. J. Sci. Manag. Tour.* **2017**, *3*, 389–411.

59.	Cheung, C.M.K.; Lee, M.K.O.; Rabjohn, N. The impact of electronic word-of-mouth: The adoption of online opinions in online customer communities. *Internet Res.* **2008**, *18*, 229–247. [CrossRef]

60.	Chu, S.; Kim, Y. Determinants of consumer engagement in electronic word-of-mouth (eWOM) in social networking sites. *Int. J. Advert.* **2011**, *30*, 47–75. [CrossRef]

61.	Martínez-Sala, A.M.; Monserrat-Gauchi, J.; Campillo Alhama, C. The relational paradigm in the strategies used by destination marketing organizations. *Rev. Lat. Comun. Soc.* **2017**, *72*, 374–396.

62.	Martínez-Sala, A.M.; Cifuentes Albeza, R.; Martínez-Cano, F.J. Las redes sociales de las organizaciones de marketing de destinos turísticos como posible fuente de eWOM. *Observatorio OBS** **2018**, *3*, 246–271. [CrossRef]

63.	Campillo Alhama, C.; Martínez-Sala, A.M. La estrategia de marketing turístico de los Sitios Patrimonio Mundial a través de los eventos 2.0. *PASOS* **2019**, *17*, 425–452. [CrossRef]

64.	Martínez-Sala, A.M. Marketing 2.0 applied to the tourism sector: The commercial function of the websites of destination marketing organization. *Vivat Acad.* **2018**, *143*, 1–23. [CrossRef]

65.	Parra-Meroño, M.C.; Beltrán-Bueno, M.A. *Estrategias de Marketing para Destinos Turísticos*; Eumed Universidad de Málaga: Málaga, Spain, 2016.

66.	Hlee, S.; Lee, H.; Koo, C. Hospitality and Tourism Online Review Research: A Systematic Analysis and Heuristic-Systematic Model. *Sustainability* **2018**, *10*, 1141. [CrossRef]

67.	Shaw, G.; Bailey, A.; Williams, A. Aspects of service-dominant logic and its implications for tourism management: Examples from the hotel industry. *Tour. Manag.* **2011**, *32*, 207–214. [CrossRef]

68.	Wang, Y.; Fesenmaier, D.R. Towards understanding members' general participation in and active contribution to an online travel community. *Tour. Manag.* **2004**, *25*, 709–722. [CrossRef]

69.	Caro, J.L.; Luque, A.; Zayas, B. Nuevas tecnologías para la interpretación y promoción de los recursos turísticos culturales. *PASOS* **2015**, *13*, 931–945.

70.	Boes, K.; Buhalis, D.; Inversini, A. Smart tourism destinations: Ecosystems for tourism destination competitiveness. *Int. J. Tour. Cities* **2016**, *2*, 108–124. [CrossRef]

71.	Koo, C.; Gretzel, U.; Hunter, W.C.; Chung, N. The role of IT in tourism. *Asia Pac. J. Inf. Syst.* **2015**, *25*, 99–104.

72.	Shen, S.; Sotiriadis, M.; Zhou, Q. Could Smart Tourists Be Sustainable and Responsible as Well? The Contribution of Social Networking Sites to Improving Their Sustainable and Responsible Behavior. *Sustainability* **2020**, *12*, 1470. [CrossRef]

73.	González-Reverté, F.; Díaz-Luque, P.; Gomis-López, J.M.; Morales-Pérez, S. Tourists' Risk Perception and the Use of Mobile Devices in Beach Tourism Destinations. *Sustainability* **2018**, *10*, 413. [CrossRef]

74. Ramos-Soler, I.; Martínez-Sala, A.-M.; Campillo-Alhama, C. ICT and the Sustainability of World Heritage Sites. Analysis of Senior Citizens' Use of Tourism Apps. *Sustainability* **2019**, *11*, 3203. [CrossRef]

75. Silva-Pedroza, D.; Marin-Calero, R.; Ramirez-Gonzalez, G. NFC Evaluation in the Development of Mobile Applications for MICE in Tourism. *Sustainability* **2017**, *9*, 1937. [CrossRef]

76. Chianese, A.; Piccialli, F. Designing a smart museum: When cultural heritage joins IoT. In Proceedings of the 2014 Eighth International Conference on Next Generation Mobile Apps, Services and Technologies, Oxford, UK, 10–12 September 2014; pp. 300–306.

77. Lee, S.J. A review of audio guides in the era of smart tourism. *Inf. Syst. Front.* **2017**, *19*, 705–715. [CrossRef]

78. Boletsis, C.; Chasanidou, D. Smart tourism in cities: Exploring urban destinations with audio augmented reality. In Proceedings of the 11th Pervasive Technologies Related to Assistive Environments Conference, Corfu, Greece, 26–29 June 2018; pp. 515–521.

79. Empler, T. Traditional Museums, virtual Museums. Dissemination role of ICTs. *DISEGNARECON* **2018**, *11*, 13-1.

80. Owen, R.; Buhalis, D.; Pletinckx, D. Visitors' Evaluations of ICTs Used in Cultural Heritage. In *VAST*; The Eurographics Association: Aire-la-Ville, Switzerland, 2005; Volume 2005.

81. Rey, F.B.; Casado-Neira, D. Participation and technology: Perception and public expectations about the use of ICTs in museums. *Procedia Technol.* **2013**, *9*, 697–704. [CrossRef]

82. Amanda, R.; Santosa, P.; Rizal, M.N. Analysis of Tourists Preferences on Smart Tourism in Yogyakarta (Case: Vredeburg Fort Museum). *J. Phys. Conf. Ser.* **2018**, *1007*, 12040. [CrossRef]

83. Podzharaya, N.; Sochenkova, A. The Concept of Smart Tourism Based on Museum Digitalization in Montenegro. In Proceedings of the 2020 9th Mediterranean Conference on Embedded Computing (MECO), Budva, Montenegro, 8–11 June 2020; pp. 1–4.

84. Encalada, L.; Boavida-Portugal, I.; Cardoso Ferreira, C.; Rocha, J. Identifying Tourist Places of Interest Based on Digital Imprints: Towards a Sustainable Smart City. *Sustainability* **2017**, *9*, 2317. [CrossRef]

85. Gargiulo Morelli, V.; Weijnen, M.; Van Bueren, E.; Wenzel, I.; De Reuver, M.; Salvati, L. Towards intelligently-sustainable cities? From intelligent and knowledge city programmes to the achievement of urban sustainability. *TeMA J. Land Use Mobil. Environ.* **2013**, *6*, 73–86.

86. La Rocca, R.A. The Role of Tourism in Planning the Smart City. *Tema J. Land Use Mobil. Environ.* **2014**, *7*, 269–284.

87. Gretzel, U.; Werthner, H.; Koo, C.; Lamsfus, C. Conceptual foundations for understanding smart tourism ecosystems. *Comput. Hum. Behav.* **2015**, *50*, 558–563. [CrossRef]

88. The Museum Register by the Ministry of Culture and National Heritage in Poland. Available online: http://bip.mkidn.gov.pl/pages/rejestry-ewidencje-archiwa-wykazy/rejestry-muzeow.php (accessed on 6 April 2020).

89. Naramski, M.; Herman, K. The Development of Mobile Tourism in the Upper Silesian Metropolitan Area of Poland. *Sustainability* **2020**, *12*, 44. [CrossRef]

90. Sprout Social, Social Media Demographics to Inform Your Brand's Strategy in 2020. Available online: https://sproutsocial.com/insights/new-social-media-demographics/ (accessed on 15 June 2020).

91. The London School of Economics and Political Science, Social Media Platforms and Demographics. Available online: https://info.lse.ac.uk/staff/divisions/communications-division/digital-communications-team/assets/documents/guides/A-Guide-To-Social-Media-Platforms-and-Demographics.pdf (accessed on 15 June 2020).