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Introducing the New Concept of Personalized Digital Tourism (PDT)

Judit Grotte

Abstract—**The primary objective of this paper is to propose the definition of personalized digital tourism, which is a new concept in the field of tourism. This theoretical term has not been defined in the field of tourism, even though technology has been transforming travel habits for more than a decade. The article introduces the concept of Personalized Digital Tourism as a high-level integration of theories like Cognitive Infocommunications, the Internet of Digital Realities, Behavioural research of Generation Y and Z, and AI-based data handling solutions to enhance their theoretical and practical outcomes in tourism. The paper first presents the main contribution of the paper, the definition of Personalized Digital Tourism, and then it discusses the most related scientific approaches such as CogInfoCom, Generation Theories, DR, and AI. Then the paper points out these new and rapid technological advancements of recent years in the tourism industry which have resulted in a transformation of human behaviour. The paper emphasizes the necessity of achieving a more advanced conceptual grasp of the field of Tourism science.**

Index Terms—**AI-based data handling, cognitive infocommunications, generation theories, Internet of digital realities, personalized digital tourism**

I. Introduction

THE primary objective of this paper is to propose the definition of Personalized Digital Tourism (PDT), which is a new concept in the field of tourism. This theoretical term has not been defined yet, even though technology has been transforming travel habits, technological tools, and "technological habits" for more than a decade.

The main motivations behind proposing the new theoretical term PDT are as follows. First the landscape of the tourism industry has undergone rapid and substantial changes: online digital access to information, its searchability, interactivity in space and in terms of time, speed, and synchronicity with events, which is not only far more efficient but also different. Second, the process of online activities like booking or paying for accommodation, or other touristic services require special skills to develop from today's human beings.

Furthermore, the concepts, theories and various aspects of scientific approaches utilized in tourism science are also radically changing in the related fields of informatics, cognitive science, and generation science. For instance, the emergence of disciplines such as Cognitive Infocommunications, Internet of Digital Reality, Cognitive Mobility, Socio-Cognitive ICT, etc. strongly influences tourism science. Therefore, the main motivation of this paper is to introduce a concept that allows the development of a higher, more comprehensive view, which brings new concepts appearing in other related fields of science into a unified view of concepts in the scientific development of tourism.

Personalized Digital Tourism leverages cutting-edge technologies and data analytics to create a more personalized, efficient, and sustainable tourism experience. This approach not only enhances traveler satisfaction but also optimizes operations for service providers, marking a significant departure from traditional tourism models.

The definition of Personalized Digital Tourism extends far beyond the mere use of digital technology for personalization. It encompasses a sophisticated integration of cognitive science, demographic insights, immersive technologies, and advanced data analytics to create a holistic, intelligent, and highly personalized tourism experience. This multidimensional approach not only enhances individual traveler experiences but also optimizes tourism management and service quality, making PDT a comprehensive and innovative paradigm in the tourism industry.

The present paper is structured as follows: firstly, we define the novel concept of Personalized Digital Tourism, which is the main contribution of the paper Subsequently, we study - about PDT - emerging disciplines and concepts such as Cognitive Infocommunications, Generation Theories, Internet of Digital Realities, Cognitive Mobility, and AI-Based Data Handling. Finally, the conclusion of the paper is presented

II. Definition of Personalized Digital Tourism

The main objective of the section is to present the definition of PDT, then subsequently briefly summarize those recent scientific disciplines and concepts with the concept of PDT built on.

A. Definition of Personalized Digital Tourism

The concept of Personalized Digital Tourism is a novel approach that employs a combination of Cognitive Infocommunications, Generation Theories, Digital Realities, and AI-based data handling to provide tailored innovative solutions for both individual travelers and tourist service providers. PDT leverages the latest advancements in technology and data analytics to deliver customized tourism experiences that cater to the unique preferences and needs of travelers.

This approach introduces a paradigm shift in the tourism industry, enabling a more personalized and targeted approach to tourism services. By utilizing AI-based data handling, PDT provides a framework for enhancing tourism experiences,

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Judit Grotte Author is with the Department of Tourism, Kodolányi János University, Budapest, Hungary (e-mail: grotte.judit@kodolanyi.hu).

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optimizing tourism management, and improving tourism service quality. The integration of PDT into the tourism industry may lead to a significant increase in customer satisfaction and loyalty, ultimately resulting in increased revenue and profitability for tourism service providers.

III. RELATED EMERGING FIELDS

A. Cognitive Infocommunications (CogInfoCom)

The concept and the definition of Cognitive Infocommunications was emerging around 2008 at the Budapest University of Technology and Economics. It was further developed at the 1st International Conference of Cognitive Infocommunications at the Tokyo University in 2010. Later on this concept was gradually going up to be a scientific discipline having annual IEEE international conference, journal forums and books with a quite huge number of publications. The concept of CogInfoCom motivated various further branches such as Methability, Socio-Cognitive ICT, Internet of Digital & Cognitive Reality, Cognitive Mobility, Cognitive aspect of Virtual Reality, Digital & Cognitive Corporate Reality and various further approaches in digital ergonomics, digital education, AI solutions and so on.

The definition of Cognitive Infocommunications is "Cognitive Infocommunications (CogInfoCom) is an interdisciplinary field that explores the interplay between the cognitive sciences and infocommunication technologies (ICT) The primary goal of CogInfoCom is to provide a systematic view of how cognitive processes can co-evolve with infocommunications devices so that the capabilities of the human brain may not only be extended through these devices, irrespective of geographical distance but may also be blended with the capabilities of any artificially cognitive system. This merging and extension of cognitive capabilities are targeted towards engineering applications in which artificial and/or natural cognitive systems are enabled to work together more effectively." [9]

The key point of CogInfoCom is that it does not view the digital environment and humans in interaction in between, but rather considers the blended combination of human and digital environment as one cognitive entity (CE) [14] with high-level entangled combination of natural and artificial cognitive capabilities. It is motivated by the fact that the border between the human and digital environment is disappearing. Thus CogInfoCom researches new cognitive capabilities of the CE.

Cognitive Infocommunications deals with the effects of rapid technological advancements on human behavior and communication patterns. These changes have led to the emergence of a "New Human," necessitating a deeper understanding of their communication habits and behaviors to improve service delivery in the tourism industry. Therefore, businesses in the tourism sector must comprehend the new patterns of communication and behavior to offer personalized services to their customers.

B. Internet of Digital & Cognitive Reality (IoD)

This concept of Internet of Digital & Cognitive Reality (IoD) is motivated by the fact that the digital environment, internet, and humans form a borderless huge "ocean" of combined natural and artificial cognitive capabilities. This concept focuses on realities as components or well-definable parts of this "ocean". It also approaches the digital transformation as a track of evolutionary milestones of DOS, Windows, and Spaces such as VR, XR, AR , digital twins etc.

The definition of Digital Reality is as follows: [11][12][13][14]:

"A Digital Reality (DR) is a high-level integration of virtual reality (including augmented reality, virtual and digital simulations and twins), artificial intelligence, and 2D digital environments which creates a highly contextual reality for humans in which previously disparate realms of human experience are brought together. DR encompasses not only industrial applications but also helps increase productivity in all corners of life (both physical and digital), thereby enabling the development of new social entities and structures, such as 3D digital universities, 3D businesses, 3D governance, 3D web-based digital entertainment, 3D collaborative sites and marketplaces."

The definition of Digital Reality was extended to Internet of Digital and Cognitive Reality (IoD) in [15][16] as

"The Internet of Digital Reality (IoD) is a set of technologies that enables digital realities to be managed, transmitted and harmonized in networked environments (both public and private), focusing on a higher level of user accessibility, immersiveness and experience with the help of virtual reality and artificial intelligence."

Digital Realities: Virtual (VR) and Augmented Reality (AR). Contemporary technological advancements in virtual and augmented reality have enabled tourism businesses to create customized experiences for travelers. These technologies offer interactive and individualized services, such as personalized hotel room experiences, map functions that enable tourists to view the opening hours of attractions on a mobile phone application, gamification, beacon technology, guest recognition, maintenance information, and translation facilities. Additionally, the integration of Artificial Intelligence (AI) in tourism businesses has facilitated data collection, analysis, and handling more efficiently and effectively. As a result, tourism businesses can now offer travelers tailored experiences that cater to their individual preferences, thus significantly enhancing the overall tourism experience [6]. According to Baranyi "a Digital Reality (DR) is a high-level integration of virtual reality (including augmented reality, virtual and digital simulations and twins), artificial intelligence and 2D digital environments" [14][22].

The term virtual reality was introduced by Jaron Lanier [63]: an accomplished designer of immersive interface devices. In his seminal work, Heim outlined three essential characteristics of virtual reality: immersion, interactivity, and information intensity.

Lanier's [63] pioneering work in virtual reality has significantly impacted the fields of entertainment, education, and healthcare. The concept of immersion, which refers to the user's sense of being present in a virtual environment, has led to the development of advanced simulation technologies that

enable people to experience complex scenarios in a safe and controlled manner.

The prevalence of CogInfoCom solutions, which are reliant upon virtual reality, has witnessed a significant increase in recent times [44][50] Such solutions encompass the utilization of three-dimensional virtual spaces, which users can navigate through in a manner that closely resembles real-life environments. These virtual reality spaces, when employed as infocommunication tools, have the potential to aid and derive advantages from research conducted on the cognitive aspects associated with virtual reality [52][62].

Interactivity is another crucial aspect of VR, which refers to the user's ability to manipulate and interact with the virtual environment. This feature has found extensive use in gaming and training simulations, where users can practice and improve their skills in a risk-free environment.

Lastly, information intensity refers to the high degree of sensory input that a user experiences in a virtual environment. This feature has significant implications for the development of immersive educational and therapeutic applications.

Overall, the combination of immersion, interactivity, and information intensity has made virtual reality an exciting and rapidly growing field with immense potential for innovation and growth [21].

C. Generations' Theories

The study of generation theories is a subject that has captured the interest of many scientists throughout history. One of the first researchers to delve into this area was Karl Mannheim in 1928. He defined a "generation" as a group of individuals who have all experienced a significant event in history that has been tied to notable social and/or cultural transformations. This definition has been a cornerstone of generational theory research ever since [16]. The Strauss-Howe generational theory is a captivating concept that attempts to explain the cyclical nature of American and Western history. This theory posits that certain historical events are closely linked to the generational personalities of the period. In essence, it suggests that the way a generation perceives the world can have a profound impact on the course of history and shape the future of society [17].

D. Cognitive Mobility (CogMob)

The motivation behind imitating the concept of Cognitive Mobility (CogMob) is that almost all corners of the scientific discipline Mobility is influenced by the blended combination of artificial and natural cognitive capabilities. The concept of Cognitive Mobility was initiated at the Budapest University of Technology and Economics around 2020.

The definition of the CogMob is [44]

Cognitive Mobility (CogMob) investigates the entangled combination of the research areas such as mobility, transportation, vehicle engineering, social sciences, artificial intelligence, cognitive infocommunications. The key aim of CogMob is to provide a holistic view of how mobility in a broader aspect can be understood, described (modeled), and optimized as the blended combination of artificial and natural/human cognitive systems. It considers the whole combination as one inseparable CogMob system and investigates what kind of new cognitive capabilities of this Cog Mob system are emerging. One of the Cog Mob focus areas based on its nature is the engineering applications in the mobility domain.

E. Cognitive Aspects of Virtual Reality (cVR)

The research field of cVR is not mentioned explicitly in the definition of PDT. However VR, AR, XR and interactive digital twins strongly influence digital access of travelers and, further, can give an alternative way of visiting places. This is the reason why it is brief studied here:

The definition of the cVR is [57]

"Cognitive Aspects of Virtual Reality (cVR) investigates the next phases of IT evolution characterized by a transition from digital environments based on 2D graphical user interfaces (e.g. windows, images, 2D widgets) to 3D spaces which represent a higher-level integration of VR/AR/MR/Metaverse/IoD systems, human spatial cognition, the 2D digital world (i.e. Web 2.0, Web 3.0) and artificial intelligence (AI). A primary focus of cVR is how this transition simultaneously makes use of and augments human capabilities, including psychological, cognitive and social capabilities – especially capabilities linked to a deeper understanding of geometric, temporal and semantic relationships. By extension, cVR further investigates the effects of these changes in human and AI capabilities with respect to a variety of sectors including education, commerce, healthcare, industrial production and others".

IV. DISCUSSIONS

The goal of this section is to study how the above-mentioned concepts are involved in PDT.

Throughout history, human beings have embarked on journeys for countless reasons, ranging from commercial pursuits to recreational activities. With the advent of technological innovations, planning and managing trips have become more convenient and hassle-free. This has been especially true for younger generations, such as Generation Y and Z, who are accustomed to utilizing mobile phones and other digital devices as indispensable instruments in their daily lives.

In the contemporary era, the rapid expansion of online platforms has facilitated swift and convenient access to a wealth of information for individuals. With the advent of these platforms, the process of retrieving data has become immensely expedited, enabling individuals to attain the information they require within a matter of seconds. The availability of online information has revolutionized the way people seek and acquire knowledge, rendering the process more efficient and streamlined. The rapid advancements in technology have transformed people's behaviors and communication habits, leading to the emergence of new patterns studied in the field of cognitive infocommunications.

In today's world, where technology plays a significant role in our lives, tourism providers are faced with the daunting task of keeping up with the constantly evolving needs and preferences of their guests. Recent studies on the travel behaviors of the younger generations, namely Generation Y and Z, have highlighted the importance of catering to individual preferences and providing personalized services to create a memorable and

satisfying travel experience. To meet the requirements of modern-day service providers, the deployment of cutting-edge technologies such as artificial intelligence, virtual reality, and augmented reality can prove to be highly advantageous. These innovative technologies can offer a range of benefits such as increased efficiency, accuracy, and cost-effectiveness. By leveraging the power of artificial intelligence and other advanced technologies, service providers can stay ahead of the curve and maintain a competitive edge in the market.

These findings have led to the development of the concept of personalized digital tourism, which aims to provide tailored experiences to individual travelers. By leveraging these advanced technologies, tourism providers can offer personalized recommendations, customized itineraries, and immersive experiences that cater to the unique preferences and interests of each guest.

A. The Role of Cognitive Infocommunication in the PDT

PDT is motivated by the co-evolution of new generation and digital realities, both at an individual and social level. The distinction between natural and artificial cognitive capabilities is becoming blurred, leading to the development of a Cognitive Entity (CE) model in generation Z research [8]. The CE model is a combination of human and ICT with integrated cognitive capabilities. When analyzing or developing a PDT service, one may base the analysis on the capabilities of CEs instead of isolated cognitive levels of humans and digital systems. This approach provides a higher level of abstraction for the present generation.

B. The Concept of Digital & Cognitive Reality in PDT Research

The PDT is a technology that is utilized through digital services and analysis to create a digital and customer experience-based reality. This technology is implemented in both 2D and 3D environments, as well as in augmented digital environments with digital content management and artificial intelligence in networked settings. As a result, the research of PDT is strongly based on the concepts of IoD. The definition of IoD is as follows [11][12][13][14]:

The term "Reality" has different definitions in literature and plays a crucial role in Personal Digital Tourism (PDT). In this context, the concept of "Internet of Devices" (IoD) defines reality as a set of cognitive capabilities of connected entities (CEs) that work towards a common goal. [15] PDT involves the use of various systems that have both general and specialized CE capabilities. These capabilities ultimately serve the goals of tourism. As a result, this digital and cognitive network can be seen as a digital reality of tourism, which is, in fact, a reality of tourism.

For example, our house has similar equipment to a hotel room or apartment, such as a bed, TV, and bathroom. However, the different quality and integrated set of capabilities of these items highlight the distinct overall purposes of a house versus a hotel room or apartment. Similarly, when we combine artificial cognitive capabilities, such as those provided by AR, VR, XR, 2D, Digital Twin, and AI, with natural cognitive capabilities to serve tourism, we create a digital reality of tourism.

Tourism is a highly significant sector in the service industry that is responsible for providing intangible services. Travelers, however, often desire to experience these services in a more tangible form. To address this desire, the tourism industry has turned to virtual and augmented reality toolkits. These toolkits enable tourists to virtually experience the destinations and services offered by the tourism industry in a more immersive way. By leveraging these technologies, tourism industry professionals can enhance the overall experience of travelers, leading to greater customer satisfaction and loyalty. Additionally, virtual and augmented reality can help businesses in the tourism industry to differentiate themselves from their competitors and attract more customers.

Visual imaging is considered one of the most effective marketing tools for tourism providers who want to create personalized marketing strategies. It allows travelers to experience the location virtually before making a decision to book their trip. Studies have shown that virtual reality (VR) is particularly effective in influencing the decision-making process of travelers [23][24][25].

The AR/VR technology has paved the way for innovative products in the travel and tourism industry. These products are primarily categorized into three segments: AR-powered glasses, AR mobile apps/software, and VR headsets. Among these, the AR mobile apps/software segment is predicted to witness the fastest growth from 2022 to 2027. The augmented reality mobile apps and software market has been expanding rapidly as technology advances, and it is estimated to reach an impressive $4 trillion by the year 2030, which is a significant rise from its 2017 value of $1 trillion [26].

Virtual tourism is a new and exciting trend that is rapidly gaining popularity among smartphone users. It is a type of tourism that allows people to explore different parts of the world without actually having to physically be there. With virtual tourism, people can travel to any corner of the world in real-time, using their smartphones as a portal to a virtual world that is both immersive and interactive. This means that you can explore different cultures, landmarks, and attractions from the comfort of your own home, without ever having to worry about travel costs, jet lag, or any other inconveniences that come with physical travel. Furthermore, virtual tourism is a safe and convenient way to explore the world during times when travel restrictions are in place, making it an ideal alternative for those who still want to satisfy their wanderlust [21].

C. The Role of Generation Theories in the PDT

Generation Theories suggest that the way people from different age groups perceive technology can be considered as a significant generational divide [43]. According to Károly Mannheim, a Hungarian-born sociologist, a generation is not just a group of people born at the same time, but they are also influenced by the common experiences they face during their youth, which have a lasting impact on their social, political, economic, and cultural lives [4]. In 2022, Preethi Lodha conducted a research study to examine the spending habits of different age groups in the United States. The findings of the research indicated that Generation X and Millennials, in

particular, possess considerable purchasing power. However, the research also revealed that the purchasing power of Gen Z is on the rise, with each passing year. These results suggest that the tourism industry can benefit by creating personalized tourism products that cater to the unique demands of these three generations. By doing so, the tourism industry can ensure that the needs of these significant age groups are met while maximizing the economic gains that can be derived from this demographic [5].

The aforementioned theories provide substantial evidence to support the notion that macro-environmental factors play a significant role in shaping the behavioral patterns of different generations, especially in relation to the adoption and usage of technology. These factors may include but are not limited to socio-economic conditions, cultural norms, political climate, and technological advancements.

The field of Sociology has a significant impact on businesses as it helps them understand the needs of their customers and create products and services that effectively cater to those needs. This is especially important in the tourism industry, which is focused on providing services and education to the spending power of generations X, Y, and Z. Digital Tourism is a highly compatible approach with contemporary educational methods and trends. With the assistance of AI (Artificial Intelligence) and digital educational resources, it is now feasible to explore and learn about other countries and continents without the requirement of physical travel. This implies that obtaining direct international experience is no longer restricted by an individual's financial status, rendering it available to everyone during their lifelong learning journey [7]. The acquisition of digital competencies is an indispensable prerequisite for effective participation in modern education. In this regard, the possesion of digital skills is imperative, as it enables individuals to navigate the complex digital environment of modern educational institutions with ease and proficiency. In light of this, individuals pursuing education in contemporary times must invest in developin their digital competencies to optimize their learning outcomes [7].

The interplay between these factors can have a profound impact on how individuals from different generations perceive, interact with, and adopt technology in their personal and professional lives. Therefore, it is essential to consider the macro-environmental factors while devising strategies to cater to the varying needs and preferences of different generations in the context of In 1964, a prominent demographer named William Strauss coined the term "Generation X" to describe the demographic cohort born after the baby boomers and before the millennials.

This generation is generally considered to include those born between the mid-1960s and the early 1980s, and they have had a significant impact on the labor market and society as a whole [18]. The text describes the current generation, which is frequently referred to as Generation Z. The article includes a figure, labeled as Fig. 1, that likely provides additional information about the subject matter [19].

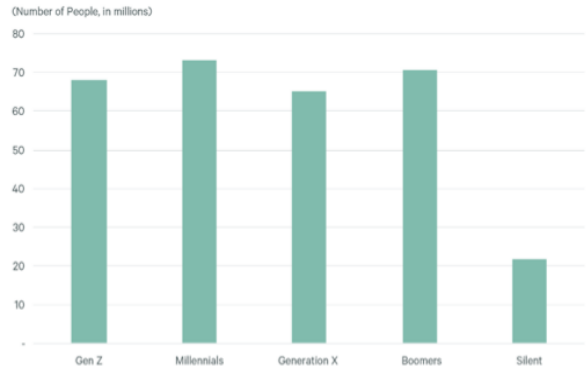

Fig.1. US Population by Generation [20]

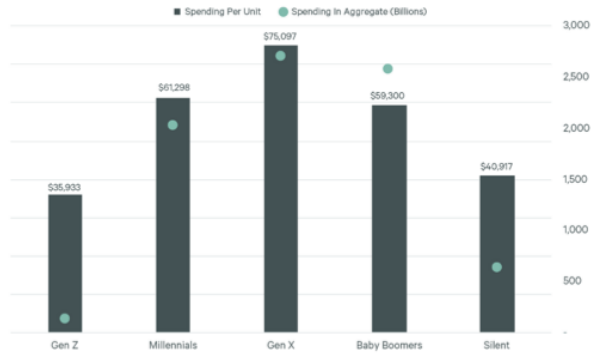

Fig. 2. Spending by Generation [20]

The tables provide information on the importance and purchasing power of Generation Y and Generation Z within the American population. These generations, who are digital natives, are currently the primary users of Personal Digital Technology (PDT).

D. The Role of AÍ Based Data Handling in the PDT

The incorporation of AI-based data handling enables effective processing and analysis of large volumes of data, leading to enhanced decision-making capabilities and improved customer satisfaction. Overall, Personalized Digital Tourism promises to revolutionize the tourism industry by providing tailored and immersive experiences that meet the evolving demands of modern travelers.

To successfully introduce new products and services in the tourism industry, service providers must possess a comprehensive understanding of the continuously evolving needs of their customers. The younger generation, comprising Generation Y and Z, is notably distinct from prior generations, largely due to their exposure to rapid technological advancements. Consequently, they seek personalized products and services that can be conveniently accessed through the Internet. This shift has resulted in the emergence of new behavioral patterns and communication habits that necessitate a thorough understanding of contemporary consumer preferences.

The trend towards Artificial Intelligence (AI) is having a significant impact on the way people communicate and the tourism industry. Face-to-face communication is giving way to digital tools such as Messenger, which has become increasingly popular for problem-solving. The tourism industry is also leveraging AI to collect customer data, which enables them to offer personalized services. In addition, digital reality technology is heavily relied upon to present tourist attractions, hotels, and other destinations. To enhance product customization, tourism service providers are integrating principles from CogInfoCom, Generation theories, DR, and AI. These tools enable providers to tailor their services to meet the unique needs of their customers.

In my paper, I delve into the fascinating world of data handling by artificial intelligence. AI has revolutionized the way we manage data, by taking into account factors such as the quality, accessibility, and security of the data. AI systems are designed to process vast amounts of data using intelligent, interactive algorithms, and to learn from the patterns and characteristics of the data they analyze. The effectiveness of AI is closely tied to recent technological advancements, such as the availability of larger, more accessible data sets, the use of graphical processing units (GPU) for faster processing, the development of intelligent data processing techniques, and the use of application programming interfaces (API) for seamless integration with other systems [29].

Marketing professionals face significant challenges in finding and targeting the right product or service to the right market segment at the right time. However, artificial intelligence (AI) has emerged as a powerful tool that can help service providers to personalize their products and services. By leveraging the power of big data and machine learning algorithms, AI enables service providers to obtain detailed information about their customers, create detailed profiles of each customer, and automatically tailor offers to meet the specific needs of each individual.

AI based data handling: Artificial Intelligence (AI) has emerged as a potent tool that can enable tourism businesses to capture, process, and store massive volumes of data. By harnessing the power of AI, hotels and online travel portals can offer personalized products and services that cater to the unique needs and preferences of their customers, both corporate and leisure. The ability to handle data using AI technology represents a paradigm shift for the tourism industry, empowering businesses to provide a more efficient and bespoke service to their clientele.

AI-based personalization aims to create real-time customer experiences that are targeted to each user's unique needs. With AI-based personalization, companies can generate personalized content, messaging, product and service recommendations, ads, websites, chatbots, and even robots. By tailoring their products and services to the needs and preferences of individual customers, companies can increase customer loyalty, improve customer satisfaction, and ultimately drive revenue growth. AI-based personalization is an essential tool for any business looking to stay ahead of the competition in today's rapidly evolving marketplace [30].

The travel industry has seen a significant transformation, all thanks to the remarkable advancements in Artificial Intelligence (AI). Ensuring successful implementation involves translating advanced AI technology into cognitive functions that can be applied to enhance digital business initiatives within the smart tourism industry [72].

AI has revolutionized the way security is ensured at airports. With the implementation of facial recognition technology, it has become one of the most reliable security solutions for airports. Moreover, this technology has also been adopted by several hotels in China for guest check-ins, making the process much faster and more convenient.

In addition to this, online travel agencies are increasingly using chatbots to assist travelers with their booking process. The chatbot is designed to offer personalized travel recommendations and important information, serving as a versatile tool for travelers seeking advice and guidance.

Chatbots are programmed to answer queries related to flight bookings, accommodation, and other tourist services, providing travelers with prompt and efficient service [73]. This has made the booking process a lot smoother and less time-consuming for travelers. Chatbots-AI is an advanced conversational agent that uses artificial intelligence to engage in intelligent human-like conversations. It is equipped with learning capabilities and can provide personalized services to users [74].

The integration of robots in the hospitality and catering industry is an increasingly pervasive phenomenon. The implementation of artificial intelligence not only facilitates the process of identifying the best value-for-money tourism services for travelers but also aids airlines and hotels in augmenting their revenue streams.

With the deployment of AI-powered robots, hotels, and catering establishments can optimize their operational processes and improve the overall efficiency of their services. The use of such technology in the industry is indicative of the growing trend towards automation and digitization in the service sector.

As AI continues to evolve, its impact on the hospitality and catering industry is set to increase. Businesses in this industry must recognize the benefits of integrating such technology into their operations to remain competitive and provide a superior service to their customers.

Overall, Artificial Intelligence has played a significant role in streamlining and improving various aspects of the tourism industry, making travel more secure, convenient, and efficient for travelers worldwide [31].

V. EXAMPLES

To provide timely assistance to customers, it is important to have a deeply understanding of the latest technologies and trends. This can involve staying up-to-date on advancements in fields such as artificial intelligence, cloud computing, and mobile app development, as well as keeping an eye on emerging market trends and consumer preferences. By staying informed and knowledgeable about these areas, customer service representatives can quickly assess and address customer needs, providing effective solutions that meet their requirements and exceed their expectations. This, in turn, can help to build strong

relationships with customers and establish a reputation for excellence in customer service. This section encompasses real-world illustrations that have not yet attained the status of scientific findings. As a result, the cited literature in this section predominantly comprises practical trade journals.

A. Personalized hotel services

The concept of service personalization entails the practice of tailoring services in a bespoke manner that specifically addresses the unique and individual requirements of each customer. This approach emphasizes the customization of services to ensure that the align with the distinct preferences, needs, and characteristics of individual customers, thereby enhancing their overall experience and satisfaction [65].

The importance of personalized hotel service is evident in three key areas of hotel operations.

(1) The implementation of personalized services at the hotel is aimed at enhancing the quality of customer service and ultimately improving customer satisfaction. Customer loyalty and a competitive edge can be cultivated as a result. The decision of customers to make repeat purchases from a company is contingent upon their satisfaction with the products or services. By ensuring high levels of satisfaction, the hotel can attract repeat business and foster loyal customers, thereby enhancing its competitive advantage.

(2) It's important to create a favorable impression of the hotel. Anticipating the needs of our guests and responding promptly is crucial for establishing a positive image for the hotel. Offering personalized service can make guests feel genuinely cared for and demonstrate that the hotel prioritizes their satisfaction. This approach can help to firmly establish a friendly and considerate image of the hotel in the minds of the public.

(3) Tailoring hotel services to meet individual consumer needs is key to improving customer satisfaction, loyalty, and overall hotel awareness. This, in turn, attracts loyal customers, boosts repeat business, and enhances the hotel's reputation, resulting in increased profits and a larger market share [66].

Due to the growing demand for unique and personalized travel experiences, many large hotel brands have started to merge with various boutique hotel chains. This trend is becoming increasingly popular in the hospitality industry, with many hotel chains recognizing the importance of offering guests a more authentic and personalized experience. One of the most notable examples of this trend is the merger between InterContinental Hotels Group PLC. (IHG) and Kimpton, which has proven to be a successful partnership. By combining their respective strengths and resources, IHG and Kimpton have been able to deliver exceptional service and experiences to their guests, while also expanding their reach and brand recognition in the competitive hotel market [32], after realizing that the habits of Generation Y customers differ from those of previous generations, as they prefer personalized services rather than standardized ones [33].

B. Generation Y guest expectations

In 2017, a survey was conducted by TCI Research on behalf of HOTREC (Hotels, Restaurants, Pubs, and Cafes) to understand the expectations of travelers from hotels and restaurants in the future. The survey was conducted in two parts - the first part examined the opinions of guests who had stayed in European hotels and restaurants, while the second part focused on mapping the expectations of future hotel and restaurant guests.

The survey found that Generation Y (Millennials) have higher expectations from hotels than the previous generations. Apart from the basic requirements of security and privacy, which are important for all generations, Generation Y expects more. They prioritize comfort services that cater to their lifestyle, such as the flexibility to invite their friends to the hotel, access to digital and high-tech entertainment options, and unique design elements that enhance the overall hotel experience. [34]. Millennials, born between 1981 and 1996, have unique preferences and priorities compared to other generations. They value experiences over material possessions and seek out opportunities to explore and try new things. In addition, they are highly tech-savvy and expect businesses and organizations to be up-to-date with the latest technologies. Sustainability is another key factor for millennials, as they are more conscious of their impact on the environment and prefer eco-friendly products and services. Overall, millennials are a dynamic and diverse group with a strong desire for innovation, authenticity, and social responsibility [35].

C. Changing Traveller Report – Gen Z – Cognitive Infocommunication

In 2022, SiteMinder, a leading provider of Australian hotel sales solutions, partnered with Kantar, a renowned market research company, to publish a comprehensive report titled The Changing Traveler Report. The report is based on the responses of over 8,000 travelers from ten countries, including Australia, China, France, Germany, Indonesia, Italy, Spain, Thailand, Great Britain, and the USA. The report aims to map the changes in travel behavior in these countries and identify the factors that influence the decision-making process of modern-day travelers, particularly those belonging to Generation Z.

According to the report, social media plays a critical role in shaping the travel decisions of young travelers. Generation Z relies heavily on online platforms to gather information about their travel destinations, and guest reviews are the primary influencers of their travel choices. The report also highlights that Generation Z prefers to book their trips through various online portals, indicating a shift towards digital platforms for travel booking.

Moreover, the report also reveals that Generation Z has a keen interest in technological advancements in the tourism industry. They are particularly fond of applications such as automated check-in, robots, and artificial intelligence. These technological innovations offer a seamless and hassle-free travel experience to younger travelers, making it a crucial factor in their travel decisions.

Lastly, the report also emphasizes the importance of personalized offers for Generation Z travelers. After completing their trip, younger travelers appreciate it when the tourism service provider approaches them with personalized deals and offers. This tailored approach makes them feel more

valued and appreciated as customers, thereby increasing the likelihood of their return in the future [37].

D. Smart room, Smart hotel – AI in the hospitality industry

Back in 2017, Village Hotels, a UK-based hotel chain, made an exciting announcement. They revealed their plans to install Amazon's famous Echo Dot smart speakers and the Alexa virtual assistant in their hotel rooms. The aim was to provide personalized guest services, allowing guests to conveniently control room functions such as lighting, temperature, and music using only their voice. This move was aimed at making the guests' stay more comfortable and enjoyable, and it was a unique approach to hotel room automation that made Village Hotels stand out from its competitors [38].

In the year 2018, a pioneering four-star smart hotel named KViHotel was launched in the heart of Budapest, becoming the first of its kind in Europe. The hotel has revolutionized the traditional hospitality experience by introducing a smartphone-controlled system, which enables guests to handle various tasks such as check-in, room access, and air conditioning control, all through their mobile devices. This innovative approach has eliminated the need for physical keys, providing guests with a seamless and convenient way to manage their stay [39].

E. AR &VR in the hospitality industry

1) AR

In the tourism sector, it's crucial for destinations to tailor their offerings to remain competitive and attractive to visitors. An effective method to achieve this is through the implementation of Augmented Reality (AR). AR can enrich the tourist experience by delivering interactive and immersive content that enhances the value of their visit [68].

The use of augmented reality applications in the tourism industry by various businesses such as hotels, tour operators, restaurants, and museums is poised to intensify competition and drive research into enhancements to improve tourist services. This trend will provide tourists with new and immersive experiences through a variety of services. Recognizing tourism activities as both an experience and a necessity will help ensure the continued travel of tourists [69].

Starwood Hotels and Resorts Worldwide, Inc. was a multinational hospitality company that owned, operated, franchised, and managed a vast portfolio of hotels, resorts, spas, residences, and vacation rental properties across the globe. The company was founded in 1969, and at its peak, it operated over 1,200 properties in nearly 100 countries.

In 2016, Marriott International acquired Starwood Hotels and Resorts Worldwide, Inc. in a merger deal worth $13 billion, which made Marriott the largest hotel chain in the world.

One of the unique features of Starwood Hotels and Resorts was their use of beacon technology, which allowed guests to receive virtual keys on their mobile phones. The virtual keys enabled guests to open their hotel room doors without having to visit the front desk, thus reducing wait times and improving convenience. This technology was a significant innovation in the hospitality industry and helped elevate Starwood Hotels and Resorts to become one of the most innovative and customer-focused brands in the world [39].

2) VR

Over the previous twenty years, there has been a notable surge in the adoption of information and communication technologies with diverse attributes aimed at generating value and offering distinct services. These technologies have significantly contributed to enriching the overall experiences of travelers throughout their journeys [69].

The implementation of virtual reality (VR) technology can provide tourists with an innovative way to engage with their travel experiences. By immersing users in interactive and simulated environments, VR has the potential to enhance engagement and enable tourists to co-create unique and personalized experiences [70].

Travelers have the ability to view hotel options, gather information, find their way around different locations, and discover points of interest and amenities through their mobile devices, allowing them to customize their travel experiences [71].

Using virtual reality (VR) is an incredibly effective way to capture the attention and interest of potential tourists in a particular destination, hotel, or attraction. For example, one could immerse themselves in a 360-degree virtual tour of Hamilton Island with Quantas, which is even better experienced with VR glasses or Google Cardboard. Similarly, one could use the Atlantis Dubai Virtual tool to get an idea of what a hotel has to offer before booking a stay there. VR allows people to experience a destination, hotel, or attraction in a way that is both informative and engaging, making it an invaluable tool for the tourism industry [40][41][42].

VI. CONCLUSIONS

In the contemporary era, technology has become a predominant macro-environmental factor, significantly reshaping human lifestyles. And throughout personality development, a child's persona undergoes continuous evolution, ultimately shaping the character traits observed in adulthood.

The tourism and other service industries have undergone rapid transformation as a result of technological advancements. The continuous evolution of technology has not only impacted human behavior and communication but has also led to an increasing demand for personalized services.

The solution lies in leveraging cutting-edge technologies like AI, virtual reality, and augmented reality to deliver customized experiences.

The tourism industry is experiencing increasing demand for personalized services, which has given rise to the development of Personalized Digital Tourism (PDT). PDT incorporates various technical elements such as Cognitive Infocommunications, Generation theories, Digital Realities, and AI-based data handling. By harnessing these technical elements, tourism service providers can more effectively customize their offerings to meet each customer's distinct preferences and requirements.

PDT delivers a distinct and personalized experience to each customer, guaranteeing that their preferences and needs are fulfilled. This concept has already been successfully implemented in the tourism industry, yielding favorable

outcomes. In the upcoming years, it is anticipated that PDT will assume a pivotal role in supporting both industry practitioners in the tourism sector and scholars within related fields.

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Judit Grotte, PhD habil., College Professor, possesses over 10 years of domestic and international professional experience in the hotel and travel agency sectors. She has lived in Austria, the Netherlands, and the United States. Alongside her tourism career, she has been teaching in higher education since 1997 in both Hungarian and English. She has been invited to teach at prestigious Hungarian institutions such as Budapest Metropolitan University, where she created and led the International Hotel Specialization for the Tourism and Hospitality BA program in both Hungarian and English. At Sopron University, she not only teaches but also supervises doctoral research in tourism. Other institutions where she has taught include Budapest Business School, Budapest University of Technology and Economics, and Corvinus University of Budapest. Her teaching contributions extend to international universities, most notably Coventry University in England, and ESSCA in France. She has been invited multiple times as a Keynote Speaker at international conferences and has undertaken roles such as section chair and conference organizer. Moreover, she is a member of the editorial boards of two international journals, performs peer review duties, and is dedicated to supporting students' scientific activities.