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HOSPITALITY & TOURISM INFORMATION TECHNOLOGY

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Chapter

Emerging Technology Trends in Hospitality and Tourism

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SUMMARY

This chapter explores how technology has radically reshaped the tourism industry in the last few decades. In particular, IT applications such as the internet since the 1990s, and more recently smartphone Apps, have contributed to that change. Today, travelers and tourists use the internet to explore the many options available to them in terms of transport, lodging and entertainment at popular tourist destinations. Therefore, many local brick and mortar agencies have disappeared and have been replaced by large, platform-based players such as Expedia, AirBnB or Booking.com. The many pictures they upload constantly while traveling, and the feedback collected immediately after service delivery by actors such as Booking.com, inform the choices of those searching for tourism services online. The chapter also discusses how the tourism experience occurs mainly at destinations, which are clusters, where many actors offering services such as transport, lodging and entertainment converge. At these destinations, the existence of many options enriches the attractiveness of the cluster itself. Finally, many examples are provided showing how Apps and emerging technologies such as virtual reality (VR) are reshaping the tourism experience in ways that we are only beginning to imagine.

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Learning Objectives

As a result of successfully completing this chapter, students will be able to:

- Understand the significant changes to the traditional tourism value chain brought about by the introduction and democratization of information technologies.
- Learn about the dynamics of information gathering and use by customers in the current tourism industry.
- List the main technology-induced changes and the key factors that have transformed the tourism value chain.
- Understand the concepts of value chain, clusters, co-creation and UX.
- Describe the tourism value chain from the traveller's point of view.
- Provide an overview of the IT evolution and the IT applications that have impacted the tourism industry.
- Know the main technologies of data transmission that are relevant to tourism.
- Understand the importance of Apps in the travel experience.
- Learn about the IT technologies behind the scenes, and how they can boost the companies' efficiency.
- Discover the emergent IT technologies, their state of maturity, and their level of implementation in tourism.
- Learn about recent technologies that can impact the traveller's experience in a significant manner.
- Discover of the importance of the User Experience (UX).
- Learn about the importance of the human factor in UX.

Introduction

This chapter discusses the significant changes to the traditional tourism value chain, brought about by the introduction and democratization of information technologies, into all steps of the process over the last few decades. Let us begin our discussion with a simple example: a family of four, two adults and two children, 11 and 13 years of age, planning to go on vacation. A few decades ago, the process might have looked something like the following, simplified into a set of sequential steps:

- Decide as a family what the parameters of the trip are: beach, mountain, theme park vacation, or other.
- Gather information about the options and associated costs. Decide where to go.
- The trip itself would have involved the following steps:
 - Travel to destination
 - Services at destination
 - i.** Lodging
 - ii.** Food
 - iii.** Entertainment and activities
 - iv.** Transport at destination
 - v.** Information about things to do at destination
 - Travel back home

Before general access to the internet became available in the late 1990s, it would not have been easy for an individual to gather all information related with the trip without assistance. Therefore, it would have been commonplace to go to a travel agency for information and suggestions about choices. The helpful travel agent would have inquired about the general parameters of the desired vacation and the budget available, and would have put together a package of services, including at least travel to and from the destination, and lodging. The cost of the trip would have included the fee for the agent's services, covered largely by the service providers. Commonly, airlines paid the travel agency a 10% fee based on the cost of the tickets purchased.

Besides travel agencies, one-stop alternatives for valuable information on destination services would have been printed travel guides catering to specific customer segments, such as the Let's Go travel guides, written by Harvard University students for other students and culturally-sensitive travellers on a tight budget (<https://letsgo.com/>).

Concerning travel to and from the destination, unless a private or rental vehicle would have been used for the entire trip, which was and still is common in some parts of the world, but not in others, air travel would have most likely been round-trip from home (H) to destination (D). The option of flying to destination D1 and returning from destination D2 would only have been available at a steep surcharge.

As for destination lodging options, travel agencies would have only offered limited choice, mostly hotel chains catering to defined customer segments at specified price ranges. Food and entertainment options, as well as local transport, would have been explored by the travellers at destination, beginning at the hotel, where brochures would have provided useful information, and by visiting the local official tourist office. Tickets for entertainment would have been bought at destination at theaters or stadiums, or through destination booking agencies.

Planning-oriented travellers would have opted to contact destination service providers for information or reservations via the telephone and would have paid or made reservations using credit cards such as American Express. In particular, international travellers might have favored American Express credit cards, because the company offered its members important travel-related services such as discounts, and more importantly travellers' checks, a valuable option to have recourse if these payment items were stolen or lost.

Welcome to Travelling in a Digital Era

Today, we live in a radically different world, and technology has completely altered all steps of the process. Steps 1 and 2 have largely become intertwined. All trip participants will enter the early negotiations about trip parameters armed with information gathered from internet sources, including social media (what other similar customers have expressed about their own trip experiences), Trip Advisor ratings, package offers from travel clubs, articles from newsletters, etc. Today, parents are likely to have less information than their children, who are digital natives. Parents might have become adept at gathering basic information, e.g., about lodging options, using sites such as Booking.com or Hotels.com, but their children will most likely use extensively social media, full of insights of their peers. These changes in a fundamental way the dynamics of information gathering, as information is no longer simply factual data, advertising or ratings, but now also includes peer-based insights from similar travellers at websites such as Booking.com.

As for step 3 in our process: travel to destination is greatly facilitated by location and GPS Apps, such as Google Maps or Waze. You can even preview your destination from a bird's perspective using Google Earth. And finding hotels when it is dark is no longer challenge, thanks to your GPS App. Further, lodging options now include house-swap online networks or the over seven million lodging options offered by AirBnB around the world. This has changed in radical ways the offer in the hospitality industry. Traditionally, only hotels of a certain size had the means to have visibility outside of their location and destination. As a remedy, small hotels joined organizations and the local tourism portals. Today, even the smallest actors of the hospitality industry can have a global presence on the internet. A well-designed multi-language webpage, an active presence in social media and blogs, are excellent opportunities for young, entrepreneurial players in the industry to be visible and attractive to international tourists. At destination you are most likely to use a panoply of smartphone Apps to find information about local transport options, restaurants, opening hours of places to visit, and to make reservations and buy tickets. Finally, as already noted,

your travel back home now is significantly more flexible, as you may fly back from a different airport you arrived at without additional costs.

Technology-Facilitated Changes

Some of the technology- induced changes illustrated by the example above, are the following:

- The amount of accessible **information**, which traditionally was available primarily through travel agencies, airlines and printed travel guides, has grown exponentially, has become immaterial (digital), and is available directly and free of charge from most service providers through the internet, including hotels, restaurants, entertainment venues, etc. The traditional importance of intermediaries and service aggregators has therefore greatly been diminished, at least in the price-sensitive segments.
- Information is accessed by end-users both through traditional and new **devices**, which continue to evolve rapidly: home computers, laptops, tablets, and smartphones. Smartwatches are the latest devices and are being used to carry boarding passes for air travel, for payment, or as digital hotel keys.
- Further, service providers now include **new players from the sharing economy**, which make available their offerings through global platforms such as AirBnB and Uber. AirBnB, which owns no real estate, is now the largest hotel chain of the world, measured by its offering of rooms and Uber, one of the largest transportation companies, without owning any vehicles. Both companies have challenged the legal status quo, claiming to be simple intermediaries in a digital marketplace, to limit their liability. The simple question, what industry do they belong to, remains an issue of legal controversy.
- Traditional travel agencies have virtually disappeared, but there are many new players in the industry, including the redefined role of the travellers themselves. One of the functions that has been redefined in a significant way is the **rating of tourism services**. This role was traditionally performed by experts, such as the feared evaluators of the French Michelin travel guides, extensively used in Europe, where the Michelin star ratings of restaurants still bring about the rise and fall of chefs around the continent.
- Today, most ratings are provided by the travellers themselves, who are bombarded by surveys immediately after service delivery, by new travel giants such as Expedia, Trip Advisor or Booking.com. Further, travellers report on their trips in real time uploading images and comments to Instagram, Facebook or Telegram. They thereby become co-creators of tourism services.
- Finally, let us highlight the growing importance of smartphone Apps, which allow travellers to know their exact location using Google Maps, travellers who may prefer to

switch to Waze, which includes input from fellow travellers, for navigation purposes. Apps also allow tourists to compare and book hotels, consult restaurant menus, make reservations, and also buy tickets for events, downloading them into their smartphones, without having to be concerned about finding a printer on the road.

Conceptualizing Tourism Services

A simple but powerful framework to understand the tourism industry is the value chain. In Kogut's version (Kogut, 1980) of this popular model, the author first describes a generic industry value chain, which corresponds to the typical sequential value-adding steps in a particular industry. Each link of the chain can be decoupled from the next one, i.e., provided by a different company at a different location.

One of the key decisions to be made by tourism companies is which links of the value chain to focus on. For example, Disneyworld in Florida integrates a theme park with lodging, but not transport to and from origin. By contrast, other nearby theme parks do not offer lodging within the park. One may also envision the tourism value chain as a sequential set of decisions and actions undertaken by tourists. A simple value chain from a traveller's point of view is described in Figure 1.

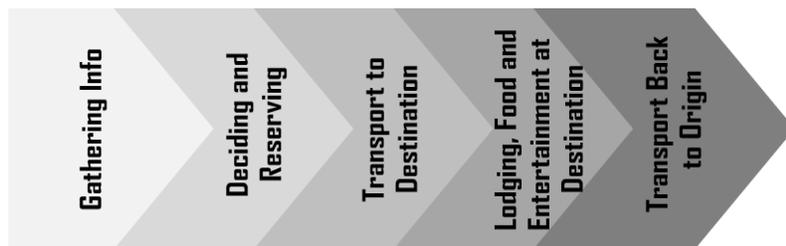


Figure 1. The Tourism Value Chain from a Traveler's Point of View.

From a conceptual point of view famed **tourist destinations** resemble Michael Porter's **competitive clusters** (Porter, 1998a). These clusters are happening places, where many tourism services providers compete to meet the demands of

discerning customers with diverse needs. In clusters more offer is better than less. A street populated with many different restaurants is better than one offering only few choices and becomes a pole of attraction in a city. Tourist destinations are often locations endowed by nature with attractive beaches, mild weather, and accessible to large populations and therefore attract multiple service providers. Their natural attractiveness may be enhanced by government investments in highways, fast trains, leisure ports, tax breaks or casino rights.

Clusters are, in general terms, geographic concentrations of interconnected companies and institutions in a particular field. They encompass an array of linked industries and other entities, which are important to competitiveness. Often cited examples include the cluster of technology companies south of San Francisco in California's Silicon Valley, and Tennessee's music industry cluster centred in Nashville (Porter, 1998b); but many other examples of clusters exist around the world (Evans, 2015). These competitive clusters offer a great variety of benefits to their members,

such as: availability of inputs or services, availability of skilled labour, knowledge creators, accumulation of social capital, generation of incentives, innovation, and complementarity.

The players within tourism clusters are all the large and small private companies, government entities of a given region, as well as communities. Finally, these are all stakeholders that represent the links of the value chain in a pre-established geographical area, or within the boundaries of a particular tourist destination; everyone who in one way or another is related to the development of tourism. Further members of the cluster include ports, airports, airlines, tour operators, travel agencies, hotels and other types of lodging facilities, restaurants, gift shops, currency exchange offices, taxi drivers, and tour guides; as well as the local community representatives (Constanzo, 2015).

A third concept that is uniquely suited to tourism is **co-creation** (Buhalis, Gouthro, Moital & Rihova, 2013). Today's customers are increasingly networked with other customers, e.g., through social media, and are considered by many fellow travellers as a more reliable source of information than tourism service providers. In other words, customers rate services, and provide many useful suggestions on local sights, restaurants, and things to do. In practice, today's customers have become **influencers**, although only a few with large followings are called such. Therefore, they assume an active role in the tourism value chain as co-creators of the product, and of the overall experience.

Through rapid advances in the field of technology, tourism experiences have become technology-mediated, leading to a new Marketing paradigm. They have moved from **Experience 2.0** (co-creation experiences), to **Experience 3.0** (technology enhanced tourism experiences) (Buhalis & Neuhofer, 2015).

Digital tools have become essential to inform about prices, general conditions, and post reviews online. Specifically, social media have turned the Internet into an immense space for networking and collaboration. Networking sites, blogs, and wikis, have enabled consumers around the world to interact, collaborate and share content, opinions, and experiences at an unprecedented scale. Mobile technologies have also contributed to important changes, since today's society is characterized by a 'mobilities paradigm', reflected in the increasingly mobile nature of people, travel, and tourism. People travel more often for work, study, or leisure, rendering tourism a simple extension of the current *mobile* everyday lifestyle. Mobile devices function as 'portable smart computers' that can be accessed almost without limitations thereby transformation travel. Hence, stationary access has been widely replaced by these devices and information has become accessible anywhere and anytime. This has resulted in a gradual revolution of tourist attitudes and actions shifting from a 'sit and search' to a dynamic 'roam and receive' behaviour (Buhalis & Neuhofer, 2015).

Finally, there is the fourth elusive concept of **user experience (UX)**, which is a powerful construct at the individual level, since user experience is unique, and time bound. A user who cannot access

information on her smartphone while walking through a historic city quarter, because of poor connectivity, will have a poor UX, no matter how well the website is designed. The key lesson in tourism is that many actors, including competitors, need to collaborate to provide a unique, positive UX to every visitor, one the tourist will be eager to share almost instantly through Instagram and other social media.

The warning is that there is a long way to go to convince the local tourism service providers that they need to collaborate with each other and that the mistake of one, such as a taxi driver overcharging on a ride from the airport, may reflect poorly on the entire destination. There are many more concepts and frameworks from the management literature we could mention as particularly useful to tourism, such as benchmarking, i.e., that is learning from best practices elsewhere, but we believe that the value-chain, competitive clusters, co-creation and user experience are both simple and powerful, and therefore an excellent starting point to understand tourism services as a **system**.

In the remainder of the chapter, we will focus on how IT has and continues to rapidly transform this system with great potential. However, the move to IT can also have negative sides, as e.g., more personalized tourist information at central locations at tourism destinations is rapidly being replaced by non-interactive web- and App-based information, and automated answering systems. There is no generic answer to the question of whether IT enhances or not what tourists experience. Therefore, we not only suggest case-specific analysis, but specifically research on UX, which holds great potential.

The Rapid Evolution of IT

It is difficult to remember the large computers of a few decades ago, usually protected in climate-controlled glass-encased spaces in companies. These mainframe computers were essentially large brains accessed from different terminals, following therefore a traditional hub structure. The power of these digital brains grew rapidly, while their size decreased, following Moore's law, an empirical postulate by Gordon Moore who expressed in 1965 that the number of components per integrated circuit was doubling every year. The rate was revised by Moore himself over the next decade, resulting in an astonishing compound annual growth rate of 40%, a prediction that has largely matched reality over the last few decades.

Currently, miniaturization is reaching a physical limit. However, new materials to replace silicon are being tested, and quantum computers, still in their infancy, promise a leap jump in computing power. Quantum computers recognize three instead of two states and it is easy to see how x^3 (quantum computers) vs. x^2 (current computers) rapidly implies many more possibilities, i.e., computing power.

While computing power has grown at an astonishing rate, hubs have become networks (the logic of the internet) and parallel computing is rapidly replacing serial computing. In simple terms, this

means that rather than relying on ever more powerful computers, tasks are divided between many inexpensive computers working in parallel. This change in design philosophy may have been more important in bringing about the current computer revolution than the accelerated pace of miniaturization or, recently, quantum computing.

Technology adoption has been accelerating following a power law curve (basically, it's getting faster and faster with each new technology introduced). It took a century for the telephone to reach 80 per cent of the US market. It took about two decades for the World Wide Web to get to similar levels of penetration. But it took only a couple of years for mobile internet to achieve the same level of adoption (Shrier, 2020).

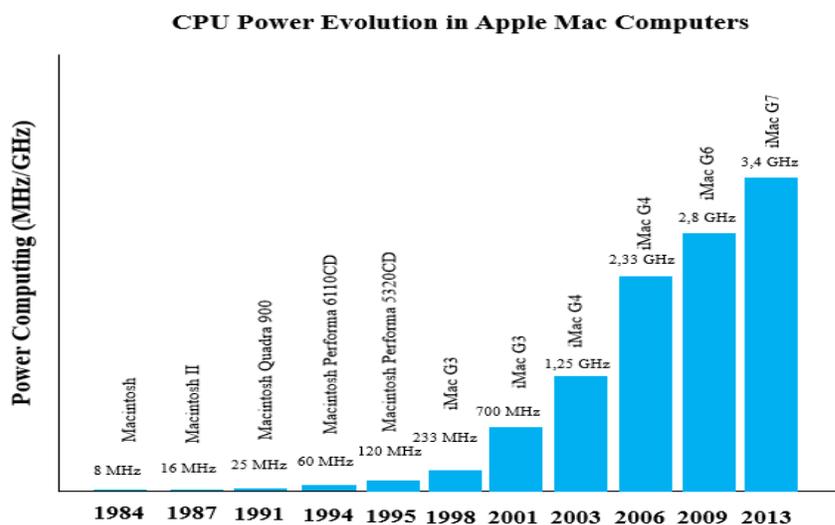


Figure 2. The Evolution of Computing Power.

Ways in Which IT is Revolutionizing Tourism

The New Petroleum

The new raw material of almost every industry is immaterial: it is digital data. Videos, music, pictures, books, and evidently numeric information of all kinds, are simply data that travel in instants around the world using the same highways and in volumes that continue to grow exponentially.

Data Highways

Let us now briefly examine the highways used by data. Around the year 2000 the use of the **internet** reached around 300 million or 5% of the world's population (five years later it reached approximately 1 billion or 15% of the population). This new infrastructure was originally developed for military and research purposes (Arpanet) (Ortiz-Ospina, Ritchie & Roser, n.d.).

Like the GPS, it was a technology that transformed the world when it democratized and moved to the civilian sector. With the ubiquitous presence of the internet today and almost 60% of the world's population using it in 2020, it is difficult to remember how the world was before, when most of us relied extensively on printed directories, where we found service providers such as hotels and restaurants, which we contacted by telephone. We made every possible effort to avoid contacting people and companies abroad, because of the steep long-distance charges involved. Today, we call around the world for free using What's App or Telegram, or Skype, which has very low international rates using VoIP (Voice over Internet Provider).

Bill Gates recognized the revolution the internet was going to bring about in his 1995 book *The Road Ahead* (Gates, Myhrvold & Rinearson, 1995) and engaged in a fierce battle against the leading browser, the software to access the internet via a PC, Netscape. To win, Microsoft started giving away the Internet Explorer (IE) browser for free and matching Netscape's features. It eventually prevailed and IE became the de facto industry standard.

WiFi was introduced in 1997 when a committee called 802.11 was created. WiFi allows for a local connection to the internet of PCs, laptops, tablets and smartphones, using wireless transmitters and radio signals (Thomas, 2014). Eventually, WLAN moved toward fiber optic-based broadband that is becoming the standard today, because it does not share the total data stream among the number of users connected to the same WiFi. WiFi completely altered the services considered basic and essential in the hospitality industry. Today, an establishment offering a poor WiFi connection would be deemed substandard.

RFID or radio-frequency identification (AB&R, n.d.) is a technology that is mature but has only been implemented gradually. In this technology, digital data is encoded in RFID tags or smart labels and captured by a reader using radio waves. RFID data can be read automatically, with little or no human intervention.

As for applications in tourism, **smart labels** incorporate both RFID and barcode technologies, making them ideal in uses such as smart luggage tags. These would make it easy for both the airline and you, using a smartphone App, to know whether your suitcase has arrived at destination.

The RFID system is composed of two basic units, the tag, and the receiver unit. The tag contains a small, inexpensive, programmable memory chip and a transponder unit that is attached to the commodity to be transported. The chip contains unique information regarding the baggage, and the transponder transmits that information to a receiver. Hence, when the baggage or commodity passes through a magnetic reader, the information regarding the baggage is captured. This information identifies what the baggage is and who the owner is (UKEssays, 2018). RFID has already been widely deployed by Emirates Airlines at the airport of Dubai (Dubai International Airport DXB Information Technology Essay, n.d.).

Bluetooth connects wirelessly at short distances. For instance, you may use Bluetooth to connect your tablet or smartphone to a set of external speakers. This is a simple, but powerful feature that hotels have not begun to exploit. Most travellers bring their own devices and their chosen music and subscribe to services such as Spotify (music streaming) or Netflix, and would value being able to wirelessly connect to a set of high- quality speakers or smart TVs in their rooms.

The shortrange nature of the technology can be exploited so that consumers with Bluetooth devices can be provided with services that are more relevant to the position of the access point. For example, a Bluetooth device could be used to alert the user, who has just entered a store, that a production location service is available (Kept Bug Technologies, 2015).

All these roads not only allow for interconnectivity but are also highways that lead to the open ocean of **the cloud**. Increasingly, technologies operate exclusively in the cloud, which means that applications software and data files may never or only rarely be downloaded onto PCs. The implications are staggering, as large companies move to analyze and exploit **big data** sets. From her PC an analyst can rent computing and storage power in the cloud in a fully scalable manner. This means that she would have immediate access to computing power significantly larger than the one provided by her PC, which she can increase or decrease with the click of a mouse. Further, she would not need to fear a catastrophe, as the valuable processed data would be backed up at multiple locations.

Finally, the data highway all of us use (large companies have enjoyed the use of large data pipelines, which are expensive, for decades) will become 10 times larger, with the introduction of 5G networks. The implications will be significant, as e.g., GPS accuracy is expected to move to the meter (1 yard) level. That would allow to pinpoint monuments and spaces with a level of precision that currently is only available for military applications.

5G network deployment involves a complete redesign of current communications technology (IMDEA Networks Institute, n.d.). Its main features are:

- very short delay
- high reliability
- very low cost
- high security
- mobility at speeds of 500 Km/h

all of it with minimal energy consumption (IMDEA Networks Institute, n.d.). Examples of 5G applications include the 5G Smart Tourism project, in West England. 5G allows tourists a virtual and augmented reality (VR/AR) experience around the Roman Baths in the city of Bath. Further, in June 2019, a 5G-enabled music event took place; a music lesson with well-known jazz musician Jamie Cullum, who was in central London while the rest of the musicians were in Bristol and

Birmingham, all remotely connected via 5G (Department for Digital, Culture, Media & Sport, UK Government, 2018).

Computing Devices

If there is one simple way to describe the rapid changes to computing hardware it is **miniaturization**, discussed earlier. Today's device brains pack significant computing power. For example, a very inexpensive Intel Pentium Core i5-7200U with two cores, has a maximum speed of 3.1GHz, i.e., it can run up to 3.1 billion operations per second. Your smartphone is likely to have more computing power than the CPU referred to in this example.

By around 1990 common PCs had become powerful enough computers to run efficiently the increasingly diverse applications software packages (Lotus 123, Microsoft Office, accounting software, desktop publishing programs, etc.), which led to the gradual disappearance of the distinction between PCs and workstations (the powerful self-standing desktop computers of the previous era). The next step was to translate this power into portable computers, generically referred to as laptops.

In parallel, phones became mobile phones (originally, backpack size) and then cellphones. In 2007, Apple inaugurated a new era of mobile computing when it introduced the iPhone, which focused on the user experience (touch screen), integrated the popular iPod into the device, and offered a significant and rapidly growing number of **Apps**, available through iTunes.

Early in 2010 Apple introduced the next category of devices, **tablets**, by launching the iPad, which could be equipped with a phone chip, and thereby provide direct access to the internet. This new, more portable device than the laptop, was gradually to start outrunning the laptop as the most widely sought-after device.

In parallel, smartphones were developing at an accelerated pace. By integrating ever more powerful cameras they were effectively undermining the market for traditional photographic equipment. This had significant implications in tourism with millions of tourists sharing their impressions in real-time through Instagram and similar websites and becoming co-creators of the tourist experience. By early 2020 tourists equipped with their powerful smartphone cameras were able to photograph all Egyptian tourist attractions for free, while those using traditional cameras had to pay fees to do so.

The next category of devices introduced was **smartwatches** when Apple introduced the Apple Watch in 2015. The applications in tourism are many and include watch-based airline boarding passes, instant payment, and sports-oriented apps, including GPS-type Apps for trekking. The growth rate of the new device segment has recently accelerated to 20% between 2019-2020 with almost 1 million watches sold in Q1 2020, with Apple controlling half of the market (Lovejoy, 2020).

The changing preference for mobile computing devices can also be portrayed in terms of changing user interfaces (UIs). Laptop interfaces are keyboards and mice, tablets and smartphones favor the use of fingers on touch screens. The smartwatch IU is the dial and a touchscreen. But all traditional devices are being transformed by the evolution of voice recognition, related to advances in Artificial Intelligence (AI). Therefore, voice-commands are likely to become a preferred IU in the future. If AI also brings about the rapid evolution of automatic translation, a major challenge, the impact on tourism user experience (UX) would be significant.

IOS and Apps

The magic behind the different devices described above are the Apps, the multiple programs they can run (see: Table 1). This parallels the development of the entire computer industry, where many earlier hardware applications are now software based. In other words, ever more powerful and smaller hardware (the CPU and auxiliary specialized chips such as those the process graphics), have become powerful and standard platforms on which to run millions of Apps, i.e., specialized programs that allow for an incredible degree of customization of portable devices.

Apps are used for a myriad of purposes in tourism: GPS Apps to guide cars to their destination and find parked cars; Apps to reserve and buy airline tickets; Apps to pay using smartphones; Apps to order food for delivery; and Apps to share car spaces.

Table 1. Number of Apps by Main Provider in 2020.

Provider	Google Play	Apple App Store	Windows Store	Amazon Store	App Store
	2 560 000	1 847 000	669 000	49 000	

Since there are so many different Apps (see: Table 2) they can be classified into categories by their function in tourism. Most Apps mirror the functions offered by their corresponding or similar websites. To illustrate what Apps can do, let us refer to the example of QR codes. These codes, which are like square-sized bar codes, are hyperlinks to websites. The QR App on a smartphone takes a picture of the QR code and opens a website. During the corona virus pandemics QR codes became popular in European restaurants. To avoid handing out menus that could spread the virus, many restaurants placed QR codes on each table, which could be scanned by patrons, leading them to the restaurants’ virtual menus.

Table 2. Examples of Apps for IOS and Mirror Websites Related to Tourism.

Category	Type/function of the App	App (IOS)	Web sites
Transport	Airlines	Iberia	www.aa.com, www.iberia.com
Lodging	Hotel reservations	Booking.com	booking.com, hotels.com
Lodging	House and room rentals	Air BnB	www.airbnb.com
	Maps and GPS	Google Maps	maps.google.com, www.waze.com
Museums	Museums	The MET	www.metmuseum.com
Destinations	Destinations	Iberia	paris.com, nyc.com
	General, site-based information and ratings	Iberia	www.tripadvisor.com
Social media	Social media, photo sharing	Iberia	www.facebook.com, www.instagram.com
Transport	Local transport	Iberia	parisbytrain.com, paris-metro
Transport	Long-distance car sharing	Iberia	www.blablacar.com

Behind-the Scenes

Much of the IT action has moved behind the scenes and is therefore invisible to the end user. This is **cloud computing** in a broad sense. The devices have become terminals, but the heavy computing using a parallel computing architecture occurs remotely in the cloud. For example, if a patron searches for a hotel room using the *booking.com* App, her request parameters will be forwarded via the internet, to which the smartphone is connected via WiFi or the regular cellular network. The request will be processed in the cloud, and she will receive what appears to her as an almost immediate answer, given that the speed at which the data travels back and forth and is processed is staggering, allowing for interactivity.

Strictly speaking the process is more complex, as data is disassembled at origin into packages using diverse possible routes and reassembled at destination. In other words, the networked architecture of the internet allows the data to take make different paths. If one path is blocked there are many others available.

Another significant change brought about by computing power is **big data** and **data analytics**. The large amounts of data collected can be organized in such a way as to recognize previously undetected patterns to create predictive algorithms. This allows for an unprecedented degree of market segmentation. It is also the secret why so many free internet-based free services are offered to customers by companies such as Google. Customers pay for these services by providing real-usage data, which analyzed in the aggregate and individually represent a goldmine.

For instance, if a traveller uses a search engine to look for flights to a destination, she is likely to continue receiving advertisements related to that destination in the banners she will find in her free e-mail account. Further, as many patrons have expressed with concern, if a destination is mentioned in a casual conversation, even when telephones are supposedly off, they are increasingly likely to receive such ads. With the advent of Alexa, and other similar voice-activated home devices, such occurrences are becoming more frequent.

What is behind the scenes in this case is **Artificial Intelligence** and **Machine Learning**, which go hand-in-hand. Voice commands and regular dialogue get translated into text (voice-to-text translation) which gets analyzed, looking for patterns that lead to action. In this case the repeated mention of a destination, say New York, as well as the mention of specific dates, may lead to sending the person an offer for a magical weekend in New York at a discount price. The promotion, one of the traditional marketing tools, becomes individually targeted to somebody who is a very likely customer. And no human being has intervened in making this assessment. One of the most common applications of AI tourism customers experience regularly are recommendations of destinations and lodging based on the pattern inferred from their past behavior (e.g., previous reservations at services such as *booking.com*).

Artificial Intelligence is also behind the ubiquitous **chatbots** found in many websites to provide answers to queries. Customers using these are often annoyed by the apparent uselessness of these query systems, without knowing that these AI-driven systems are learning with every new query they receive. Like those using online translation systems have discovered, these systems appear to learn over time. They do, by pattern comparison repeated millions of times. AI is also being used by large platforms such as AirBnB. Patrons may find themselves in hopeless loops of unanswered questions talking what they initially interpret as being friendly service personnel that somehow does not seem to understand their needs. Such robotic personnel even send messages saying that they may not be available for a few days, to appear more real.

Let us finally address **Blockchain**, a technology made popular by the cryptocurrency Bitcoin. Blockchain is, from a technical point of view a secure, shared, distributed ledger of transactions between the actors of a system who have chosen to collaborate. Using Blockchain, if a transaction takes place, it becomes indelible, and if manipulated, all other system members will be alerted that the chain has been broken. Further, the system can be set up in such a way that the detailed content of a transaction be communicated to specific actors.

Let us imagine that in a tourism system we have a hotel, an airline, a taxi company and a restaurant. Let us also consider that our system is set up in such a way that the content of every transaction is informed to all other members of a system. The four initial transactions relate to transport to destination (flight reservation), transport from the destination airport to the hotel (taxi reservation), the hotel reservation and a reservation at a nearby restaurant. If the system is well set up, a cancellation of the flight to destination by the airline (e.g., because of bad weather) would

automatically be informed to the taxi company, the hotel and the restaurant. Since the first reservation had to be cancelled, the other three are also cancelled. This process would be extremely useful to the customer. Since tourism implies a complex chain of sequential and parallel transactions and services, Blockchain holds great promise to significantly improve the UX through collaboration of the service providers, integrated into an automated system using block chain.

Assessment: Technology Maturity and Level of Implementation in Tourism

In this section the authors offer their assessment of the level of maturity of key IT technologies and the extent to which they have been implemented in the tourism sector. This is summarized in Tables 3.

Table 3: Technology Maturity in Tourism

	Expected Year Maturity	Level of Maturity	Level of Implementation	Ranking of most promising technologies in tourism UX	Ranking of technologies to manage system
Artificial Intelligence, AI (incl. Machine Learning)	2030	2	1		4
Augmented and Virtual Reality (AR/VR)	2024	2	1	1	
Automatic Translation	2030	2	1	1	
Autonomous Transport	2026	1	0	2	
Big Data and Analytics	2023	4	2		2
Blockchain	2024	2	1		3
Chatbots	2022	2	2	3	
Cloud	2021	4	3		1
Drones	2024	2	1	6	
Facial Recognition	2021	2	0	5	
IoT	2024	2	0	4	
Service Robots	2023	2	1	4	

Level of maturity of each technology:

1. Research, University
2. Early adopters. Atomized vendors
3. Adoption by Fortune 500 and Big Co.
4. Vendors concentration. Adoption in medium companies.
5. Commoditized. Early Adopters. Big Companies

Level of implementation in the tourism industry:

- 0 = no
- 1 = early. Early adopters exist
- 2 = take-off. Large initial investments, inflexion of curve
- 3 = widespread adoption by tourism actors

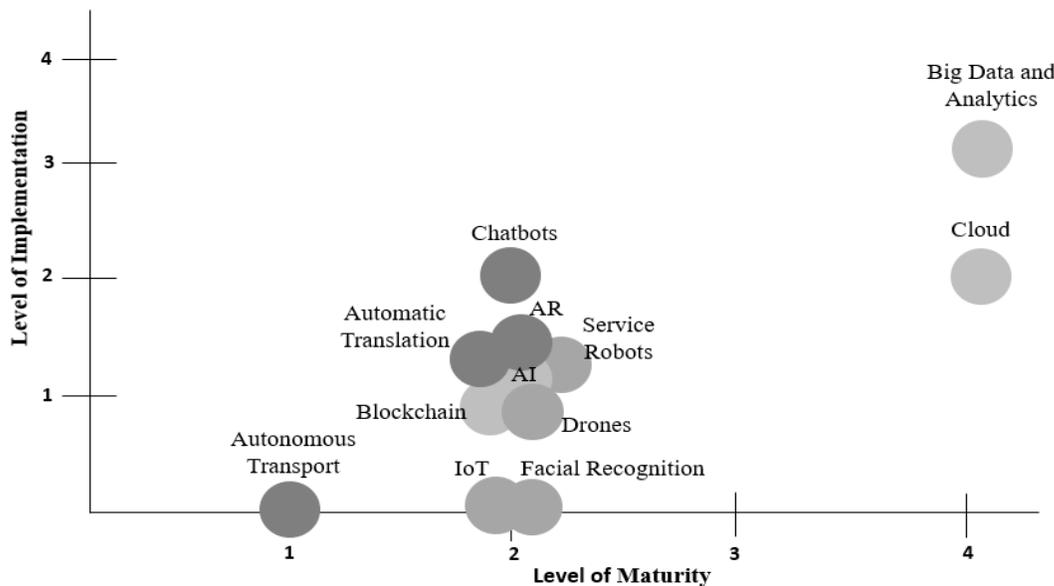


Figure 3: Level of Maturity in Technologies Tourism

Many IT technologies are maturing rapidly, as seen in the table above. These technologies hold great promise for the enhancement of UX and the back-office management of tourism systems.

Let us highlight a few examples:

Augmented Reality

Two leading technologies are Augmented and Virtual Reality (AR and VR), which are very close. However, VR replaces the real-world environment, while AR only augments it by overlaying digital components. Typically, augmented reality is experienced with the help of a smartphone, tablet, or similar device. As a result, it is less expensive for the consumer than most virtual reality-enabled headsets or devices (Revfine.com, n.d.).

Augmented reality is appearing at tourism sites in the form of tablet devices which visitors receive instead of traditional multilingual audio guides. Visitors to the most celebrated French Chateaux by the Loire River, i.e., French Renaissance palaces such as Chambord, have the option to rent these tablets (the Histopads, as they are known), which recreate how different rooms looked in historic times. They thereby can see simultaneously the **now** through their eyes, and the **then** on

their tablets. The devices also double as traditional, multilingual audio guides (Domaine de Chambord, n.d.).

At the Smithsonian Natural History Museum in Washington, D.C. the skeletons in its Bone Hall can be seen from a new perspective with the Skin and Bones iPhone app. The app allows visitors to see a full live representation of the original animals overlaid on their skeletons (Natural Museum of Natural History, n.d.).

At Ashbury Park, the recreational complex in New Jersey, the popular boardwalk carousel was moved in the '90s to a new place in South Carolina. The original building still exists, and visitors can download an App to see in their smartphones the old carousel turning in today's empty building (Augmented Asbury Park, n.d.).

AR can also be used as a virtual tour guide. As the traveller moves around the city, the mobile application points out places of significance describing them and providing interesting information.

Automatic Translation

Automatic translation has a long way to go, and its development will most likely closely be linked to the one of AI and machine Learning. Envision using your smartphone to say a phrase that is translated into the language of your choice and can be heard by the waiter you are talking to. The waiter then answers and immediately after an accurate translation is repeated. Such a process would undoubtedly significantly enhance the UX but appears to be some years into the future.

This delay in offering a reliable solution has much to do with the complexities of the languages and the need to train the systems (Davies, 2020). The current state of machine translation is that it can provide information and contact to customers, but only in the most rudimentary form. Using machine translation for your website, for example, is like saying 'Me hotel, you guest. Here come, pay this much, I bed for you provide. And this is not the appropriate way to sell high-value services like accommodation and spa packages to overseas visitors (Anja Jones Translation, 2016).

Driverless Vehicles

Imagine calling for a driverless car on your App to take you to your hotel, to the airport, or to another city. Also, to be able to rent such a car for the day at a destination island, waiting for you as you move to your next destination (while it charges its electric battery), if a new car cannot be guaranteed within 15 minutes notice.

For the moment, existing regulations are a big obstacle to the development of this technology. It is quite advanced (remember Tesla) but it hasn't been tested at a large scale in the real world. Departments of Transportation and City Planners still see those autonomous actors with great suspicion. However, small and controlled tests are being performed, like at Heathrow Airport and

Great Britain's Lake District, where they cut travel time and carbon emissions (ITP Business Publishing, 2018).

Despite slow implementation, the important actors related to the transport industry, like Uber, have plans for deployment of fleets of such vehicles, and expect to implement them when the existing legal and administrative barriers disappear (Bainbridge, 2018).

The dramatic savings of cost related to human driven rent vehicles can change the landscape of tourism rentals: Travellers will be able to take totally personalized tours on demand, making traditional bus sightseeing tours obsolete. Welcome to the new 'auto-tour' (Bainbridge, 2018).

Further, the need for parking of a rented vehicle will decrease, greatly improving the user experience, especially in urban tourism.

The future driverless vehicles will also increase safety providing expert driving, instead of tourists driving their own vehicles or hiring vehicles in unfamiliar environments with different driving rules, or where the tourist cannot drive (ITP Business Publishing, 2018).

Cloud Computing

Cloud computing is now ubiquitous and is used for example for data analysis of big data sets by large companies in all industries, including tourism (Table 3). The flexibility, scalability, back-up options and remote access provided by cloud-based systems ensure that crucial structures are still running in case of a single point failure and make system recovery in case of failure a great deal easier and faster.

Let us focus on a special feature of cloud computing that affects the tourism actors: scalability. Tourism is one of the more seasonal industries. Because of its seasonal nature, with large fluctuations in demand, investments in fixed IT infrastructure suffer from underutilization for most of the year. Cloud Computing offers tourism companies the option of renting significant IT resources only for the season's time, downgrading the volume of rented resources when demand decreases in the low season.

Blockchain

Finally, as mentioned, the applications of blockchain hold great promise in tourism. For example, Travelflex is a blockchain based universal traveller's currency to reduce costs that is being embraced to large tourism-companies such as Booking.com, British Airways, Emirates and Hilton (Kovalenko, 2019).

The advantages of blockchain introduction are more related with changes in the relationships between the tourism actors than a significant improvement in terms of speed, security, UX, or other traditional technological advantages. Despite being one of the vast markets, the travel and

tourism industry is being dominated by monopolies... Major companies like Expedia, Booking.com, and Airbnb have become the most sought-after places for finding accommodation, but they all have fees and different charges while the vendor charges a customer for payment processing (Oodles Technologies, n.d.).

The blockchain technology is based on the principle that nobody owns the information. Every transaction is recorded in a system that is distributed among the participants. Furthermore, the chain of transactions takes care of itself: if someone tries to modify the smallest part of a transaction, a warning is issued to all the system participants, identifying the bad actor. That makes blockchain perfectly suitable for clusters of tourism actors, where no one owns the data. It is a very collaborative environment that enforces the trust between the members of the cluster.

The main concern, for the moment, is the technology's early development state regarding the identification and control of the agents coming into the system. The technology has proven to be very robust for decades, supporting the virtual universe of Bitcoin and other cryptocurrencies. But cryptocurrencies represent only a relatively simple and completely anonymous application of the technology. Clusters and public Blockchain implementations still need to deal with the administrative burden of creating an identity layer that reinforces confidence between vendors, customers, and regulators.

Envisioning the Future

Drones

The sky is the limit in the future, so let us begin by discussing drones. **Drones**, which have been embraced by professional photographers could offer live tours at destinations such as famed cathedrals or archeological sites, or at safaris, greatly enriching the current experience with a new from-the-air perspective.

Drones can also be used to detect where the wildlife populations are in a nature park, to guide visitors to them, and to detect poachers (Association for Unmanned Vehicle Systems International, 2020). Drones also enhance destinations marketing: a company like Skift.com, with only 9 employees, became a reference in the travel industry in less than two years, by creating astonishing videos that compel people to visit the places visited from the air (Ali, 2014). Similarly, cities like Trondheim in Norway, use beautiful aerial videos to show innovative and highly aesthetic points of view that attract visitors (Expedia, 2015). Such video, with a cost of less than \$30,000, had 50,000 virtual visitors in the first few weeks (Flynn, 2016).

Robots

Those who like a science-fiction view of things envision friendly bartender robots listening late at night to their personal sorrows with empathy. However, such bartender **robots** already exist.

Several companies are selling those robotized arms that mix cocktails, especially in Japan, a country that suffers a shortage of qualified staff for drinks mixing. Priced \$82,000, the QBIT Robotics one, installed in a Japanese pub operated by restaurant chain Yoronotaki, not only mixes a cocktail in a minute, with total precision, but chats about the weather while preparing orders using an attached tablet computer that smiles to the customer. Also, four cameras monitor customer faces to analyse their expressions using artificial intelligence (AI) software (Reuters, 2020). Other company devices, the Makrshakr bartender arms, are part of the show in the Royal Caribbean ships. Fortunately, humans are still needed to manually replace the large number of bottles the robots use to mix drinks (Makrshakr, n.d.).

For late room service, or to pick up luggage, the presence of robots is around the corner. But don't get it wrong. While you may immediately think of a human-like android, in reality robots can take many different forms. They can be completely autonomous, or semi-autonomous, operating with some human assistance. Modern robots use technology ranging from collision detection to speech recognition, as well as artificial intelligence (Revfine.com, n.d.).

In 2015, the world's first hotel staffed almost entirely by robots, the Henn-na Hotel (Strange Hotel) at Nagasaki, Japan, opened doors. There, 243 robots serve customers, from an English-speaking dinosaur robot (designed to appeal to kids at the reception desk) to a human shaped concierge.

The experiment wasn't a success at first attempt. Three years after, the company fired more than half of its automatized workforce, maintaining robots in areas where it found them to be effective and efficient. Guest complains about robots waking them up repeatedly during the night, the impossibility to deal with tasks more complicated than the basic ones, or the constant need for corrections by the human staff were the negative result of the experiment. But the positive one is that the half of them remain in use. And the problems were only a function of early evolution and training. As Hideo Sawada, the man in charge, said, For five-star hotels that are selling high-end service, human staff are essential. But for three- or four-star hotels, you need comfortable lodging, and a basic level of communication at a reasonable price. The aim is that robots can help reduce labour costs by about 70 percent. And, at the end, the hotel's parent company, H.I.S., announced plans to construct eight more humanoid robot-staffed Henn-na Hotels (Hertzfeld, 2019).

Smart Cities

Many tourist destinations are aspiring to be known as smart cities, through their IT-based systems intended to significantly enhance User Experience (UX). An analysis of why this often remains wishful thinking deserves a moment. The authors believe that technology is not a driver but an enabler. And for technology to truly make a difference, those trying to create smart cities need to first understand the real UX of their most important tourist segments, and to bring the many local actors of the tourism system to the same table. Without the shared commitment of the different service providers the UX is likely to remain unequal (i.e., a combination of good and bad experiences).

Further, a misuse of technologies may actually undermine UX. Automated answering services or poorly designed websites that only address the most basic tourist queries cannot replace a centrally-located tourism office with long opening hours, staffed by knowledgeable and friendly staff eager to share with visitors the many wonders of their beloved city. If this sounds like a chimera, and possibly is, we would invite our critics to visit an Apple store to be greeted by a young, enthusiastic staff, eager to share with other their love for Apple products. This points to a simple but powerful management technique, referred to as **benchmarking**, which simply means that one may learn from others in one's own industry or in other ones that do things well, i.e., have optimized their core processes.

UX

The potential future of a significantly enhanced tourism UX will not be primarily technologically dependent. Technology does hold a great promise, but a change in mindset by the key players is a prerequisite. Currently, technology is being used above all to reduce costs instead of enhancing UX. Personnel is being cut rather than trained, and, as the spread of low-cost airlines shows, has led to cut-throat price competition to attract a segment of customers willing to pay less and less. The problem in tourism is that this is a no-win proposition, since, because of currency and cost-of living differences, no offer will ever be cheap enough. Bargain shoppers have infinite alternatives today. The quest needs to focus on a different type of customer, whose specific needs are met, greatly enhancing her UX, leading to a wish to return next year. And if UX becomes the focus, then the technologies mentioned above may become powerful enabling tools.

Conclusion

The landscape of tourism has changed in fundamental ways in the last decades, because of IT reaching the masses. First, microcomputers, then, the internet, and recently, smartphone Apps have altered the "who and how" in tourism. Traditional, local tourism agencies have largely been replaced by global platforms, such as Expedia and Booking.com. Travelers can now easily search for package deals, specific travel services, and compare offers online using price comparison websites. Further, they have not only become empowered customers, but also co-creators of the tourism experience, not only for themselves, but also for fellow travelers. Finally, new technologies, such as virtual reality promise new augmented experiences on-site, and, in the future, immersion experiences from the comfort and safety-zone of our own living rooms.

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