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Analysis of Digital Tourist's Purchasing Decision Process Based on Feedback and Opinions

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ABSTRACT

Today, tourism and digitalisation are very much intertwined. The phenomenon of tourism in the digital space - digital tourism - emerged with the birth of the internet and has grown in intensity over the years. The evolution of digitalisation has brought about a paradigm shift that has not only led consumers to adopt information and communication technologies, but has also greatly transformed consumer behaviour, preferences and motivations. Indeed, the development of technology has disrupted the traditional booking trends of tourists, their attitudes towards tourism and the social groups of tourists by providing dynamic online communication channels. Digital tourism users - digital tourists - are increasingly aware of the information and communication technologies, services and tools available to them, and are able to shape the market offer tailored to their needs through their actions and the data they provide. One of the most effective means of doing this is to share feedback and opinions online. In our research, I provide secondary information to support the importance of feedback and opinions, clarify its role in digital tourism, and then investigate the phenomenon of electronic-world-of-mouth through a questionnaire survey and decision tree analysis, and highlight the insights and implications of eWOM for digital tourists' behaviour in the online space based on opinions.

1. Introduction

In the field of digital tourism, the importance of feedback and opinions is essential for successful business activity. Feedback and opinions help service providers understand what consumers value and what changes are needed to improve the service.

Research shows that feedback and opinions play an important role in consumer decisions. For example, one study [1] found that feedback and opinions have an effect on consumer booking decisions and the relationship with price. Another study [2] found that feedback and opinions have an effect on consumer choice among tourism products.

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The importance of feedback and opinions in the field of digital tourism is further reinforced by the spread of digital technology. Digital technology is permeating industries, facilitating transport, smart cities and [3], more importantly for tourism, making it easier for consumers to access and share feedback and opinions.

More and more service providers are using feedback and opinions analysis to improve services. For example, one study [4] found that hotels use feedback and opinions to improve their services.

1.1 The paradigm shift

Since the late 1990s, major hardware and software developments have been initiated, including massive improvements in processing capabilities, enabling computers to handle complex algorithms at ever-increasing computational speeds [5]. The Internet and information and communication technologies (ICT) have enabled companies to expand their customer base to cover the global population in a cost-effective way. Tourism-related industries, such as airlines and hotel chains, now have access to international customers [6]. Digitalisation, being consumer-driven, is an unstoppable process in tourism [7, 8]. The number of guest nights at a destination is influenced by both its accessibility and local conditions [9, 10]. As they have evolved, interoperability between processes, departments and functions has enabled businesses to reduce labour costs, increase efficiency, improve responsiveness and make more informed decisions. Globalization, enhanced by technological advancements, has significantly influenced the tourism industry, leading to increased competition and the need for innovative management practices [11]. By electronically connecting and sharing data and processes, organisations have started to cooperate with each other to create complementary services, thereby expanding their reach and business network. The Internet has enabled the proliferation of multimedia applications such as the distribution of text, graphics, images, video and sound. And search engines such as Google and Yahoo began to give people almost unlimited possibilities to find anything, including destinations, service descriptions and product information. Gradually, an electronic marketplace emerged and businesses began to communicate with customers and partners through online platforms through which they now sold directly. New intermediaries have also emerged to exploit the opportunities offered by the Internet and to combine products with dynamic packaging [12, 13, 14]. Of course, tourism businesses have also recognised the importance of technology in their own domains and have acknowledged that having an online presence is a prerequisite for success [15]. For our part, we believe that the key idea that emerges from this basic premise, which I still believe is valid today, is that an online presence is no longer a strategic advantage for a company, but a strategic necessity.

The specificities of modern-day travel are not only reflected in supply, but also, of course, in demand. Buhalis and O'Connor in their study paint an accurate picture of how technological developments have greatly changed tourism by revolutionising information gathering and communication. Technological advances have broken down traditional social groups of tourists by providing dynamic online communication channels [13].

Several researchers agree that the emergence of social media and the spread of smartphones has re-dimensioned tourism [16, 17], but its effects on tourists have also been traced. Their writings also show – according to Jansson's collection – that through social media (be it popular platforms such as Facebook, Flickr and Instagram, or even travel blogs focusing on specific places or sub-types of tourism) people started to immediately follow, share and appreciate different types of content, from media reports and advertisements to private photos and videos. Social media platforms have become increasingly influential in the design and construction of websites, linked to commercial services such as booking systems, hotels, tour operators, and sharing sites for accommodation, transport and other

hospitality services, which are increasingly dependent on user-generated content and reviews. An example of this is probably TripAdvisor, which sits between social media and the tourism industry [17].

The rise of digital technologies, the development of blogs and other social media platforms has facilitated interaction for all users, and online travel communities and social networks have revolutionised communication from simple producer-consumer communication to much more complex consumer-consumer, consumer-producer, and many-to-many, one-to-one interactions [18]. Technology has revolutionized the entire sales channel by enabling direct communication and transactions between principals and consumers, and has colored it with the emergence of a multitude of new intermediaries [19]. Review sites such as TripAdvisor and Yelp have enabled consumers to express their opinions online², which has influenced reputation, branding and business performance [20].

The parallels between the demand and supply sides are visible, with many researchers reaching similar conclusions that the cultural paradigm shift dominated by social media coincides with a new online commercial strategy that encourages people to invest their time and creativity online, thus creating a sharing and attention-based marketplace today, shaped by their own consumers.

1.2 The importance of digital tourism and eWOM

The interconnection between tourism and digitalisation has therefore become clear and unquestionable, and the relationship between these two components can be understood as digital tourism.

One of the most comprehensive definitions, and perhaps the most accepted among tourism researchers, is that of Buhalis (2003). According to this definition, e-tourism reflects the digitalisation of all processes and value chains in tourism, travel, hospitality and catering [19]. At the tactical level, it includes e-commerce and uses information and communication technologies (ICT) to maximise the efficiency and effectiveness of tourism organisations. The latter is also an important issue in terms of sustainability, as the use of ICTs in tourism is a key issue, especially among young people [21, 22]. At the strategic level, e-tourism revolutionises all business processes, the entire value chain and the strategic relationships of tourism organisations with all stakeholders. The concept of e-tourism encompasses all business functions (e-commerce and e-marketing, e-financing and e-accounting, e-HRM, e-procurement, e-R&D and e-production) as well as e-strategy, e-planning and e-management in all sub-sectors of the tourism industry, including tourism, travel, transport, leisure, hospitality, clients, intermediaries and public sector organisations. E-tourism thus brings together three separate disciplines, namely business management, information systems and management, and tourism [23].

Buhalis [18] in his study, distinguishes several major eras of digital tourism by exploring the use of technology and tools. If we exclude the period of early GDS systems³, we can distinguish three eras [18]:

- i. The eTourism era of the internet network (1990-2005): for operators, this era allowed them to develop their presence through websites and e-commerce, and for the user, Google and Yahoo search engines revolutionised the way to find information online.
- ii. The era of Web 2.0 (2005-2015): the development of blogs and other social media platforms has made it easier for all users to interact, while online travel communities and social networks have revolutionised communication.

² This is known in the trade as e-WOM, which I will discuss later

³ the first, which is detailed in Buhalis (2020), but which goes from the 1960s to the 1990s, when the tourist was not yet directly part of digital tourism, but only indirectly through the service provider's database

- iii. The era of the semantic web (2015 -): characterised by the linking and integration of big data from different data sets to improve data management, stimulate creativity and innovation, and foster collaboration through social networks. Smartphones and mobile devices have changed the way people communicate and interact, mediating the tourism experience. Here, Buhalis [18] mentions the Internet of Things, the proliferation of fifth generation mobile networks, radio frequency identification, the importance of mobile devices, 3D printing, cryptocurrencies, sensor and signalling networks, pervasive computing, and enhanced analytical capabilities supported by artificial intelligence and machine learning [18].

Of course, all these are only summaries of Buhalis' work on the technological background of each era, but I think it is important to present one of the elements of technology separately, as it helps to understand the behaviour of digital tourists and the importance of digital tourism, and thus the complexity of digital tourism today:

In the context of social media, however, it is important to note that Facebook was founded in 2004 and by 2010 it had half a billion users [17]. Of course, social media existed before Facebook, TikTok, WeChat, Instagram, QZone, Weibo, Twitter, Tumblr, Baidu Tieba and LinkedIn⁴, but the importance of Facebook and its global breakthrough, and especially the influence it has had on tourism, cannot be denied, as it is still the most popular platform today, as the following Figure 1 shows.

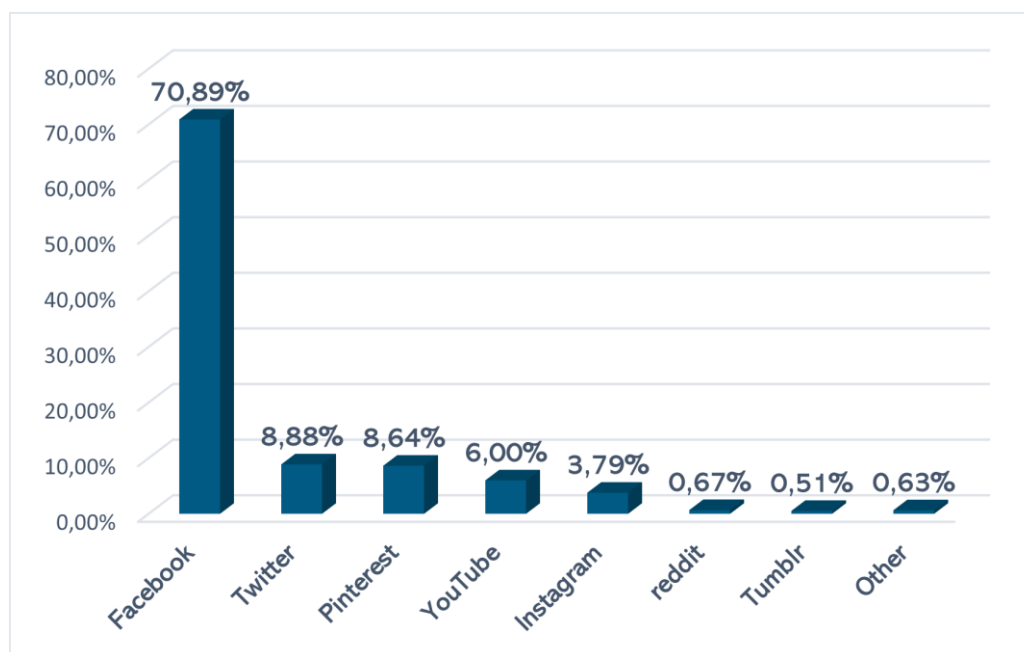


Fig. 1. Worldwide popularity of social networking sites as of May 2021
Source: own edited graph based on Statistical Office data

However, it is important to explain an associated phenomenon of social media, which is eWOM. Electronic word of mouth (eWOM) in the digital age has completely changed the way consumers consume information and is increasingly attracting the attention of both academics and practitioners. Derived from the concept of "word of mouth" (WOM), eWOM refers to any informal communication about products, services or brands, regardless of the information valence, mediated by the Internet.

⁴ these social media are mentioned because they have a subscriber base of more than 100 million

In tourism, customers are increasingly relying on eWOM to seek information about service providers and to share their personal experiences of service encounters. According to industry reports, 94% of travellers say that reviews play an important decision factor when choosing accommodation, and 80% of customers leave reviews online when asked [24].

Thus, eWOM is a highly important phenomenon, which is not only supported by Kwok et al. [25], but also by Grotte, who notes in his work that eWOM is much more important in the hotel industry than in the case of physical products [25, 26]. On the one hand, Grotte draws on research by Nielsen, Net Ratings, which found that the appearance of blogs was based on a trust issue for tourists, that blogs written by users have a higher trust power. An example of this is the success of Tripadvisor.com, which, as we know, is one of the world's largest digital tourism hotspots, as it provides potential travellers with real advice and almost all the information relevant to them is available in one place (map, newsletter, attractions, etc.). The importance of positive customer feedback is also linked to a higher willingness to pay: potential travellers are even willing to pay more for services that are positively charged in the eWOM [27].

1.3 Digital tourism technology and tools

Based on a literature review in an earlier paper, I now summarise the technology and tools of digital tourism in Figure 2. It can be clearly seen that the technology and tools are based on smart devices and the internet on the one hand, and on information search, booking, in-trip activities and post-trip activities on the other. It is a circular system, as information gathering is followed by booking, then most digital tools, technologies and services are used during the journey, and then feedback is given after the journey, where the eWOM comes into existence, which of course becomes searchable information for others, which is used to make bookings and so on. The model also illustrates that several tools and technologies are overlapping as, for example, all four of these steps can be "done" through a direct website of a hotel. Likewise, in some cases, tools such as search engines are included which are not included in a travel process (booking) alone.⁵

On technology, I should mention that many studies show that the Central and Eastern European countries are not fully prepared for Industry 4.0. It is important to make this clear at this point because the subjects of the analysis to be carried out later are from this region, where one of the main gaps is the development of ICT at the right level. In addition, the connectivity of global value chains (GVCs) with ICT in the region is of course not negligible, as it is an essential criterion for the CEE countries to adapt to Industry 4.0. In CEE, the number of people with IT qualifications, the number of manufacturing and patent applications, and the use of robots are low [27].

There are many efforts to reduce this gap, either through international organisations such as the European Union, or through agreements between nations, or through national efforts. The list of these is long, but in a few sentences it is useful to mention the concept of the Digital Single Market.

The Digital Single Market ensures the free movement of goods, people, services and capital, where individuals and businesses, regardless of their nationality or place of residence, can access and conduct online activities seamlessly, under fair conditions of competition and with a high level of consumer and personal data protection. The Digital Single Market strategy sets out the main directions for the digital transformation of the European economy by fully exploiting the potential of the Single European Market and supporting the free movement of goods and services across internal borders. The European Commission divides its support for tourism into four groups, the objectives of which are as follows [28]:

⁵ For ease of interpretation, these elements and tools are marked on the same line, with the same colour codes.

- i. Improve the business environment and increase investment in the tourism sector by making better use of available EU funding opportunities.
- ii. Encourage digitalisation and the use of online marketing and distribution tools within the sector to meet new trends and consumer expectations.
- iii. Develop skills and competences in the tourism sector to improve career opportunities and support the sector.
- iv. To raise the profile of Europe as a tourist destination.

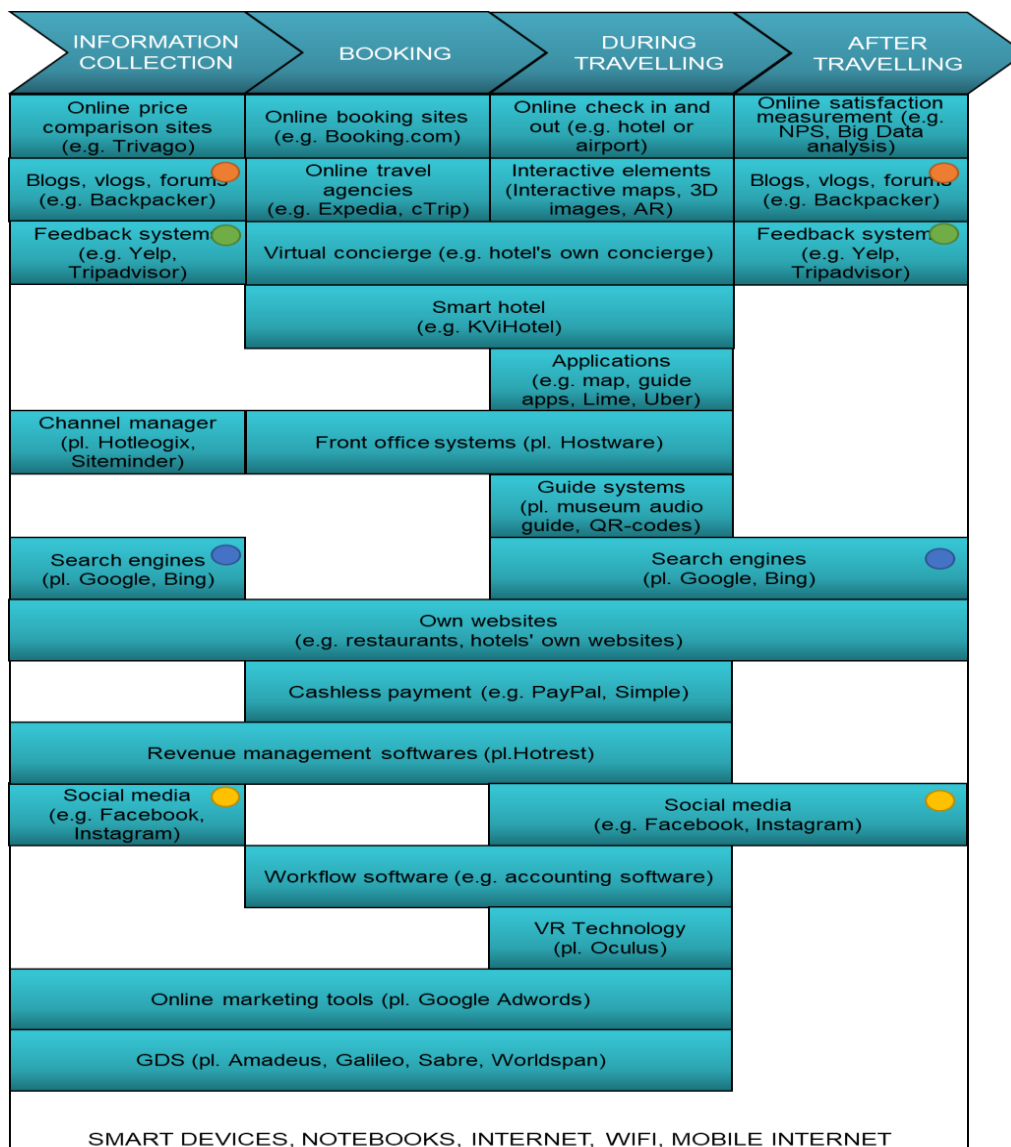


Fig. 2. Digital tools and technologies in tourism

Source: own edit

Due to the backlog mentioned by Cieřlik, the Digital Single Market also focuses on the Central and Eastern European region, in which area I will further investigate the digital tourism sector myself, more specifically, I will analyse the respondents in the selected region with my primary research [27].

2. Methodology

During the primary analysis of the demand side, a questionnaire was distributed in order to identify the basic parameters of Hungarian, Slovak, Czech and Polish demand, to assess the

importance of feedback and opinions, and to assess the profile of the data. Guest satisfaction is very important in the region, it is linked to profit [29].

The questionnaires were distributed in 4 countries in the online space⁶, therefore minimal IT skills were required to complete them. The topic is not a topic that concerns the whole population, hence the sample is hybrid. In the survey, which involved 1942 fillers, not all questions were compulsory. Although the sample is large, it is not representative. The aim was not to carry out a penetration study, the sample is in fact an amorphous group of movers, which is difficult to define, but has clearly distinguishable parts (e.g. those who do not travel at all). The main characteristics of the sample are presented in Table 1 below.

Table 1
Presentation of the sample

Country (n)		Hungarian respondents	Slovak respondents	Czech respondents	Polish respondents
		527	502	463	450
Gender (n)	Male	149	139	186	167
	Female	378	363	277	283
Generation (%) (McCrindle Research (2012))	Veteran	0%	0,20%	0,43%	0,67%
	Baby boomer	9,21%	11,34%	8,41%	15,56%
	Generation X	14,01%	12,55%	22,20%	24,44%
	Generation Y	21,31%	15,18%	29,09%	37,11%
	Generation Z	55,47%	60,73%	39,87%	22,22%
Type of residence (%)	Capital	22,07%	12,35%	26,30%	33,86%
	City	23,99%	26,32%	30,00%	41,07%
	Town	33,97%	31,58%	28,48%	21,94%
	Village	19,96%	29,76%	15,22%	3,13%
Education (%)	Less than or equal to general	0,77%	0,61%	0,44%	0,22%
	Apprenticeship / vocational school	2,11%	4,08%	2,42%	13,39%
	Vocational school / secondary school	37,81%	44,08%	30,55%	15,63%
	Higher vocational education / Technical college	13,63%	9,59%	7,47%	28,35%
	College / University BA-BSC	23,42%	23,67%	28,79%	26,12%
	University / MA-MSC	18,62%	14,29%	23,74%	10,49%
	Doctorate	3,65%	3,67%	6,59%	5,80%
Income status (%)	I live well on my income, I can also save.	12,20%	26,83%	33,25%	23,81%
	I live well on my income, but I can't save.	30,77%	19,50%	29,56%	15,04%

⁶ in different ways, such as social media sharing, Google Ads, Facebook ads, forum posts, direct messages, etc.

Country (n)	Hungarian respondents	Slovak respondents	Czech respondents	Polish respondents
	527	502	463	450
I can barely make ends meet on my income.	13,26%	15,14%	10,10%	29,57%
I can't live on my income.	6,10%	5,73%	2,46%	11,28%
I have no income (e.g. student)	37,67%	32,80%	24,63%	20,30%

Source: own edit

This study undertakes an analysis of the demand for digital tourism based on the V4 countries. The literature research has demonstrated the complexity of the digital tourism issue and its complexity for tourists, thus justifying a deeper investigation into its main aspects.

In my literature collection, I have presented above the paradigm shift caused by digital tools, supported by Buhalis and O'Connor's paper that technological developments have changed tourism in a major way by revolutionising information gathering and communication [19]. Complementing this with other authors, I found key findings such as that the emergence of social media and the spread of smartphones have re-dimensioned tourism, and that through social media people have started to instantly follow, share and appreciate different types of content, from media reports and advertisements to private photos and videos. Given this level of user influence, which in fact allows users to create their own offerings on the demand side, and to create pages dominated by reviews and thus motivations on the social media and social networking sites, I assume that *H1: the online spatial behaviour of digital tourists based on reviews can be understood, accurately described and tracked, and their set of actions modelled*.

In our primary research, I wanted to examine the importance of feedback and opinions and the eWOM phenomenon, and to review its significance and to paint a more comprehensive picture of the electronic-world-of-mouth and the weight of opinions in the V4 countries.

Our questionnaire included several questions to explore this. As a first step, I wanted to specifically address attitudes towards this and to guide the process of cluster analysis. However, in the hierarchical analysis, the leading distances justified the creation of 1 cluster. If I did not take this into account and still tried to run a K-means analysis for 2 or 3 groups, the results painted a distorted picture: unrealistic shifts in sample size towards one cluster group, and/or negligible differences in means, and/or overlaps for several attitudes tested. This means that the sample is rather homogeneous in this area, in fact, of the 10 statements on feedback and opinions, only 1 could be considered for a plausible group split: posts shared on social media during the trip.

This suggests that the motivations for the feedback and opinions are not revealed by grouping, i.e. the respondents do not have preferences that can be categorised, but rather build their decision processes following a certain pattern. Therefore, in the present case, I consider it appropriate to apply the decision tree methodology.

An artificial neural network is a supervised machine learning technique capable of identifying relationships, mapping relationships by considering different variables to classify unknown data. The advantages of such networks include the ability to handle large amounts of data, the ability to

approximate nonlinear relationships, but also the ability to generalize from relatively imprecise input data, and the resistance to outliers and overfitting [30].

Decision tree (DTC) classification is an artificial machine learning technique that tries to classify a given target variable homogeneously by operating on a recursive partitioning of the data set. The DTC algorithm seeks to reduce the disorder of the target variable in the resulting dataset for each split by selecting the optimal split from among a large number of independent variables. The main advantages of this method are that it is computationally inefficient compared to traditional artificial neural networks, insensitive to the pattern of the distribution, and robust to missing data and redundant environmental variables [31].

3. Results

A decision tree is thus a supervised, expressive, classifying algorithm consisting of a set of nodes, where the inner layers test the nodes. In order to implement the decision tree, I choose attributes based on different properties, so that each layer will have an associated value. For the algorithms used, I relied on the traditional top-down simplified approach to build the decision tree. These methods provide a clearer choice for deciding which attributes to test in the decision tree and how to define the allocations.

Windeatt and Ardeshir propose the so-called pruning procedure to deal with overcomplicated, so-called overgrowth trees. This procedure prunes out paths in the decision tree that are only subgraphs of the overall network structure, or replaces the sub-tree with a "leaf". However, in the case of the present research, I did not apply such a restrictive pruning procedure, as I did not see any justification for it, since the number of combinations does not result in such subtrees [32, 33].

The very first step in running a decision tree is for the researcher to select a starting point, so I have tried to use logic to select this starting point. This statement was "Sometimes online reviews or social media make me want to travel", which in its original form was to be rated by the respondents on a scale of 1 to 5⁷. I chose this statement as a starting point because it is logically the first point at which a motivation to travel can be triggered in a person. To enable the decision tree to handle this, I have represented it on a nominal scale, to which I have associated yes-no response options in a transcoded form in the procedure. The sample size was thus (due to outliers) $n=1482$. The other decision variables, however, were retained in the range 1-5. I placed these decision variables in a question that contained seemingly random statements, followed by random shuffling in order not to guide the respondent, not to give the expected answers, not to guide them through the decision process dictated by logic, so they were not even necessarily presented by topic group. These are shown in Figure 3, however the list shown in the figure has already been ordered by the analysis software according to G-squared sums (these G2 values and their analysis are discussed below), so the order shown here was not the order the respondent encountered, but the order of each question shows the original display.

⁷ where 1 was the answer "strongly disagree" and 5 was the answer "strongly agree"

Table 2
Claims and G2 values for the first case

Term	Number of splits	G ²	Portion
18. I used to look at the travel-related content shared by bloggers and celebrities.	12	17987.59	0.32
18. I read other people's reviews online before choosing a service provider.	6	12893.37	0.229
18. I am happy to pay for services online (accommodations, tickets).	9	22763.09	0.404
18. Before booking I check the hotel website for pictures/videos of the services.	6	16135.47	0.287
18. I am happy to buy a city card with which I can travel at a discount and visit museums.	5	2313.306	0.041
18. I only use the internet to gather travel information.	3	19134.05	0.34
18. I book accommodation in a place where there is wifi.	4	1065.238	0.019
18. I would try a hotel without staff.	2	963.686	0.017
18. A 24-hour customer relationship is important.	2	818.2375	0.0146
18. Personal contact with the service provider is important.	2	813.0866	0.0145
18. I would rather stay in a hotel with robots to help me.	2	703.0953	0.0125
18. I use tourism-related applications (apps) when I travel.	1	609.1933	0.0109
18. If I have a complaint, it is important to have personal contact with someone.	1	72.59	0.0013
18. When I can, I prefer to contact service providers online (e-mail, chat, skype).	0	0	0
18. Before my travels, if I have the opportunity, I usually take a virtual walk to that place (accommodation, museum, etc.).	0	0	0
18. If I could see a city or an attraction through Virtual Reality glasses, I wouldn't go there.	0	0	0
18. It's important that I can organise my trip myself.	0	0	0

Source: output from own analysis

The best routes and splits are illustrated by the G-squared sums. These sums of squares G can, if you like, be seen as an explanatory power for the decision splits and their strengths. On this basis (~after the need arises), it is possible to derive the decision process for three cases: "I tend to look at the travel-related shared material of bloggers, celebrities" (G²=17997.58), "I read other people's reviews before choosing a service/service provider online" (G²=12918.33), and "I look at the pictures/videos on the hotel website before booking" (G²=12765,065), the latter not associated with feedback and reviews, but the sample data also points to this option, so it is also associated with the information stage, it is also associated with the decision process. Of course, other factors were also taken into account, as illustrated in Table 2. However, these had such low G² values compared to the peak values that the decision tree expressed them in its calculations but did not interpret these results and even did not display them in the graphical representation.

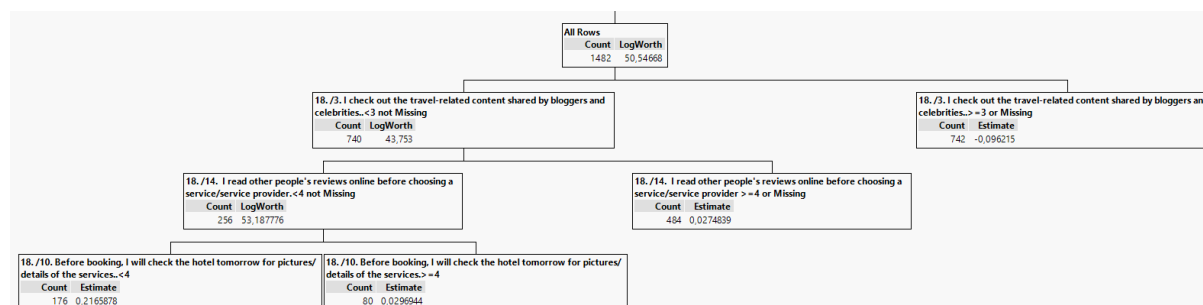


Fig. 3. Illustration of the first case of the decision tree

Source: output from own analysis

So, for the first case, the results showed that, for respondents who do, online reviews or social media may create a desire to travel, there are two possible outcomes for the first case, "I tend to check out travel-related content shared by bloggers and celebrities": those with a score of 3.00 and above who then almost immediately open a suitable portal, such as YouTube or a travel blog (742 sample respondents). Those with a score of less than 3.00, i.e. those who practically do not look at travel-related shared material by bloggers or celebrities after the motivation arises (740 sample)⁸, taking it to the next level, typically read other people's reviews online before choosing a service/service provider (above 4.00, 484 sample). The decision structure is therefore already noticeable here, however, for completeness, the tree builds up in the other case, i.e. for the few who do not typically read other people's reviews online before choosing a service/service provider (256 respondents), 80 of them search for pictures/videos on the service providers' websites (above 4.00), while 176 of them engage in some other activity not revealed by the questionnaire data after the motivation arises.

The emergence of demand can logically be understood as a zero point, a basic tenet of tourism, and indeed a condition for tourism to be realised. As the secondary information has shown, it is mediated by information and communication technologies for the digital tourist. And the decision tree confirmed that the second step - which of course also follows logically - is information gathering. Of course, this may not only be based on what bloggers and vloggers share, or perhaps on other people's reviews, or specifically on information published on the websites of service providers, but my sample confirms these.

Based on my statistics on information gathering, the following results can be highlighted: the power of personal word of mouth has not been taken over by digitalisation, the primary source of personal opinions of the sample is the personal opinion of friends and acquaintances⁹ ($\bar{x}$ = 3.76; δ = 0.96). The second most important decision-support factor is social media ($\bar{x}$ = 3.56; δ = 0.98), i.e. eWOM. Almost as important is the evaluation of services, second opinions and scores ($\bar{x}$ = 3.50; δ = 0.99), Figure 4. Interestingly, while influencers and blogs as well as the website of the service providers are highly supportive for the development of demand according to the decision tree, they play a smaller role in the decision, inferred from the lower mean scores.

⁸ who of course appear in the decision tree because of the data, but in real life it is not a conscious decision to not look at the material of vloggers and bloggers after the motivation has arisen, but simply move on to other ideas

⁹ But this can be communicated via the internet!

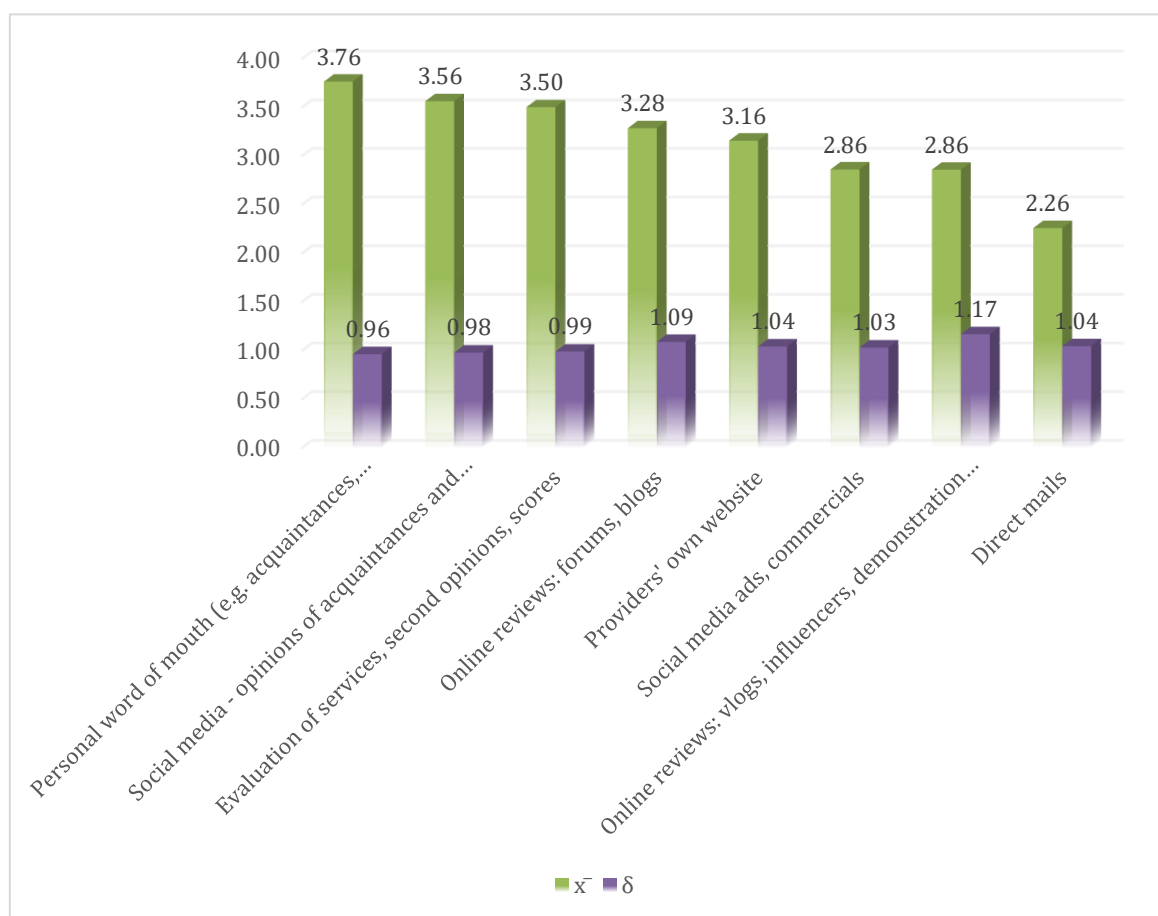


Fig. 4. Mean and standard deviation of factors influencing respondents' travel decisions (n=1942)
Source: own edit

Since decision trees set up divisions and assign smaller and smaller G-squared values to each factor, their runs are finite, it is useful for the researcher to define a new starting point, preferably from the final conclusion of the previous decision tree. In this way, other aspects can be investigated. The question related to the options shown in Figure 4¹⁰, as an information point, was again followed by a zero point, which I therefore considered as the starting point of the new decision tree. There were no respondents in the sample who entered a value of 1.00 or 2.00 in each category, so (of course) everyone is (naturally) informed to some degree about a travel decision. However, very low scores were selected out by the decision tree, so the sample has n=1920 items for this question. In the second case (Figure 5), where the same statements were included in the decision tree as presented in the first step in Figure 4, the first and most important decision is the internet, which is presented as booking accommodation only in places with wifi. For the remaining 171 respondents, wifi is not a consideration, they have a score below 3.00, their thread is broken at this point, nothing else in the questionnaire data applies to them, but they account for barely 10% of the sample in terms of item count (anyway, their new route formation power is very low, $G^2=234.54$).

$G^2=2379.28$ is the sharing power of the wifi aspect, so those who have mapped the available information in the previous step, specifically the next emerging issue is wireless internet. This typically arises in the case of a specific accommodation - and therefore a specific destination choice.

¹⁰ How much do the following factors influence you when making a travel decision?(1 = Not at all, 5 = Totally)

Going beyond the question of wifi, the next aspect to be addressed is the virtual tour, which is also linked to the choice of destination. Among the sample, 271 respondents break the line here with a score below 2.00 ($G^2=366.03$), while 1478 respondents rate this question above 2.00 on a 5-point scale, with additional options ($G^2=1973.72$). However, the main thread breaks at this point, so basically we can map a two-step sequence, for those who answered below 5.00 that they would take a virtual walk in the place before their trip if they had the opportunity, 1246, the main branch of the decision tree stops. However, it can be seen that those who are really committed, 232 people, are even more likely to make a breakdown, raising the idea that they would be happy to buy a city card to travel at a discount or visit museums. This is still linked to the destination, but can be seen more as a prelude to a next step, where the purchase of services can take place.

Of course, the process is still entirely logical: the emergence of a need (which the digital space can create), then the gathering of information, and thirdly the choice of destination, which can be complemented (and is logically linked) to the choice of accommodation.

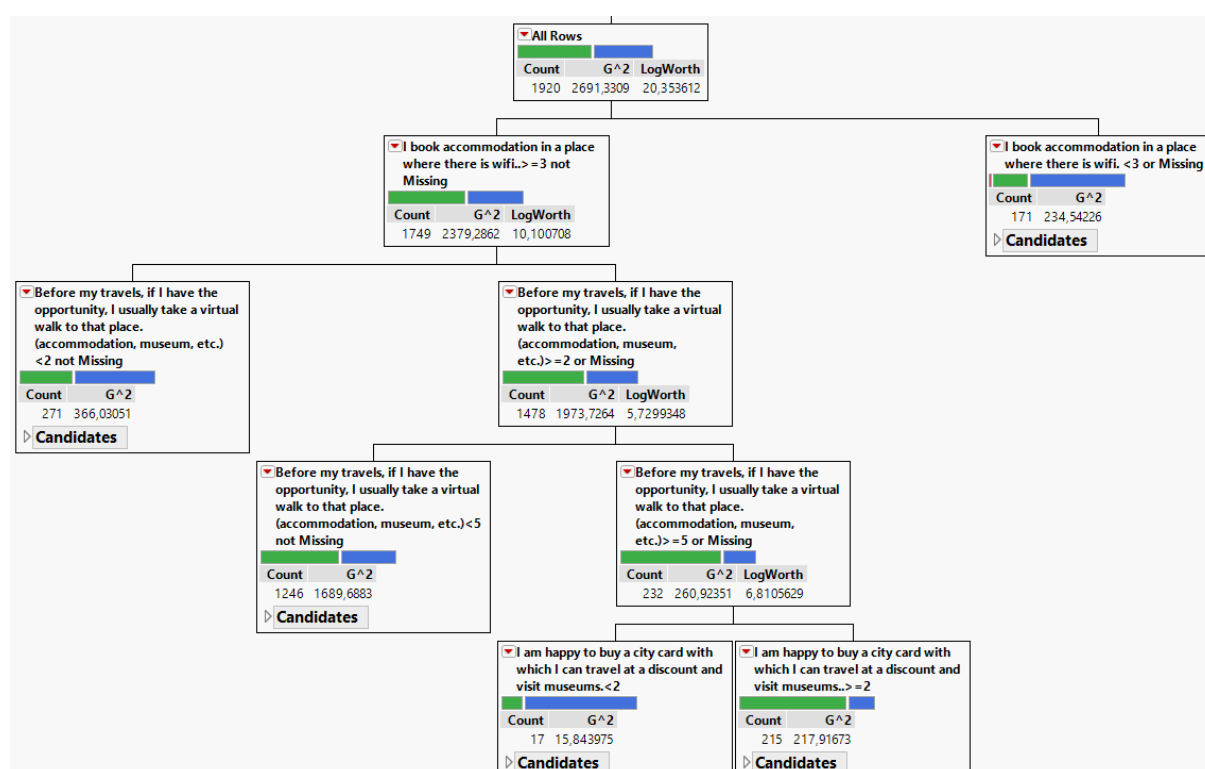


Fig. 5. Illustration of the second case of the decision tree

Source: output from own analysis

The purchase of services can also take place immediately after the choice of destination - as indicated in the analysis (but one could also mention the booking of a flight as an example). Of course, many services in tourism are purchased during the trip itself (e.g. buying tickets during the holiday). Beyond the basic logic of tourism, this is confirmed in the literature as "choice of means of transport", followed by "complementary services and activities at the destination".

We measured the activities during the trip on a scale¹¹ of 1 to 4, with map ($\bar{x}= 3.40$; $\delta = 0.77$), searching for restaurants ($\bar{x}= 3.25$; $\delta = 0.81$) and events and programs ($\bar{x}= 3.03$; $\delta = 0.86$) being almost regular Figure 6.

¹¹ where a value of 1 was equivalent to a "not at all" response, while a value of 4 was equivalent to an "almost always" response

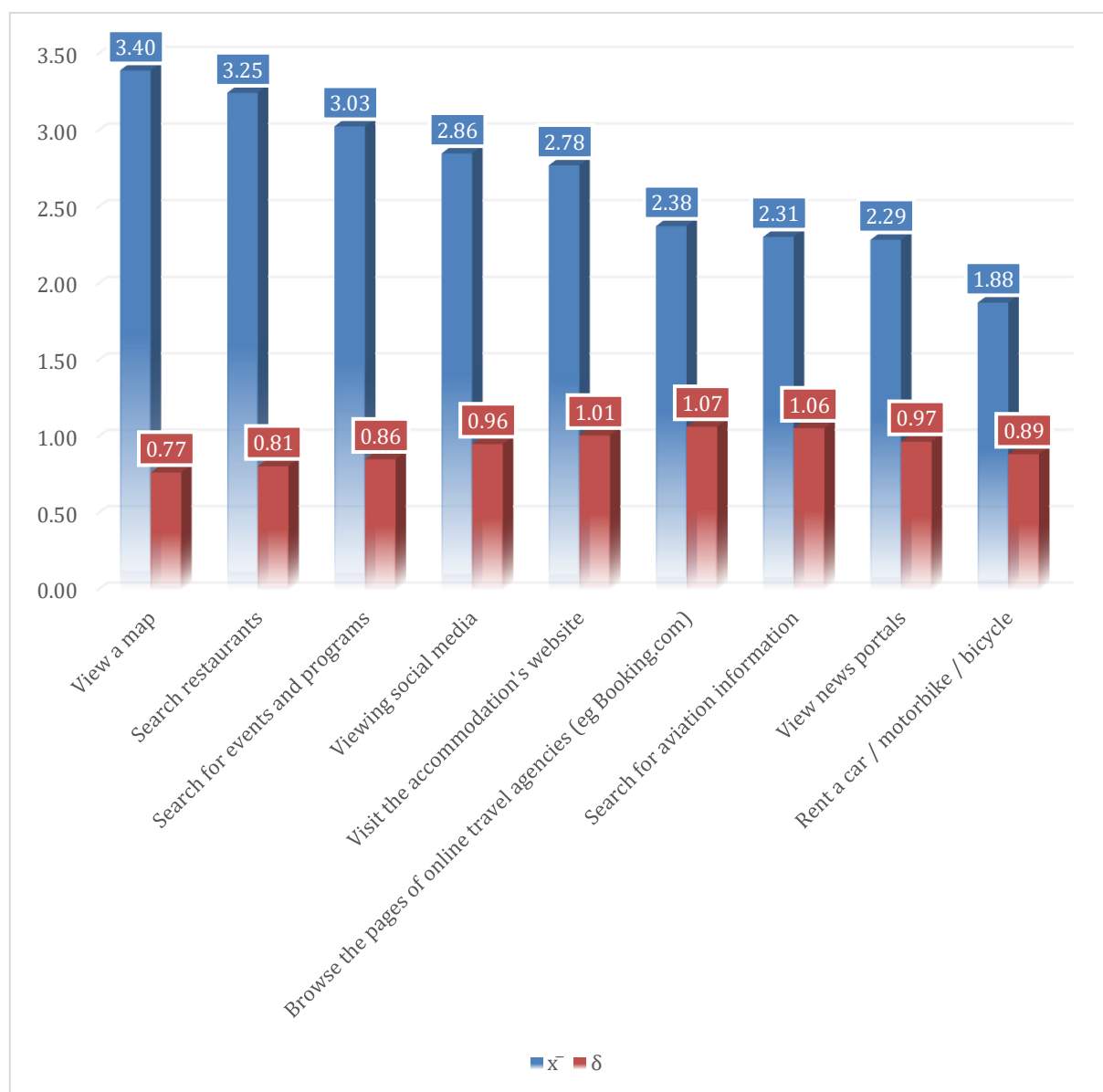


Fig. 6. Mean and standard deviation of respondents' travel activity (n=1942)

Source: own editing

I have analysed these three factors in the third step. However, the statements I had used in the previous two steps were not appropriate, as they were not specifically related to the topic of feedback and opinions, so it would have been pointless to run the analysis, as I had to refer to a specific topic. Accordingly, my questionnaire also assessed the importance of online reviews, which included the following statements¹²:

- i. Sometimes online reviews or social media make me want to travel.
- ii. I check out what other people are saying about where I want to travel.
- iii. I only decide where to travel based on objective facts.
- iv. The opinions of other travellers and guests matter a lot to me.

¹² where a score of 1 was equivalent to "strongly disagree" and a score of 5 was equivalent to "strongly agree"

- v. I'm interested in what others have tried in a particular place (either services or accommodation).
- vi. I usually compare prices online.
- vii. I'm interested in how many points others have rated a place (e.g. on Accommodation.com or Booking)
- viii. I often use my digital device when travelling (e.g. exploring, finding activities, etc.).
- ix. I (also) share reviews, pictures or posts online while on holiday/traveling.
- x. After the holiday/travel (also) share reviews, pictures or posts online.

Each of the three most popular services - map, search for restaurants, and search for events and programmes - served as a starting point to look at all three.

The positive range of *map viewing* includes $n=1909$ completers ($G^2=3883.78$). The first decision associated with the map is that the sample members often use their digital device during travel e.g. for exploring, searching for events. I also tested this statement independently of the decision tree using logistic regression analysis, with a p-value of less than 0.0001 when examining χ^2 . The strong association and the decision tree help to rule out possible pattern bias for those who might use a traditional map.

For many of those who rated the statement at 5.00, this is where the decision tree line stops ($n=788$). This is not surprising, after all, people who are good at using Google maps, for example, can find everything they need immediately: destinations, service providers, associated images, feedback, ratings, reviews, etc. 1121 people continued along the decision tree ($G^2=2472.70$), these are the ones who rated it at less than 5.00. Here the decision cycle is repeated, one could separately continue narrowing down one value, for cases greater than 4.00 and for cases less than 4.00. Those who rated the strength of the claim at 4.00 are again 'out of line', presumably the map and the solutions provided by digital tools alone are sufficient for many $n=616$. However, those who do not find their expectations are trying to find some other form of concrete opinion, as the next level shows "I am interested in what others have tried in a particular place". 126 participants rated below 3.00, while those who remained in the positive range at this level, i.e. above 3.00, numbered 379.

The search for events and programmes also raises the importance of digital devices ($n=1913$) ($G^2=4600.08$). The first line ($n=788$) remains at 5.00 and it can be seen that those who found the right programme for themselves e.g. with their smartphone or laptop, the next step for them is to share reviews, pictures, posts while on holiday/travel. I think this is very important, as this is where the feedback happens first. 262 people do this completely, with a score of 5.00 indicating that they do share their experiences while travelling, e.g. on social media. Below 5.00, 526 participants appear, but their line is broken, there is no trend to track their behaviour based on the questionnaire. On the other line of respondents linking the importance of looking for events and programmes and digital devices, 1125 sample participants were below 5.00. On this strand, the decision cycle is repeated, i.e. they continue to search until the next split point where they move on to consider "other travellers' and guests' opinions matter a lot to me", also with two outputs.

The search for restaurants ($n=1909$) also unsurprisingly boiled down to digital. In summary, this tree is characterised by a lengthy search, with some users finding what they expect, and others going as far as sharing content while on holiday/travelling (presumably these are the 'food photos' category in this context). This in turn leads to further online enquiries, presumably the resulting online interactions attract further opinion-seeking.

The third case thus outlined several places for feedback, but it is logical that this can be done not only during travel, but (especially) after travel.

To do this, we assessed whether and in what form they usually give their opinion on the services they have used.

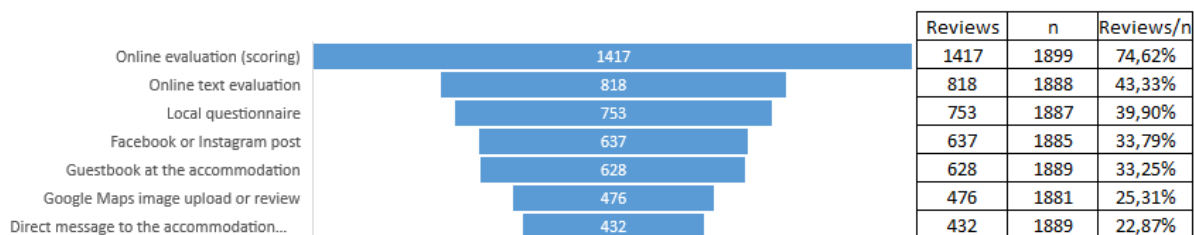


Fig. 7. Frequency of service evaluation for completers
Source: own editing

As shown in Figure 7, the most popular (and of course the easiest way) to give feedback is an online evaluation that consists of a scoring system. Of the 1899 respondents, 1417 answered yes, representing a 74.62% response rate. Of course, this can manifest itself on any platform, whether it's a Google map, an OTA, or in a number of places - if there is an option - a provider's website, social media page. This high rate suggests that the average user does leave some form of feedback. Confirming this, I examined the full sample and there were only 164 users who did not leave any form of review/opinion/feedback. This is less than 10% of the sample. In addition to this, another question surveyed the statement "I (also) share reviews, pictures or posts online after the holiday/trip", which was associated with a mean value of 3.00 above, 3.23 to be precise, i.e. a positive rather than negative attitude.

If we summarise all the above results as a sequence of steps, we can see concretely that if we start from the need, which is shaped by the opinions, it is followed by a collection of information, then the choice of destination and the assignment of services, the purchase of services, which is further mediated and connected to the realisation of the trip (where feedback is already given), and then the sequence of results also ends in opinions after the trip. Based on my primary data and analyses, as well as secondary data and literature review, I can visualise the opinion-based behaviour in Figure 8 below.

As we have referred to several times in my description, and as we have illustrated in Figure 8, I have of course seen the whole purchase process. But importantly - and the novelty of this approach is that while the need comes first in the buying process itself, my research shows that the digital space can shape it. This is further compounded by the fact that the digital space has an impact at every step of the buying process, influencing the buying decision at virtually every level.

Through the results of the decision tree, the correlation analysis, the mean and standard deviation, and the mapped secondary information, the sequence of actions and the opinion-based impulses that influence them can be traced and even represented in a model, as shown in Figure 8, and therefore I consider my *H1 hypothesis to be confirmed and claim that the online space behaviour of the digital tourist based on opinions can be understood, accurately described and traced, and the sequence of actions can be modelled.*

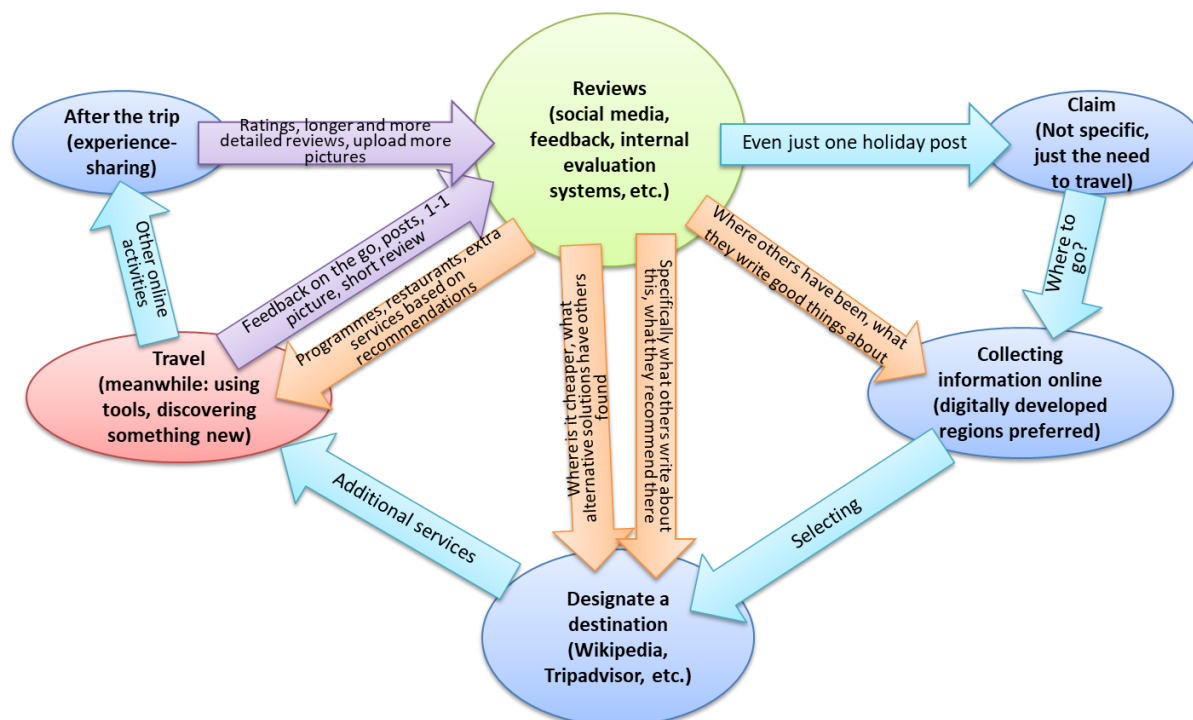


Fig. 8. Set of actions for the digital tourist based on opinions
Source: own editing

4. Conclusions, proposals

The digital world and the online space have transformed tourist behaviour. The emergence of social media and the spread of smartphones has shaped a new community in tourism, and has had a growing impact on the design and structure of websites, linking them to commercial services such as booking systems. They also facilitated the interaction of all users, which led to the rise of a phenomenon known as electronic word of mouth (eWOM). In the digital age, eWOM has completely changed the way consumers consume information, and in the tourism sector, tourists are increasingly relying on eWOM to find information about service providers and to share their personal experiences of services. Pointing this out, my research used the tool of artificial neural networks to answer my research question by modelling decision trees to understand the online spatial behaviour of digital tourists based on their opinions and how eWOM affects the behaviour of digital tourists.

Through the results of the decision tree, correlation analysis, mean and standard deviation, the action sequence and the opinion-based impulses that influence it can be traced: even just seeing content on social media can trigger a demand. This does not necessarily indicate a specific need, but rather a general need to travel. The information gathering then takes place, with a more focused focus on the opinions of others. With the information gathered, a destination is chosen, based on the opinions of friends and social media, and the first phase of purchasing services is carried out. During the trip, the purchase of services also takes place, but here too the opinions of others on programmes, restaurants and sub-destinations are an influencing factor. It is important that feedback is also given during the trip, feedback on the go. And the post-travel experience is entirely a sharing phase, where new demand is generated through reviews and scores.

At this point, however, I think it is worth projecting my results onto the supply side, first and foremost at the level of SMEs. After all, the aim may not only be to reach WoM and eWoM - which have been shown to be the most effective way to reach consumers - but it is also possible to calculate regularities such as the behaviour of digital tourists based on reviews. Recognising this, SMEs can

therefore plan their communications as effectively as their larger competitors. Indeed, success in the online space depends on small things such as reading positive things from consumers about services, reflecting on negative comments and monitoring their own e-platforms, thus generating a better and more successful eWoM and, of course, getting to know the tourist better.

Author Contributions

Conceptualization, M.K. and F.B.; methodology, M.K.; software, M.K.; validation, F.B.; formal analysis, M.K.; investigation, M.K.; resources, M.K.; data curation, M.K.; writing—original draft preparation, M.K.; writing—review and editing, F.B.; visualization, M.K.; supervision, M.K. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement

The datasets generated during and/or analysed during the current study are not publicly available due to the privacy-preserving nature of the data. However, they can be obtained from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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