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Hamed Gheibdoust, Shahram Gilaninia, Mohammad Taleghani

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## Evaluating the influence of service quality factors in the digital hospitality industry during the COVID-19 pandemic

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Hamed Gheibdoust\*, Shahram Gilaninia and  
Mohammad Taleghani

Department of Industrial Management,  
Rasht Branch,  
Islamic Azad University,  
Rasht, Iran

Email: gheibdoust@phd.iaurasht.ac.ir

Email: drgilaninia@iaurasht.ac.ir

Email: Taleghani@iaurasht.ac.ir

\*Corresponding author

**Abstract:** During the COVID-19 pandemic, digital technology has been employed in many parts of the hospitality and tourism industry. The present paper aims to evaluate the factors of the service quality (SERVQUAL) approach in the digital hospitality industry. The present research prioritised the SERVQUAL factors for the digital hospitality industry in Iran using the analytic network process (ANP). The data collection instrument was an ANP questionnaire, and data were collected in 2021. In the present research, five criteria and 20 sub-criteria were used for SERVQUAL in the field of digital hospitality. The most influencing criteria were intangibles, and among the sub-criteria, the most important one was mobile integrity. This study helps hospitality managers and policymakers to improve their use of digital services by emphasising the most influential factors in the hospitality industry.

**Keywords:** digital hospitality; digitalisation; SERVQUAL; COVID-19; analytic network process; ANP; service quality; hospitality industry; digital technology; digital services; Iran.

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**Biographical notes:** Hamed Gheibdoust is a PhD candidate and his field is industrial management. He is studying for PhD in the Department of Industrial Management, Islamic Azad University, Rasht Branch, Rasht, Iran. He does research on supply chain management, food supply chain, food security, green supply chain management, and hospitality.

Shahram Gilaninia is an Associate Professor of Industrial Management at Islamic Azad University, Rasht, Iran. He received his PhD in Industrial Management (Production) from the Science and Research Branch, Islamic Azad University, Tehran, Iran. He has published more than 200 papers in

reputable academic journals and conferences. His research interests are applications of operational research in industries, new product development, supply chain management, and production planning.

Mohammad Taleghani holds a PhD degree in Industrial Management with a focus on production. He is an Associate Professor in the Industrial Management Department and a member of the academic faculty of Islamic Azad University, Rasht branch. In addition, he cooperates with several universities and institutes of higher education as a visiting professor. His main expertise is in the field of production and operations management and he has published more than 100 scientific articles in international journals and has books in the fields of quality management, productivity management, information systems and strategic management. He also cooperates with industrial companies in educational and research fields.

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## 1 Introduction

The service industry is becoming more significant every day, and everybody knows that it can improve a country's economic situation, as service industries are always concerned about customer satisfaction (Sari et al., 2016; Tan et al., 2014). Service quality can be considered a source of competitive advantage and a determining factor of company success. Service quality contributes to the retention of current customers and the attraction of new ones and improves the company's reputation and profits (Carrasco et al., 2017).

The COVID-19 virus first started in China and spread rapidly all over the world, forcing governments to quarantine people extensively, and causing severe damage to the economy (Umar et al., 2021). Technological development is under progress in various fields including robotics, digitalisation, etc. The pandemic has nearly affected all aspects of our lives all over the world (Haleem et al., 2020). This fact has resulted in the increasing rate of use of the above-mentioned technologies in the real world, with considerable outcomes (Zimmerling and Chen, 2021).

This paper presents a multiple-criteria decision-making (MCDM) model, which is appropriate as an evaluation method. The analytic network process (ANP) is used to measure the weight of criteria and sub-criteria based on the SERVQUAL factors in the digital hospitality industry. The present study aims to evaluate service quality factors in the digital hospitality industry and find the significant factors during the COVID-19 pandemic. The innovation of the present study lies in the fact that Today, digital technology has various uses in the hospitality industry, and with the advent of COVID-19, the use of this technology in the hospitality industry has rapidly expanded. Therefore, this study is supporting hospitality managers to have better performance during this critical period. Another innovation is that this study used the ANP method to rank service quality (SERVQUAL) influencing factors in digital hospitality and added two new digital hospitality sub-criteria to the model.

Representing the problem structure as a network allows the consideration of the relationships between elements at different levels and that makes it possible to find out which elements are more dominant and which criteria are more influential. Analysis of the criteria enables researchers to understand the problem. Such prioritisation of the

criteria represents the main purpose of the present study (Becker et al., 2017). The analytic hierarchy process (AHP) deals with the problem as a one-way hierarchy, but complicated relationships at decision-making levels cannot be addressed using this approach. Interactions between elements at upper and lower levels in the hierarchy necessitate using such techniques as ANP that are suitable for complicated problems (KianiMavi et al., 2019). AHP considers a hierarchical relationship between criteria and alternatives, but this structure is not suitable for many decision-making situations. In ANP a network replaces the hierarchy emphasising the mutual relationship between decision-making factors; that allows a systematic analysis and present research shows the benefits of this approach (Chen, 2016). During the past 20 years, the ANP concept has been widely diffused and adopted all around the world (Alotaibi and Al Anizi, 2020). ANP approach is applied in various areas including construction (Becker et al., 2017), airlines (Chen, 2016), supply chains (Salahi, 2020), projects (Yücelgazi and Yitmen, 2020), tourism (García-Melón et al., 2012), etc.

Service quality in the field of digital hospitality can be evaluated based on a lot of factors. Evaluating the influence of SERVQUAL factors and the outcome of research may be helpful for service providers that have started to use digital technologies and help the management and service providers to provide better digital services to the guests (Büyüközkan et al., 2019). The present research has identified and prioritised the influence factors of the digital hospitality industry by presenting the ANP method and using the opinion of experts. The research questions are as follows:

- RQ1 What factors have the greatest influence on SERVQUAL in the digital hospitality industry?
- RQ2 What are the priorities of factors influencing SERVQUAL in digital hospitality?
- RQ3 What is the influence of SERVQUAL on digital hospitality?

Increasing use of digital services in the hospitality industry results in a decrease in tourists' problems, and the study of service quality in this sector can lead to improved efficiency. Respecting the fact that the present research evaluated and prioritised the factors influencing service quality in the hospitality industry using the ANP technique and identified the factors contributing the most to providing better services in this sector, therefore, this study can help relevant managers and policymakers and the result in improved service quality in this field. Service quality contributes to the profitability and competitiveness of firms. In a previous research study conducted to evaluate service quality in digital hospitality using the AHP approach, the factors influencing service quality were prioritised and the most significant ones contributing to improved performance and better digital services in this field were identified (Büyüközkan et al., 2019). Given that the COVID-19 disease has new strains in different countries and threatens various industries, including the hospitality industry, the use of new technology in this industry is inevitable and requires further studies in this field.

## 2 Literature

### 2.1 COVID-19

COVID-19 was first identified by the World Health Organization (WHO) in Wuhan, China in December 2019 and quickly spread throughout the world (Honarmandi and Zarei, 2022; Goar et al., 2021). Today the COVID-19 pandemic is one of the main challenges facing the world with more than 99 million cases and 2 million deaths up to late January 2021 (Tu et al., 2021). Since the outbreak of COVID-19, companies have gradually been faced with reduced profit and some interruptions in their supply chain; there has also been an increasing demand for certain specialised products (Zimmerling and Chen, 2021). Song et al. (2021) examined the impact of COVID-19 on the tourism industry, and the results showed that death from COVID-19 had a significant impact on the tourism industry. Estiri et al. (2022) in their study examined the tourism industry during COVID-19, and the results showed that the ability to plan for disaster management is more significant among the factors under study.

### 2.2 Hospitality industry in COVID-19 pandemic

The tourism and hospitality industry has been severely affected by the outcomes of this highly contagious virus including extensive quarantines, travel restrictions, social distancing rules, and long-term lockdowns (Yin and Ni, 2021). Concerning the global spread of COVID-19 and protective actions taken to prevent the viral infection, many industries and businesses, especially those related to tourism, travel, and hospitality, have been affected devastatingly (Canhoto and Wei, 2021; Almeida and Silva, 2020). After COVID-19, the tourism and hospitality industry with a 78% decrease affected about 120 million jobs and is one of the most significant factors in reducing profitability in the tourism sector (Cheng et al., 2021).

The role played by the hospitality industry is increasing across most of the world and the COVID-19 pandemic has put an obstacle on this path. As this industry deals mainly with people from various parts of the world, there is an increased risk of the spread of viral infection (Shapoval et al., 2021). On the other hand, there has been an increasing focus on observing hygiene in the hospitality industry since the outbreak of the pandemic (Pillai et al., 2021). According to Khan et al. (2021) given the highly contagious nature of COVID-19 and the necessity of social distancing, special emphasis should be placed on the automation of operations in the hospitality industry.

### 2.3 Digitalisation

Today digitalisation has enormously transformed the world; smart gadgets and IoT devices have changed our lives globally leading us toward a connected life. Massive advances in information technology and the emergence of the Internet and mobile phones are known as the best agents of information exchange (Al-Nawayseh et al., 2019). All aspects of society have been influenced by digital innovations and technologies. They also have implications for tourism and the hospitality industry (Pencarelli, 2020). However, people, and in particular workers in the hospitality industry, should be given the required advice and instructions on using new technologies to avoid irreparable mistakes (Chadee et al., 2021). Misser et al. (2020) evaluated the implementation of new

technology in the hospital, and the result showed that the technology implementation protocol consists of five factors and executive activities. Ali et al. (2014) reported that hospitality students believed digital technologies contribute to sustainable development and make it more likely for job seekers to be employed. In general, technology improves and enriches the services provided by the hospitality industry (Mingotto et al., 2021). He (2022) investigated the use of social platforms in smart communities in the post-COVID-19 era. The results help to achieve sustainable development in smart communities. Bhati et al. (2021) designed a digital device for diagnosing COVID-19 with the lowest cost. The results showed that the design of this device helps prevent the spread of COVID-19 and saves the lives of many people.

#### *2.4 Digital hospitality industry in COVID-19 pandemic*

The COVID-19 pandemic has paved the way for more technological opportunities and innovations not only in the field of healthcare but also in all other industries and businesses (Zimmerling and Chen, 2021). Digital innovations have made it possible for tourism and hospitality industry clients to use various smart gadgets to experience augmented and virtual reality offers (Rese et al., 2017). As mentioned above, various actions have been taken to prevent the spread of the new coronavirus relying on health and safety protocols including lockdowns, quarantines, social distancing rules, travel restrictions, and prohibitions, etc. and the hospitality industry, by nature, has been affected most devastatingly by these measures (Chadee et al., 2021).

Also, digital technology has allowed companies operating in the hospitality and tourism industry to provide their clients with online services, and potential customers have many choices to start and plan their journey (Buhalis and Law, 2008). Currently, many activities including bookings in the tourism and hospitality industry are mostly done online because of the COVID-19 pandemic and many employees do not go to their physical workplaces, but they work from home as in other industries. Digitalisation innovations are increasingly used by companies, in particular those in tourism and the hospitality industry, to keep in contact with their clients and customers at such a critical time (Chadee et al., 2021). According to Alhasan and Hasaneen (2021) healthcare professionals have been increasingly focused on digital technologies during the COVID-19 pandemic to stay connected with and provide appropriate care to their clients. Moreover, the retail sector also has increasingly shifted towards digital innovations in response to the COVID-19 pandemic, and this trend is likely to continue in the future because customers gradually adapt to it, and demand new ways of providing retailer services. Grekousis and Liu (2021) conducted a systematic review of digital contact tracing concerning the COVID-19 pandemic and concluded that this technology was effective in various environments.

Companies operating in the tourism, hospitality, and travel industry are faced with the ever-increasing use of online services by their customers. These companies should focus on the quality of these services to survive and grow in their market (Rahahleh et al., 2020). Ivankovič et al. (2010) studied the Hospitality industry in Slovenia, and the results showed that the performance of measurement levels negatively affects the profitability of hotels.

## 2.5 *SERVQUAL*

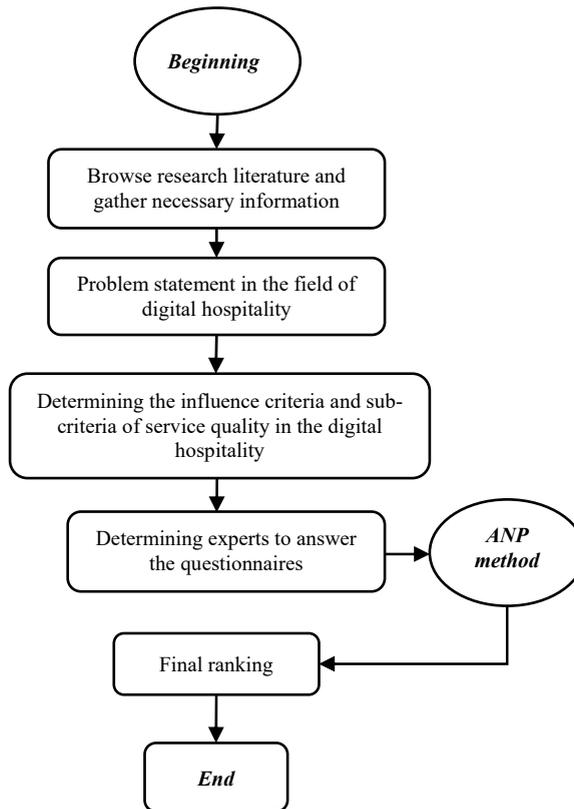
Service quality and customer satisfaction are two critical factors contributing to the ever-increasing rate of growth for hospitality and tourism businesses besides other driving forces. The hospitality and tourism industry has relied on these two significant factors to retain existing customers and attract new ones (Ruel and Njoku, 2021).

Parasuraman et al. (1985) proposed *SERVQUAL*, a multiple-item scale, for the measurement of service quality. It is based on a comparison between customers' expectations and perceptions of the service provided by an organisation (Sakyi, 2020; Wattanakamolchai et al., 2014; Ekinici, 2002). Sakyi (2020) compared the service quality among the Economic Community of West African States (ECOWAS) seaports using the *SERVQUAL* technique and found that all seaports provided poor services. Büyüközkan et al. (2019) proposed a new service quality model for the digital hospitality industry based on the classic *SERVQUAL* rearrangement and used Analytic Hierarchical Process (AHP) to rank the criteria. Also, Stefano et al. (2015) employed the fuzzy AHP to measure the Service quality in a large hotel and revealed the quality issues which could be addressed by the hotel management.

Having identified the most important factors of *SERVQUAL*, the present research partly fills the gaps in digital hospitality development policymaking in developing countries. Contrary to previous research, the present study developed a model and it is of more importance concerning this fact. Also, previous research used an AHP approach which has a hierarchical structure and does not take the criteria interdependencies into account (Büyüközkan et al., 2019). The present research used the ANP technique, a more developed version of AHP, which considers the relationships between criteria and provides better results.

## 3 Methodology

This research employed ANP to evaluate *SERVQUAL* factors in the digital hospitality industry. After identifying the influence factors of *SERVQUAL* in digital hospitality, the factors *SERVQUAL* were ranked, and the most influential factors were identified. Data was collected using a questionnaire. ANP questionnaire is a type of closed questionnaire. For this purpose, five main criteria and 20 sub-criteria of *SERVQUAL* were compared in pairwise comparisons. ANP questionnaire is a standard tool that is used to determine the weight of criteria and options based on pairwise comparison and was presented by Satty (2008). To analyse this method, we need to prepare an ANP questionnaire, which is also known as paired comparison questionnaire. That is, in each question, those criteria or options are compared two by two. Using the research questionnaire, pairwise comparisons were conducted between the factors on a nine-point scale ranging from equal importance (1) to strongly higher importance (9) and vice versa (KianiMavi et al., 2020). Data collection was done from April to December 2021 in Iran. A total of 12 experts were identified using the snowball sampling method. The experts were 12 managers and employees of Rasht travel agencies, all of the experts are full familiarity with the digital hospitality industry and at least have a master's degree with more than ten years of work experience. The obtained data were analysed by Super Decision software. The research framework is well shown in Figure 1.

**Figure 1** Research framework

### 3.1 ANP method

MCDM, subsumed under operations research, is a technique that deals with decisions involving conflicting criteria (Nilashi et al., 2016). In the real world, it is difficult to measure service quality by relying on language power (KianiMavi et al., 2019). MCDM techniques allow management to make systematic decisions in complicated situations (Aragonés-Beltrán et al., 2014). The ANP is used to overcome the limitations of the AHP. Representing the problem structure as a network allows the consideration of the relationships between elements at different levels and that makes it possible to find out which elements are more dominant and which criteria are more influential. Analysis of the criteria enables researchers to understand the problem. Such prioritisation of the criteria represents the main purpose of the present study (Becker et al., 2017). AHP deals with the problem as a one-way hierarchy, but complicated relationships at decision-making levels cannot be addressed using this approach. Interactions between elements at upper and lower levels in the hierarchy necessitate using such techniques as ANP that are suitable for complicated problems (KianiMavi et al., 2019; Toosi and Samani, 2012).

In this research, the ANP method has been used. ANP is an extended version of AHP that considers the internal relationships of criteria. ANP, proposed by Saaty and Vargas (2006), is a generalised form of AHP and is applied to those decision-making contexts in

which various decision elements are interdependent and influence each other. Contrary to AHP which is based on a hierarchical structure, in ANP a network of relations is considered (KianiMavi et al., 2019). Similar to AHP, pairwise comparisons are used in ANP where pairwise comparisons are conducted between the criteria concerning the alternatives, and also another set of pairwise comparisons are performed between the alternatives concerning the criteria (Nilashi et al., 2016).

As the first step in ANP, a super matrix is formed by entering the weights (priorities) derived from pairwise comparisons. One method to conduct calculations in ANP is that the weights obtained from pairwise comparisons are set in a matrix called supermatrix. In order to understand the concept of supermatrix, assume that the problem has  $K$  clusters  $C_1, C_2, \dots, C_k$  and there are  $n_i$  elements  $e_{i,1}, e_{i,2}, \dots, e_{i,n_i}$  ( $i = 1, 2, \dots, K$ ) in the  $i^{\text{th}}$  cluster. If two clusters  $i$  and  $j$  are chosen and all elements of cluster  $i$  are compared in a pairwise manner with respect to the first element of cluster  $j$ , then, the resulting eigenvector will be  $w_i^{j,1}$  which shows the priority weights of  $e_{i,1}, e_{i,2}, \dots, e_{i,n_i}$  in regards to  $e_{j,1}$  (the sum of weights will be one). If this comparison is not significant, then the corresponding eigenvector would be zero (Saaty, 2008).

$$W = \begin{bmatrix} w_{i1}^{j1} \\ w_{i2}^{j1} \\ \vdots \\ w_{in_i}^{j1} \end{bmatrix} \tag{1}$$

After pairwise comparisons of branch  $i$ 's elements to branch  $j$ 's elements and obtaining the eigenvectors, the result is the following matrix:

$$W = \begin{bmatrix} w_{i1}^{j1} & w_{i2}^{j2} & \dots & w_{i1}^{jn_j} \\ w_{i2}^{j1} & w_{i2}^{j2} & \dots & w_{i2}^{jn_j} \\ \vdots & \vdots & \ddots & \vdots \\ w_{in_i}^{j1} & w_{in_i}^{jn_j} & \dots & w_{in_i}^{jn_j} \end{bmatrix} \tag{2}$$

Then a similar matrix is formed for all branches using the same process, and finally, the supermatrix is resulted as shown in (3). It is obtained using the eigenvectors of the relationships among network components. The supermatrix consists of several blocks representing the weights obtained by comparing rows and columns in a pairwise manner.

$$W = \begin{matrix} & \begin{matrix} C_1 & C_2 & \dots & C_n \\ e_{11}e_{12}\dots e_{1m_1} & e_{11}e_{12}\dots e_{1m_1} & & e_{11}e_{12}\dots e_{1m_1} \end{matrix} \\ \begin{matrix} C_1 \\ e_{11} \\ e_{12} \\ \vdots \\ e_{1m_1} \end{matrix} & \begin{bmatrix} W_{11} & W_{12} & \dots & W_{1n} \\ W_{21} & W_{22} & \dots & W_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ W_{n1} & W_{n2} & \dots & W_{nn} \end{bmatrix} \end{matrix} \tag{3}$$

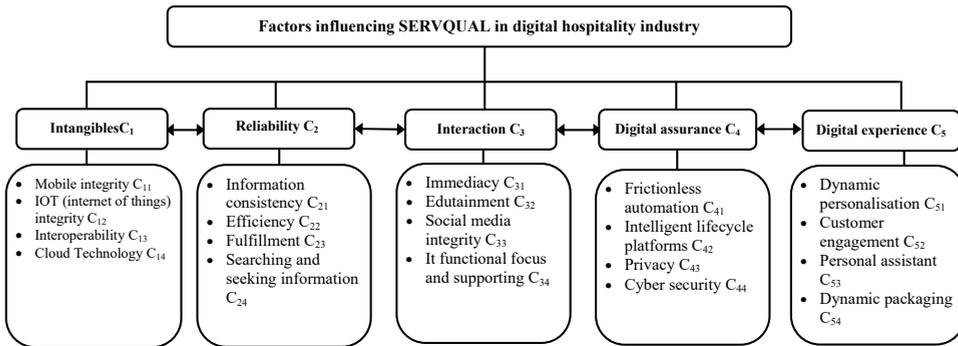
This way the unweighted supermatrix is obtained. It contains the weights of decision criteria representing their priorities and the priority vectors of alternatives. In the next step, the weighted supermatrix is formed by normalising the unweighted supermatrix columns. To this end, we divide all elements at each column of the unweighted supermatrix by the summed priority weight of that column. As shown by Saaty (2008), the final weight of elements can be obtained using the following equation:

$$W = \lim_{k \rightarrow \infty} w^{2k+1} \tag{4}$$

In the above equation,  $k$  represents an arbitrary number; the final matrix i.e., limit matrix results from solving that equation. In this matrix, all numbers in one row represent the criterion weight in the same row (Saaty and Vargas, 2006).

In this study, a SERVQUAL model was developed for the digital hospitality industry (Büyüközkan et al., 2018; Buhalis and Leung, 2018; Zsarnoczky, 2018; Oracle, 2017; Neuhofer et al., 2015). The model was derived from Büyüközkan et al. (2019), but after studying various articles, two new sub-criteria, Searching and Seeking Information (Ali et al., 2014; Guo et al., 2011; Kolb, 1984), and IT Functional Focus and Supporting (Lam and Law, 2019) were added to the model. Figure 2 shows the developed model presenting the network of relationships between criteria and sub-criteria.

**Figure 2** Structural network of service quality evaluation (SERVQUAL) for digital hospitality industry



## 4 Findings

The present research utilised the ANP method and compared all criteria and sub-criteria in a pairwise manner. The geometric means of rows were used to determine the weights of criteria and sub-criteria. Then the geometric means of rows were calculated and separately divided by the sum of all geometric means. Based on the obtained special vector, the main criteria are prioritised and their rank is determined.

The inconsistency was less than 0.1, thus our comparisons were valid. There were five criteria and twenty sub-criteria. We performed a separate pairwise comparison for each cluster. In the next step, an unweighted supermatrix was obtained representing the output of criteria comparisons in terms of the intended goal and relationships among the criteria. After normalising, we obtained the weighted supermatrix. Then, the weighted supermatrix was raised to the power and the output was the limit supermatrix. These

steps were performed repeatedly up to the point that the elements in each super matrix's row converged to the same value. The whole process for obtaining the limit super matrix was implemented by the Super Decision software.

**Table 1** SERVQUAL criteria and sub-criteria for digital hospitality industry weighted and ranked using ANP approach

<i>Criteria</i>	<i>Total weight</i>	<i>Sub-criteria</i>	<i>Ideal weight</i>	<i>Normal weight</i>	<i>Total weight</i>	<i>Rank</i>
Intangibles C <sub>1</sub>	0.180646	Mobile integrity C <sub>11</sub>	1	0.216189	0.108095	1
		IOT integrity C <sub>12</sub>	0.216936	0.046899	0.02345	7
		Interoperability C <sub>13</sub>	0.098265	0.021244	0.010622	12
		Cloud technology C <sub>14</sub>	0.355983	0.07696	0.03848	5
Reliability C <sub>2</sub>	0.141594	Information consistency C <sub>21</sub>	0.395918	0.085593	0.042797	4
		Efficiency C <sub>22</sub>	0.150691	0.032578	0.016289	10
		Fulfilment C <sub>23</sub>	0.082236	0.017778	0.008889	14
		Searching and seeking information C <sub>24</sub>	0.681062	0.147238	0.073619	2
Interaction C <sub>3</sub>	0.032775	Immediacy C <sub>31</sub>	0.0417	0.009015	0.004507	18
		Edutainment C <sub>32</sub>	0.019699	0.004259	0.002129	20
		Social media integrity C <sub>33</sub>	0.173202	0.037444	0.018722	8
		IT functional focus and supporting C <sub>34</sub>	0.068603	0.014831	0.007416	15
Digital assurance C <sub>4</sub>	0.057494	Frictionless automation C <sub>41</sub>	0.027584	0.005963	0.002982	19
		Intelligent lifecycle platforms C <sub>42</sub>	0.056492	0.012213	0.006106	17
		Privacy C <sub>43</sub>	0.302086	0.065308	0.032654	6
		Cyber security C <sub>44</sub>	0.145724	0.031504	0.015752	11
Digital experience C <sub>5</sub>	0.087492	Dynamic personalisation C <sub>51</sub>	0.162948	0.035228	0.017614	9
		Customer engagement C <sub>52</sub>	0.095129	0.020566	0.010283	13
		Personal assistant C <sub>53</sub>	0.059143	0.012786	0.006393	16
		Dynamic packaging C <sub>54</sub>	0.492181	0.106404	0.053202	3

According to Table 1, experts considered 'intangibles' with a weight of 0.180646 as the most significant service quality factor in the digital hospitality industry. The second and third ranks respectively belonged to 'reliability' and 'digital experience' with weights of 0.141594 and 0.087492. 'Digital assurance' with a weight of 0.057494 and 'interaction' with a weight of 0.032775 were respectively obtained the fourth and the lowest ranks.

Among sub-criteria, 'mobile integrity' with a total weight of 0.108095 was the most influence factor among 20 sub-criteria, and then 'searching and seeking information' with a total weight of 0.073619 obtained the second rank. 'Edutainment' obtained the lowest rank among sub-criteria with a total weight of 0.002129.

## 5 Discussion

The present research aimed to evaluate SERVQUAL influencing factors for the digital hospitality industry during the COVID-19 pandemic in Iran. Results showed that Intangibles was the most significant criterion with a weighting of 0.180646. Among 20 sub-criteria, Mobile Integrity was the most influential factor with a total weighting of 0.108095, noting that it is related to the most influential criterion, Intangibles. The least influential factor among the sub-criteria was Edutainment with a weighting of 0.002129 which is related to the lowest-ranked criterion, Interaction, with a weighting of 0.032775.

The tourism and hospitality industry has benefited from increased digitalisation and technological development. The clients can use various technology products and solutions, including mobile devices, social media, websites of travel agencies, etc. to make a booking, communicate with others, who are interested in their experiences, obtain required information, and so on (Sun et al., 2020). Mobile services and ICT, by nature, are highly welcomed by the travel and tourism industry and nearly can be used by tourists and travellers anywhere and anytime on the move. These services enrich customers' experience and are increasingly becoming personalised and context-aware, relying on intelligent software technologies. Therefore, new and up-to-date mobile services may well be considered a major competitive advantage in the hospitality industry in the future (Carlsson et al., 2005).

Online services and internet applications, particularly those of a mobile nature, are increasingly being used by people. In this context, the protection of users' information and preserving their anonymity are of significant importance. Achieving this goal is even more sensitive and difficult in the field of mobile networks, which, by nature, are wireless and not protected physically. Because of this, encryption algorithms are developed and used to ensure data security in mobile networks (Madani and Tanougast, 2021). Companies operating in the hospitality industry usually collect a great volume of data on their clients to customise their services and enrich customers' experience as this industry, in particular, is based on interacting and dealing with people. However, the collected data, that is the customers' information, are faced with various threats; they may be hacked and misused or lost because of system failures and other potential events. Therefore, hospitality companies do not tend to give any information about security threats and cyber-attacks against their computer systems because they are afraid of losing customers' trust and loyalty and in turn their profit. On the other hand, they do their best to keep their system stable and secure through continuous monitoring (Shabani and Munir, 2020).

The internet of things (IoT) refers to the internet connection of things and devices. IoT can be considered the next technological revolution. IoT is already in use in different forms (smart homes, smart cities, etc.) and provides new advanced services to people (Litoussi et al., 2020). It has a good potential for use in the hospitality industry and can be adapted to revolutionise and further personalise current services provided by this industry (Shabani and Munir, 2020). On the other hand, cloud computing technology is a nearly new concept in the field of information technology. It provides a virtual storing space to the users. The hospitality industry is considered a potential target for services based on cloud computing technology (Gülmez et al., 2014). With increasing progress in the field of IoT and more extensive use of it by people and organisations, an ever-increasing volume of data is produced that brings about a challenge of how to effectively store that information. Cloud technology in the form of cloud storage services provided by big

companies like Google is a good solution to this problem. But this solution has its drawbacks because in this way the data owners lose their direct control over their data, and there are potential security risks (Zhao et al., 2020).

With the increasing use of the internet in various aspects of our life, it is not surprising that tourism, travel, and the hospitality industry is also being widely influenced by this phenomenon, for example in the field of data collection (Prantner et al., 2007). In addition, the internet and related technologies have allowed customers to plan and purchase travel packages online. Therefore, companies in the travel and hospitality industries may build on these technological developments as a critical competitive advantage (Cardoso, 2004). They can rely on these technologies to further personalise and customise their services and ensure their survival and growth in the competitive market. The concept of dynamic packaging appears in this context. It provides various combinations of different components of travel including flights, making a reservation, transferring arrangements, visiting tourist attractions, etc., and can be purchased online. Pricing, inventory, and other features of the packages can be changed dynamically in real-time. Using the internet, customers are currently able to plan and purchase their own personalised (as opposed to pre-determined) holiday packages and enjoy ever more individualised and enriched travel experiences besides attractive discounts (Song and Lee, 2020; Ayazlar, 2014).

Digitalisation affects all parts of our lives and causes productivity in various industries (Gheidar and Shami Zanjani, 2021). Digital technologies have created competition in the hospitality industry and provided a way to attract customers by providing innovative services (Liu et al., 2022). The use of digital technology in the hospitality industry has various applications that bring satisfaction to guests. Digital technologies include mobile applications, artificial intelligence (AI), the IoT, and search engines. The use of digital technology allows travellers to interact with travel agencies, reduce prices, and reduce the traffic of travel agencies (Büyükköçkan et al., 2019).

The use of digital services in the hospitality industry will increase accuracy and improve performance in this industry during COVID-19. The use of online platforms, mobile applications, and software systems such as food delivery applications, and hotel and ticket reservation systems will reduce operational costs and lack of human contact in case of any future integration (Alotaibi and Khan, 2022). In many sectors of the hospitality industry, the use of digital technologies has not been done enough (Ben, 2020). The hospitality industry can provide better digital services during the spread of COVID-19 by providing reservation, ordering, and food delivery programs through mobile applications. Robots, mobile phones, the IoT, and software systems are helping employees provide hospitality services during the COVID-19 pandemic (Alotaibi and Khan, 2022). The role of mobile phone applications in the fight against COVID-19 is significant because mobile phones have enormous applications in the spread of COVID-19 such as information sharing, home monitoring, education, and reporting of disease symptoms (Ali and Khan, 2022). Since the hospitality industry is one of the industries that can cause the spread of the COVID-19 pandemic, digitalisation in this industry is significant. It is critical to be prepared for future outbreaks of similar viruses through digitisation and automation of the hospitality industry.

The current research has significant applications for the digital hospitality industry of Iran as well as other developing countries. By moving towards digitalisation, developing countries will help improve the performance of the hospitality industry, especially during pandemics and natural disasters. Communities that use digital services in different parts

of their lives will have more capacity to accept and use new technologies. This facilitates the use of digital services in the hospitality industry more than ever. The use of influence SERVQUAL factors in the digital hospitality industry will increase the satisfaction of passengers and increase profitability in this industry. By doing this research, managers of the hospitality industry have become familiar with the influence factors of SERVQUAL and can use appropriate policies when faced with possible crises and minimise the effects of possible crises by increasing their strengths. Therefore, the managers and policymakers of this field can minimise the stagnation in this industry and bring about the prosperity of societies. Also, managers help to create innovation in the provision of digital services in the hospitality industry by using sufficient financial resources to implement digital services.

## 6 Conclusions

The hospitality industry is one of the most significant industries in many countries, and digital innovation can make travelling in the era of COVID-19 more enjoyable for travellers. The results of the present study might fill the gap in underdeveloped countries by identifying some of the most influential factors of the digital hospitality industry and paying higher attention to them. Prioritising the influencing factors can help managers and governments to become more familiar with them, improve their performance in the digital hospitality industry and present the best services to tourists. The limitation of the present research is that the appropriate infrastructure for new technologies is not available in some developing countries, which can reduce their use. Governments should adopt appropriate policies and regulations and allocate relevant resources to make it possible for the whole society to use digital services. Future research on using new technologies in the hospitality industry in other countries with different political situations may provide interesting results which help the industry to further develop in the future and provide governments with high revenues. Also, future studies may use other MCDM methods including, CRITIC, and SWARA to prioritise the influencing factors.

## References

- Alhasan, M. and Hasaneen, M. (2021) 'Digital imaging technologies and artificial intelligence applications during COVID-19 pandemic', *Computerized Medical Imaging and Graphics*, Vol. 91, pp.1–22, DOI: 10.1016/j.compmedimag.2021.101933.
- Ali, A., Murphy, H.C. and Nadkarni, S. (2014) 'Hospitality students' perceptions of digital tools for learning and sustainable development', *Journal of Hospitality, Leisure, Sport & Tourism Education*, Vol. 15, pp.1–10, DOI:10.1016/j.jhlste.2014.02.001.
- Ali, Y. and Khan, H.U. (2022) 'Designing evaluation framework for the empirical assessment of COVID-19 mobile apps in Pakistan', *Computers and Electrical Engineering*, Vol. 102, <https://doi.org/10.1016/j.compeleceng.2022.108260>.
- Almeida, F. and Silva, O. (2020) 'The impact of COVID-19 on tourism sustainability: evidence from Portugal', *Advances in Hospitality and Tourism Research (AHTR)*, Vol. 8, No. 2, pp.440–446, DOI: 10.30519/ahtr.775340.
- Al-Nawayseh, M.K., Baarah, A.H., Al-Masaeed, S.A. and Alnabhan, M.M. (2019) 'Mobile learning adoption in Jordan: technology influencing factors', *International Journal of Networking and Virtual Organisations*, Vol. 20, No. 4, pp.400–417, <https://dx.doi.org/10.1504/IJNVO.2019.10022273>.

- Alotaibi, E. and Khan, A. (2022) 'Impact of COVID-19 on the hospitality industry and responding to future pandemic through technological innovation', *Procedia Computer Science*, Vol. 204, pp.844–853, <https://doi.org/10.1016/j.procs.2022.08.102>.
- Alotaibi, T. and Al Anizi, C.A. (2020) 'The impact of advanced nurse practitioner (ANP) role on adult patients with cancer: a quantitative systematic review', *Applied Nursing Research*, Vol. 56, pp.1–13, <https://doi.org/10.1016/j.apnr.2020.151370>.
- Aragonés-Beltrán, P., Chaparro-González, F., Pastor-Ferrando, J-P. and Pla-Rubio, A. (2014) 'An AHP (analytic hierarchy process)/ANP (analytic network process)-based multi-criteria decision approach for the selection of solar-thermal power plant investment projects', *Energy*, Vol. 66, pp.222–238, <https://doi.org/10.1016/j.energy.2013.12.016>.
- Ayazlar, R.A. (2014) 'Dynamic packaging applications in travel agencies', *Procedia – Social and Behavioral Sciences*, Vol. 131, pp.326–331, <https://doi.org/10.1016/j.sbspro.2014.04.125>.
- Becker, J., Becker, A. and Saġabun, W. (2017) 'Construction and use of the ANP decision model taking into account the experts' competence', *Procedia Computer Science*, Vol. 112, pp.2269–2279, <https://doi.org/10.1016/j.procs.2017.08.145>.
- Ben, R. (2020) *How Machine Learning Will Transform Hospitality* [online] <https://www.information-age.com/how-machine-learning-will-transform-hospitality-123461441/> (accessed 4 June 2021).
- Bhati, A.N., Maharshi, H. and Kumar, A. (2021) 'Analysis of low-cost electronic device for diagnosis of COVID-19', *International Journal of Networking and Virtual Organisations*, Vol. 25, Nos. 3/4, pp.252–267, <https://dx.doi.org/10.1504/IJNVO.2021.10043850>.
- Buhalis, D. and Law, R. (2008) 'Twenty years on and 10 years after the Internet: the state of tourism research', *Tourism Management*, Vol. 29, No. 4, pp.609–623, DOI: 10.1016/j.tourman.2008.01.005.
- Buhalis, D. and Leung, R. (2018) 'Smart hospitality-Interconnectivity and interoperability towards an ecosystem', *International Journal of Hospitality Management*, Vol. 71, pp.41–50, <https://doi.org/10.1016/j.ijhm.2017.11.011>.
- Büyükoġkan, G., Feyzioġlu, O. and Havle, C.A. (2018) 'A new service quality model for aviation industry', *Proceedings of the 16th International Logistics and Supply Chain Congress*, October, pp.18–20, <https://doi.org/10.1016/j.jairtraman.2020.101817>.
- Büyükoġkan, G., Feyzioġlu, O. and Havle, C.V. (2019) 'Intuitionistic fuzzy AHP based strategic analysis of service quality in digital hospitality industry', *IFAC Papers on Line*, Vol. 52, pp.1687–1692, DOI: 10.1016/j.ifacol.2019.11.443.
- Canhoto, A.I. and Wei, L. (2021) 'Stakeholders of the world, unite!: Hospitality in the time of COVID-19', *International Journal of Hospitality Management*, Vol. 95, pp.1–12, DOI: 10.1016/j.ijhm.2021.102922.
- Cardoso, J. (2004) 'Issues of dynamic travel packaging using web process technology', *Interactional Conference e-Commerce*, pp.357–362 [online] [https://www.researchgate.net/publication/236860231\\_Issues\\_of\\_Dynamic\\_Travel\\_Packaging\\_using\\_Web\\_Process\\_Technology](https://www.researchgate.net/publication/236860231_Issues_of_Dynamic_Travel_Packaging_using_Web_Process_Technology) (accessed 4 July 2021).
- Carlsson, C., Hyvönen, K., Repo, P. and Walden, P. (2005) 'Asynchronous adoption patterns of mobile services', in *Proceedings of the 38th Hawaii International Conference on System Sciences*, IEEE Computer Society Press, <https://doi.org/10.1109/HICSS.2005.106>.
- Carrasco, R.A., Sánchez-Fernández, J., Muñoz-Leiva, F., Blasco, M.F. and Herrera-Viedma, E. (2017) 'Evaluation of the hotels e-services quality under the user's experience', *Soft Computing*, Vol. 21, pp.995–1011, DOI: Google Scholar.
- Chadee, D., Shuang, R. and Tang, G. (2021) 'Is digital technology the magic bullet for performing work at home? Lessons learned for post COVID-19 recovery in hospitality management', *International Journal of Hospitality Management*, Vol. 92, DOI: 10.1016/j.ijhm.2020.102718.

- Chen, I-S. (2016) 'A combined MCDM model based on DEMATEL and ANP for the selection of airline service quality improvement criteria: A study based on the Taiwanese airline industry', *Journal of Air Transport Management*, Vol. 57, pp.7–18, <https://doi.org/10.1016/j.jairtraman.2016.07.004>.
- Cheng, J., Gao, X., Saliba, C. and Dördüncü, R. (2021) "Examine the nexus between COVID-19 and tourism: evidence from Beijing", *Economic Research-Ekonomska Istraživanja*, <https://doi.org/10.1080/1331677X.2021.1942119>.
- Ekinci, Y. (2002) 'A review of theoretical debates on the measurement of service quality: implications for hospitality research', *Journal of Hospitality & Tourism Research*, Vol. 26, No. 3, pp.199–216, <https://doi.org/10.1177/1096348002026003001>.
- Estiri, M., Dahooie, J.H. and Skare, M. (2022) 'COVID-19 crisis and resilience of tourism SME's: a focus on policy responses', *Economic Research Ekonomska Istraživanja*, <https://doi.org/10.1080/1331677X.2022.2032245>.
- García-Melón, M., Gómez-Navarro, T. and Acuña-Dutra, S. (2012) 'A combined ANP-Delphi approach to evaluate sustainable tourism', *Environmental Impact Assessment Review*, Vol. 43, pp.41–50, <http://dx.doi.org/10.1016/j.eiar.2011.12.001>.
- Gheidar, Y. and Shami Zanjani, M. (2021) 'Designing a conceptual framework for digital employee experience', *Iranian Journal of Management Studies*, Vol. 14, No. 4, pp.669–680, <https://doi.org/10.22059/ijms.2020.305871.674131>.
- Goar, V.K., Yadav, N.S., Chowdhary, C.L., Kumaresan, P. and Mittal, M. (2021) 'An IoT and artificial intelligence-based patient care system focused on COVID-19 pandemic', *International Journal of Networking and Virtual Organisations*, Vol. 25, Nos. 3/4, pp.232–251, <https://dx.doi.org/10.1504/IJNVO.2021.10043853>.
- Grekousis, G. and Liu, Y. (2021) 'Digital contact tracing, community uptake, and proximity awareness technology to fight COVID-19': a systematic review', *Sustainable Cities and Society*, Vol. 71, pp.1–11, DOI: 10.1016/j.scs.2021.102995.
- Gülmez, M., Ajanovic, E. and Karayun, I. (2014) 'Cloud technology in hotels: comparison with the current software solutions', *Entrepreneurship in the Hospitality Industry Trends in Hospitality*, Cuj-Napoca Romania [online] <https://www.researchgate.net/publication/322068609> (accessed 4 July 2021).
- Guo, Z., Lu, X., Li, Y. and Li, Y. (2011) 'A framework of students' reasons for using CMC media in learning contexts: a structural approach', *Journal of the American Society for Information Science and Technology*, Vol. 62, No. 11, pp.2182–2200, DOI: 10.1002/asi.21631.
- Haleem, A., Javaid, M. and Vaishya, R. (2020) 'Effects of COVID-19 pandemic in daily life', *Current Medicine Research and Practice*, Vol. 10, No. 2, pp.78–79, doi: 10.1016/j.cmrp.2020.03.011.
- He, M. (2022) 'Understanding residents' continued usage intention of community sharing platforms in smart communities in a post-COVID era: evidence from China', *International Journal of Networking and Virtual Organisations*, Vol. 26, No. 4, pp.268–290, <https://dx.doi.org/10.1504/IJNVO.2022.10049504>.
- Honarmandi, Z. and Zarei, S. (2022) 'How Does COVID-19 affect the volatility spillover between the exchange rate and the export-oriented businesses in Iran?', *Global Business Review*, <https://doi.org/10.1177/09721509211060616>.
- Ivankovič, G., Jankovič, S. and Peršič, S (2010) 'Framework for performance measurement in hospitality industry – case study Slovenia', *Economic Research-Ekonomska Istraživanja*, Vol. 23, pp.12–23, <https://doi.org/10.1080/1331677X.2010.11517420>.
- Khan, A., Bibi, S., Lyu, J., Latif, A. and Lorenzo, A. (2021) 'COVID-19 and sectoral employment trends: assessing resilience in the US leisure and hospitality industry', *Current Issues in Tourism*, Vol. 24, pp.952–969, <https://doi.org/10.1080/13683500.2020.1850653>.
- KianiMavi, R., Gheibdoust, H. and Khanfar, A.A. (2020) 'Prioritizing strategic factors of creative tourism industry in Iran by analytic network process (ANP)', *Event Management*, Vol. 24, pp.553–565, <https://doi.org/10.3727/152599519X15506259855977>.

- KianiMavi, R., Gheibdoust, H., Khanfar, A.A. and KianiMavi, N. (2019) 'Ranking factors influencing strategic management of university business incubators with ANP', *Management Decision*, Vol. 57, No. 12, pp.3492–3510, <https://doi.org/10.1108/MD-06-2018-0688>.
- Kolb, D.A. (1984) *Experiential Learning: Experience as the Source of Learning and Development*, Prentice-Hall, Englewood Cliffs, N.J.
- Lam, C. and Law, R. (2019) 'Readiness of upscale and luxury-branded hotels for digital transformation', *International Journal of Hospitality Management*, Vol. 79, pp.60–69, <https://doi.org/10.1016/j.ijhm.2018.12.015>.
- Litoussi, M., Kannouf, N., Makkaoui, K.E., Ezzati, A. and Fartitchou, M. (2020) 'IoT security: challenges and countermeasures', *Procedia Computer Science*, Vol. 177, pp.503–508, <https://doi.org/10.1016/j.procs.2020.10.069>.
- Liu, Y., Henseler, J. and Liu, Y. (2022) 'What makes tourists adopt smart hospitality? An inquiry beyond the technology acceptance model', *Digital Business*, Vol. 2, <https://doi.org/10.1016/j.digbus.2022.100042>.
- Madani, M. and Tanougast, C. (2021) 'Optimized and robust implementation of mobile networks confidentiality and integrity functions', *Computers & Security*, Vol. 100, <https://doi.org/10.1016/j.cose.2020.102093>.
- Mingotto, E., Montaguti, F. and Tamma, M. (2021) 'Challenges in re-designing operations and jobs to embody AI and robotics in services. Findings from a case in the hospitality industry', *Electronic Markets*, Vol. 31, pp.493–510, <https://doi.org/10.1007/s12525-020-00439-y>.
- Misser, N.S., Jaspers, J., Zaane, B.V., Gooszen, H., Versendaal, J. (2020) 'A protocol for the implementation of new technology in a highly complex hospital environment: the operating room', *International Journal of Networking and Virtual Organisations*, Vol. 22, No. 2, pp.199–217, <https://dx.doi.org/10.1504/IJNVO.2020.10025195>.
- Neuhofner, B., Buhalis, D. and Ladkin, A. (2015) 'Smart technologies for personalized experiences: a case study in the hospitality domain', *Electronic Markets*, Vol. 25, No. 3, pp.243–254, <https://doi.org/10.1007/s12525-015-0182-1>.
- Nilashi, M., Ahmadi, H., Ahani, A., Ravangard, R. and Ibrahim, O.B. (2016) 'Determining the importance of hospital information system adoption factors using fuzzy analytic network process (ANP)', *Technological Forecasting & Social Change*, Vol. 111, pp.244–264, <https://doi.org/10.1016/j.techfore.2016.07.008>.
- Oracle (2017) *Cloud Technologies for the Hospitality Industry* [online] <http://www.oracle.com/us/industries/hospitality/cloud-technologies-hospitality> (accessed 15 June 2021).
- Parasuraman, A., Zeithaml, V.A. and Berry, L.L. (1985) 'A conceptual model of service quality and its implications for future research', *The Journal of Marketing*, Vol. 49, No. 4, pp.41–50, DOI: 10.2307/1251430.
- Pencarelli, T. (2020) 'The digital revolution in the travel and tourism industry', *Information Technology & Tourism*, Vol. 27, pp.455–476, DOI: 10.1007/s40558-019-00160-3.
- Pillai, S.G., Haldorai, K., Seo, W.S. and Kim, W.G. (2021) 'COVID-19 and hospitality 5.0: redefining hospitality operations', *International Journal of Hospitality Management*, Vol. 94, pp.1–11, <https://doi.org/10.1016/j.ijhm.2021.102869>.
- Prantner, K., Ding, Y., Luger, M., Yan, Z. and Herzog, C. (2007) 'Tourism ontology and semantic management system: state-of-the-arts analysis', *IADIS International Conference*, pp.1–5 [online] <https://yingding.ischool.utexas.edu/Publication/OnTourism-IADIS-cameraready.pdf> (accessed 15 June 2021).
- Rahahleh, A., Al-Nsour, S., Moflih, M., Alabaddi, Z., Al-nassar, B. and Al-Nsour, N. (2020) 'The influence of electronic service quality on relationship quality: evidence from tourism industry', *Management Science Letters*, Vol. 10, pp.2759–2768, DOI: 10.5267/j.msl.2020.4.034.

- Rese, A., Baier, D., Geyer-Schulz, A. and Schreiber, S. (2017) 'How augmented reality apps are accepted by consumers: a comparative analysis using scales and opinions', *Technological Forecasting and Social Change*, Vol. 124, pp.306–319, <https://doi.org/10.1016/j.techfore.2016.10.010>.
- Ruel, H. and Njoku, E. (2021) 'AI redefining the hospitality industry', *Journal of Tourism Futures*, Vol. 7, No. 1, pp.53–66, doiL 10.1108/JTF-03-2020-0032.
- Saaty, T.L. (2008) 'Decision making with the analytic hierarchy process', *International Journal of Services Sciences*, Vol. 1, No. 1, pp.83–98.
- Saaty, T.L. (2008) 'Decision making with the analytical hierarchy process', *International Journal of Services Sciences*, Vol. 1, No. 1, pp.83–98, doi/10.1504/IJSSci.2008.01759.
- Saaty, T.L. and Vargas, L.G. (2006) *Decision Making with the Analytic Network Process: Economic Political, social and Technological Applications with Benefits, Opportunities, Costs and Risks*, Springer US. New York, NY.
- Sakyi, D. (2020) 'A comparative analysis of service quality among ECOWAS seaports', *Transportation Research Interdisciplinary Perspectives*, Vol. 6, pp.1–10, <https://doi.org/10.1016/j.trip.2020.100152>.
- Salahi, F. (2020) 'Providing a model to reduce the cost of supply chain risk with a hybrid approach', *Management Accounting*, Vol. 13, No. 45, pp.155–167.
- Sari, F.O., Bulut, C. and Pirnar, I. (2016) 'Adaptation of hospitality service quality scales for marina services', *International Journal of Hospitality Management*, Vol. 54, pp.95–103, <https://doi.org/10.1016/j.ijhm.2016.02.004>.
- Shabani, N. and Munir, A. (2020) 'A review of cyber security issues in hospitality industry', *Intelligent Computing*, pp.482–493, DOI: 10.1007/978-3-030-52243-8\_35.
- Shapoval, V., Hagglund, P., Pizam, A., Abraham, V., Carlback, M. and Nygren Smith, R.M. (2021) 'The COVID-19 pandemic effects on the hospitality industry using social systems theory: A multi-country comparison', *International Journal of Hospitality Management*, Vol. 94, pp.1–12, <https://doi.org/10.1016/j.ijhm.2020.102813>.
- Song, W-K. and Lee, H.C. (2020) 'An analysis of traveler need for and willingness to purchase airline dynamic packaging: a Korean case study', *Journal of Air Transport Management*, Vol. 82, pp.1–11, <https://doi.org/10.1016/j.jairtraman.2019.101735>.
- Song, Y., Zhao, P., Chang, H-L., Razi, U. and Dinca, M.S (2021) 'Does the COVID-19 pandemic affect the tourism industry in China? Evidence from extreme quantiles approach', *Economic Research - Ekonomika Istraživanja*, <https://doi.org/10.1080/1331677X.2021.1941180>.
- Stefano, N.M., Casarotto Filho, N., Barichello, R. and Sohn, A.P. (2015) 'A fuzzy SERVQUAL based method for evaluated of service quality in the hotel industry', *Procedia CIRP*, Vol. 30, pp.433–438, <https://doi.org/10.1016/j.procir.2015.02.140>.
- Sun, Y., Shao, Y. and Chan, E.H.W. (2020) 'Co-visitation network in tourism-driven peri-urban area based on social media analytics: a case study in Shenzhen. China', *Landscape and Urban Planning*, Vol. 204, pp.1–12, DOI: 10.1016/j.landurbplan.2020.103934.
- Tan, Q., Oriade, A. and Fallon, P. (2014) 'Service quality and customer satisfaction in Chinese fast food sector: a proposal for CFFRSERV', *Advances in Hospitality and Tourism Research (AHTR)*, Vol. 2, No. 1, pp.30–53.
- Toosi, S.L.R and Samani, J.M.V. (2012) 'Evaluating water transfer projects using analytic network process (ANP)', *Water Resources Management*, Vol. 26, No. 7, pp.1999–2014, <https://doi.org/10.1007/s11269-012-9995-2>.
- Tu, Y., Li, D. and Wang, H.J. (2021) 'COVID-19-induced layoff, survivors' COVID-19-related stress and performance in hospitality industry: The moderating role of social support', *International Journal of Hospitality Management*, Vol. 95, pp.1–8, <https://doi.org/10.1016/j.ijhm.2021.102912>.
- Umar, M., Xu, Y. and Mirza, S. S (2021) "The impact of Covid-19 on gig economy", *Economic Research-Ekonomika Istraživanja*, Vol. 34, pp.2284–2296, <https://doi.org/10.1080/1331677X.2020.1862688>.

- Wattanakamolchai, S., Singal, M. and Murrmann, S.K. (2014) 'Socially responsible customers and the evaluation of service quality', *Journal of Hospitality & Tourism Research*, pp.1–14, DOI: 10.1177/1096348014525635
- Yin, J. and Ni, Y. (2021) 'COVID-19 event strength, psychological safety, and avoidance coping behaviors for employees in the tourism industry', *Journal of Hospitality and Tourism Management*, Vol. 47, pp.431–442, <https://doi.org/10.1016/j.jhtm.2021.04.017>.
- Yücelgazi, F. and Yitmen, I. (2020) 'An ANP model for risk response assessment in large scale bridge projects', *Civil Engineering and Environmental Systems*, Vol. 37, pp.1–27, <https://doi.org/10.1080/10286608.2019.1702030>.
- Zhao, Q., Chen, S., Liu, Z., Baker, T. and Zhang, Y. (2020) 'Blockchain-based privacy-preserving remote data integrity checking scheme for IoT information systems', *Information Processing & Management*, Vol. 57, No. 6, pp.1–12, <https://doi.org/10.1016/j.ipm.2020.102355>.
- Zimmerling, A. and Chen, X. (2021) 'Innovation and possible long-term impact driven by COVID-19: manufacturing, personal protective equipment and digital technologies', *Technology in Society*, Vol. 65, pp.1–12, DOI: 10.1016/j.techsoc.2021.101541.
- Zsarnoczky, M. (2018) 'The digital future of the tourism & hospitality industry', *Boston Hospitality Review*, pp.1–9, Boston University School of Hospitality Administration [online] <https://www.bu.edu/bhr/2018/05/31/the-digital-future-of-the-tourism-hospitality-industry/> (accessed 18 July 2021).