



# Ranking online shopping websites by considering the criteria weights

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## ABSTRACT

In this study, a three-step methodology is proposed. To begin with, a total of seven main criteria and 23 sub-criteria that affect the selection of online shopping websites are determined by searching the literature and interviewing people. Next, a questionnaire is applied to the people from Turkey and Croatia. It is evaluated using AHP methodology to find the main and sub-criteria weights from the perspective of Turkish and Croatian people. Furthermore, a second questionnaire for ranking three popular online shopping websites in Turkey has been applied. Finally, online shopping websites are ranked as B, A, and C based on the scores obtained from the second questionnaire and criteria weights found in the second step. After estimating the decision weights of the sample from Croatia, we use that as a “what if” analysis for websites A, B, and C. Customers’ shopping behaviors from those online shopping websites are analyzed using SPSS.

## 1. Introduction

The internet usage and the opportunities it offers have expanded in recent years. Online shopping, which has been proliferating for the last two decades, is one of the most popular ways of using the internet that prevents people from wasting time. As a result, many online shopping website companies have increased their revenues. For example, Amazon is one of the most popular online shopping websites worldwide, making its owner the wealthiest businessperson globally. Around 1.8 billion people worldwide purchased goods online in 2018. In the same year, global e-retail sales amount was \$2.8 trillion. Furthermore, projections show that global e-retail sales will grow to up to \$4.48 trillion by the end of 2021 (Chen et al., 2018). In general, the market rate of online shopping has increased at a significant rate in recent years.

The online shopping websites provide a wide range of product variety and discount options better than regular shopping options at shopping malls or stores. Online shopping websites increase their popularity nowadays due to the Covid-19 Pandemic. People prefer to stay home and shop online rather than going to the shopping malls or supermarkets. Significantly, the tendency to shop online for groceries and daily used products has been increased due to the pandemic to prevent diseases. The increasing share of online shopping makes the market more competitive for website owners. Therefore, the online shopping website owners should consider the process behind selecting the best online shopping website to satisfy the customers’ wishes and attract the attention of possible future customers. The decision process can be explained in three steps. First, the criteria and their weights

behind selecting an appropriate online shopping website are considered to understand the importance of each criterion for the customers while selecting the online shopping website. Next, how the customers score the abilities of online shopping websites for each criterion are measured. Finally, those scores and criteria weights are used to find the weighted scores of online shopping websites for each criterion. The website owners should analyze those weighted scores since they clarify the decision process while selecting an online shopping website to place the following order. Thus, the managers of online shopping websites can improve their service quality by focusing on customers’ opinions and their decision process to increase the number of their customers.

This study shows that slight changes in website scores cause changes in online shopping websites’ ranking when the criteria weights are considered. Criteria weights are significant to find more realistic rankings of online shopping websites. The ranking is crucial for the decision-makers of advertisement and marketing companies if they are planning to select the most popular shopping websites to reach out to more customers via their advertisements. It is also vital for the suppliers and manufacturers since they prefer to cooperate with the most popular online shopping websites to sell their products. The criteria weights are also very significant for the online shopping website owners to learn more about the factors behind customers’ decisions while selecting the most convenient websites to shop. So, we focus on the following research questions to analyze the decision process that lies behind selecting the online shopping website:

- What are the criteria that affect the decision process?

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- What are the importance weights of those criteria?
- Based on shopping experiences: How do the customers score the websites they have shopped on before? How do the customers score the websites they have not shopped on before (those customers are potential customers of online shopping websites that they have not shopped yet)?
- How can online shopping websites be ranked based on the criteria weights and scores?

The above research questions are analyzed in this study, and a three-step mixed-methodology for the online shopping website selection process is proposed. There are studies about the same concept using different names. However, those studies focus on finding the criteria weights or sorting/selecting shopping websites. Unlike those studies, our mixed-method research improves the reliability of selecting/sorting the online shopping websites since better estimations can be made with our compact model, which determines the criteria, finds their weights, and rates the online shopping websites in which criteria weights are considered. Furthermore, we compare Turkish and Croatian people's opinions not only to explore cross-cultural differences but also to refer to Croatian findings as a robustness check. We applied the robustness check: (1) to make sure that our results are robust to different cultures while measuring the online shopping website selection criteria, (2) to demonstrate that our primary analysis is correct, and (3) to see how our results (criteria weights and online shopping website rankings) change when Turkish and Croatian people are considered.

In this research, the criteria for choosing online websites are determined first. Next, the weights of the criteria are found using Analytic Hierarchy Process (AHP) methodology. We select people from Ankara-Turkey to apply our face-to-face questionnaire to find the criteria weights since Ankara is the capital and multi-cultural city and hosts people from all regions of Turkey. In addition, we apply the questionnaire to the volunteer people who live in Croatia so as to analyze cross-cultural differences. Another questionnaire is also prepared and applied online to rank the three most popular shopping websites (named as A, B, and C in this study) in Turkey and evaluate their scores. After estimating the decision weights of the sample from Croatia in the second step, we use that as a "what if" analysis for websites A, B, and C. The rest of this paper is organized as follows: The following section describes the key literature on which this paper has been developed and the hierarchy of our study. AHP methodology is defined in the third section. Results and analysis are given in the fourth section. Finally, conclusions and future research opportunities are provided in the last section.

## 2. Literature review and criteria analysis

The literature is reviewed to determine the criteria that affect the consumer's online shopping website selection decision. We interview (face-to-face) people who have online shopping experience to ensure that the criteria found in the literature are also valid for the people who live in Turkey. People living in Ankara-Turkey are selected for the interviews since Ankara is a multi-cultural capital city that accommodates people from different regions of Turkey. In addition, 18–25 years old young people are selected for the interviews since online shopping is more prevalent among them. Brief information about the study is given during interviews. We ask them to talk about the criteria which affect their decision while selecting the online shopping website. We did not ask specific questions not to restrict the replies of the interviewed people. Additional sub-criteria which affect the customers' decisions are also found from those interviews.

As a result of the interviews and literature survey, we determine seven main criteria (Website Quality, Payment Methods, Product Variety, Delivery and Guarantee, Family Friend Effect, Past Experiences, and Advertisements) and 23 sub-criteria. Detailed information on how the main criteria and sub-criteria are determined can be found in the following subtitles.

### 2.1. Website quality

Koufaris (2002) finds that website quality is more effective when compared with the service quality and low prices of traditional shops. Moreover, Wells et al. (2011) claim that fonts, visuals, shapes, and layouts satisfy consumers and positively impact the websites. Kim and Niehm (2009) find that people continue to shop from websites if websites offer specific information. Hsieh and Liao (2011) point out that consumers do not tend to shop outside the websites they are accustomed to. So the usefulness and quality of information will positively affect consumer attitudes to select online shopping websites. On the other hand, when the websites offer unique treatments, customers feel more e-satisfaction and loyalty to these online shopping websites (Sun & Lin, 2009). Oliveira (2007) states a significant association between website service quality and customer loyalty. According to the interviews, people are also interested in the efficiency and accessibility of the website. They point out that the online shopping website should easily direct the customers to the products they want to buy without encountering complicated details. So, it is imperative to arrange easy-to-use shopping websites.

### 2.2. Payment methods

Online shopping websites offer different payment methods (i.e., credit card, debit card, virtual card, money order, cash on delivery, payment by mobile phones, and Electronic Funds Transfer). Sun and Lin (2009)'s research shows that security and trust are the most important for improving the competitive advantage of shopping websites. Therefore, it is pretty essential to avoid such concerns. If the related precautions are taken, this will reassure the consumers and encourage them to shop from the online shopping website. However, Gao (2005) finds that 52% of participants classified payment protection as their primary concern, and 17% did not have a high level of confidence in online stores. Moreover, three other research results show that online shopping was affected by online payment security and convenience (Smith, 2003; Sheikh, 2009; Sheikh et al., 2015). In addition, Liu (2008) finds that, in terms of privacy and security dangers, online retailers ought to post the formal security arrangements of their online security framework on their site and receive predominant encryption innovation so that buyers can be effectively educated almost online retailers' security measures. Our interview results also are in line with the above literature.

### 2.3. Product variety

Product variety and price range help people decide what they want to buy from online shopping websites (Keeney, 1999). Sun and Lin (2009) show that a product's unit price impacts consumers' use of online shopping websites for both high and low involvement consumers. Our interviews show that when the customer adds a product to the shopping cart, the website usually offers other campaigns to attract the customers' attention. On the other hand, the opportunity of buying from different sellers also affects consumers' shopping website selection. Various marketers sell their products in different price ranges, making them very competitive. In addition, sellers try to provide a strong bond between their consumers (Sheikh et al., 2015). Therefore, when clients are happy with the item or administration they purchase, they will generally buy from the same provider.

### 2.4. Delivery and guarantee

Koyuncu (2004) claims that online shopping organizations must guarantee the transportation of their products in a reasonable time. In addition, lack of information about guarantees is the dominant factor that influences the consumer's online shopping website selections. Sun and Lin (2009) use the fuzzy TOPSIS model and find that trust is the most significant factor for competitive online websites. Therefore,

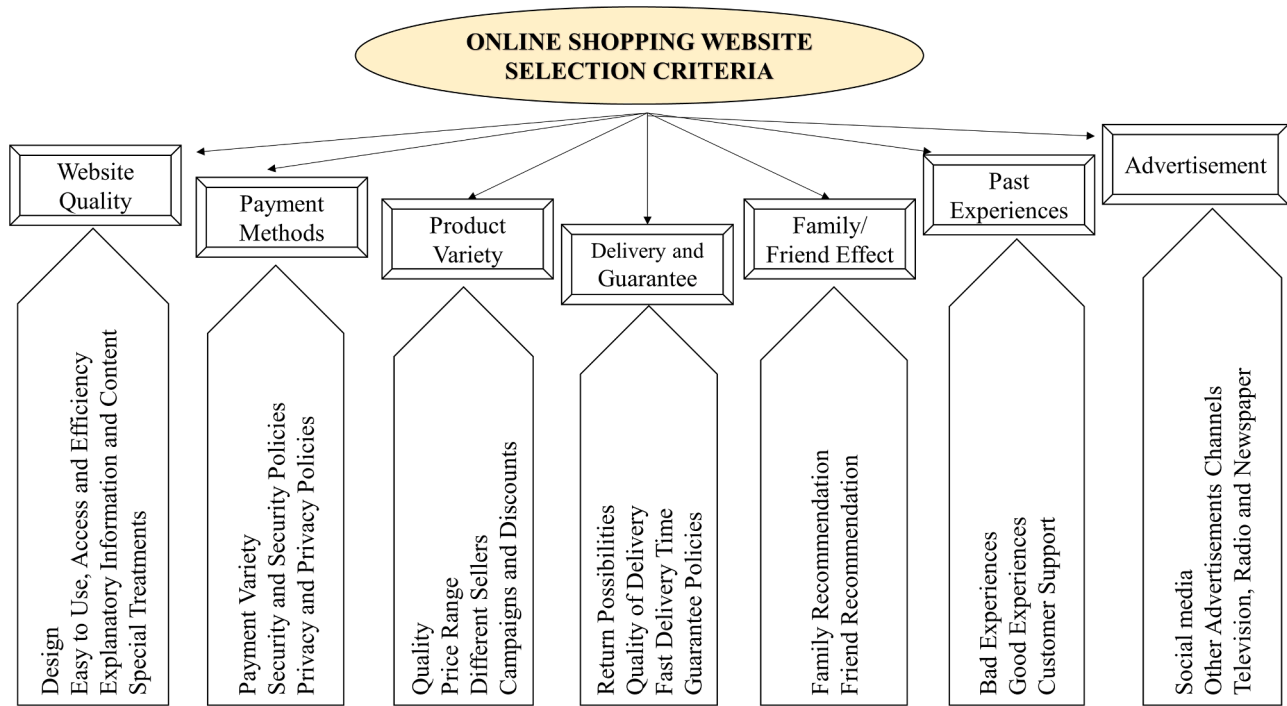


Fig. 1. Main and Sub-Criteria for online shopping website selection.

**Table 1**  
Saaty's 1–9 comparison scale.

Level	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one activity over another
5	Strong importance	Experience and judgment strongly favor one activity over another
7	Very strong importance	An activity is favored very strongly over another
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order
2,4,6,8		Intermediate values

**Table 2**  
Random consistency index.

Random consistency index							
N	RI	N	RI	N	RI	N	RI
1	0	4	0.9	7	1 0.32	10	1 0.49
2	0	5	1 0.12	8	1 0.41	11	1 0.51
3	0.58	6	1 0.24	9	1 0.45	12	1 0.53

consumers tend to choose those websites. If their guarantee policies are available online, consumers will feel more comfortable shopping on those websites. Without the trust of guarantee, the efficiency of the online websites will be significantly reduced. Martínez-López and Luna (2005) discuss that website owners should create trust with products and implement guarantees to differentiate online shopping websites. Consumer reviews obtained from the websites show that providing fast and secure delivery free from broken parts will help the online shopping websites to increase their number of customers.

## 2.5. Family and friendship effect

Whittler (2002)'s research has demonstrated that companion gatherings can influence singular shopper choices, for instance, item

assessment, buying plausibility, and genuine buying. Also, other researches show that given the apparent hazard associated with web-based shopping, they accepted that forthcoming on the web customers would solicit the assessment from their companions or online purchaser bunches before they settle on an online buy choice (Cheung & Lee, 2005; Pires et al., 2004). Moreover, according to Lima et al. (2015), the customers will participate in general tune in to verbal suggestions from close families and family members, companions, or even media before settling on a shopping choice. Islam (2015) shows that family members, friends, and peers' online experiences and suggestions will positively influence online-buying behavior. The interview results also are in line with the above literature.

## 2.6. Shopping experience (named as past experience in this study)

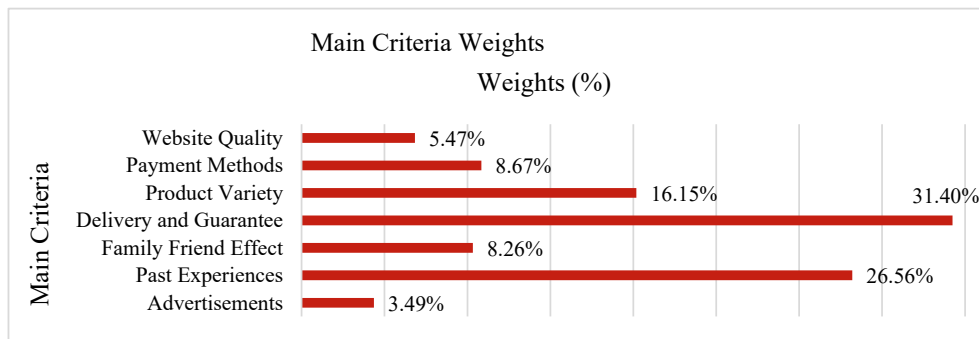
Zhou (2007) has demonstrated that experience affects emphatically the goal to buy. Even though clients happy with past encounters may not generally come back to a similar supplier (Sánchez-García et al., 2012). Liu (2008) recognize how critical consumer loyalty is in web-based shopping. Fruitful past buys, and fulfillment from them may build clients' hope and execution anticipation. Correspondingly, Tong (2010) has led a cross-national investigation and inspected, among others, the immediate impacts of past web-based shopping experience on apparent helpfulness and convenience. Ilias et al. (2014) show that the normal execution of the web-based shopping experience influences fulfillment just on high-experienced clients. Instead, the exertion expected to utilize internet shopping and the client's faith in possessing capacities to utilize web-based shopping (self-viability) impact fulfillment just on low-experienced clients.

## 2.7. Advertisements and Social media

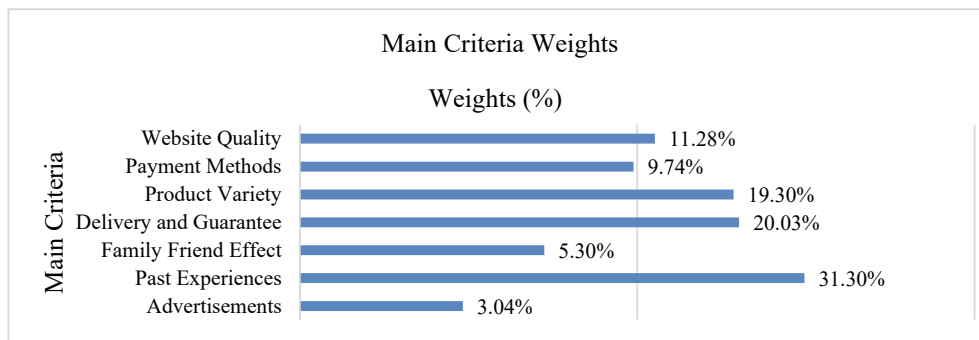
Ducoffe (1996) and Zhau and Bao (2002) explain that Web ads may exploit addressable media innovation to choose relevant ads that are harmonious with shoppers' online practices, in this manner making the commercials progressively applicable to customers. At last, regardless of whether a sort of notice is adequate or not relies upon online purchasers'

**Table 3**  
Main Criteria Comparison Table.

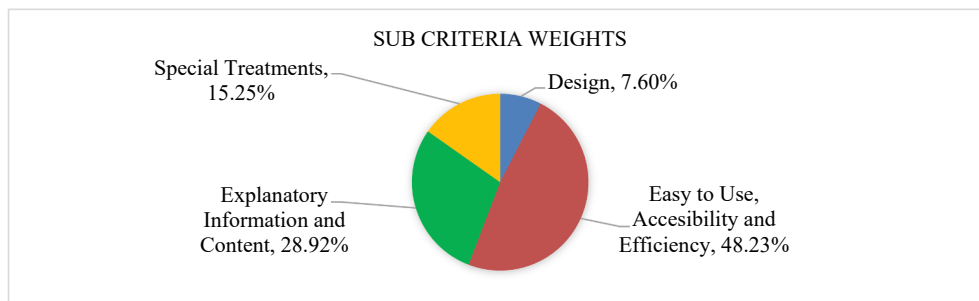
	Absolutely Very Important	Much More Important	More Important	Partially More Important	Equally Important	Partially More Important	More Important	Much More Important	Absolutely Very Important	
Website Quality	9	7	5	3	1	3	5	7	9	Payment Methods
Website Quality										Product Variety
Website Quality										Delivery and Guarantee
Website Quality										Family Friend Effect
Website Quality										Past Experiences
Website Quality										Advertisements



**Fig. 2.** Main Criteria weights (Turkish People).



**Fig. 3.** Main Criteria weights (Croatian People).



**Fig. 4.** Weights of Sub-Criteria for Website Quality.

**Table 4**  
Main and Sub-Criteria Weights (Turkish People).

Main Criteria	X	Abbr.	Sub Criteria	Y	Z
WQ (Website Quality)	5.47%	D	Design	7.60%	0.42%
		EU	Easy to Use, Access, and Efficiency	48.23%	2.64%
		EIC	Explanatory Information and Content	28.92%	1.58%
		ST	Special Treatments	15.25%	0.83%
PM (Payment Method)	8.67%	PV	Payment Variety	9.37%	0.81%
		SSP	Security and Security Policies	56.61%	4.91%
		PPP	Privacy and Privacy Policies	34.01%	2.95%
PV (Product Variety)	16.15%	Q	Quality	39.79%	6.43%
		PR	Price Range	23.20%	3.75%
		DS	Different Sellers	7.96%	1.29%
		CD	Campaigns and Discounts	29.04%	4.69%
DG	31.40%	RP	Return Possibilities	13.25%	4.16%
(Delivery and Guarantee)		QD	Quality of Delivery	25.75%	8.09%
		FDT	Fast Delivery Time	22.63%	7.10%
		GP	Guarantee Policies	38.36%	12.04%
FFA (Family Friend Effect)	8.26%	FR1	Family Recommendation	33.76%	2.79%
		FR2	Friend Recommendation	66.24%	5.47%
PE (Past Experience)	26.56%	BE	Bad Experiences	23.88%	6.34%
		GE	Good Experiences	45.28%	12.03%
		CS	Customer Support	30.84%	8.19%
A (Advertisement)	3.49%	SM	Social media	66.27%	2.31%
		OA	Other Advertisements Channels	23.45%	0.82%
		TRN	Television, Radio, and Newspaper	10.28%	0.36%

discernments concerning whether the ads can satisfy their destinations. Social media offers instant access to all users through mobile communication channels without the limit of time and space has brought social media to the forefront in marketing activities. Social media, where applications in the Web are used interactively, have become necessary for both personal and commercial communication (Mislove, 2007).

Hence, based on the literature and interviews, we determine seven main and 23 sub-criteria, shown in Fig. 1.

Even though most of the criteria are considered in the above studies separately, our study focuses on all of them together. In addition, our study is the first study in which the literature is reviewed in detail for each criterion, and interviews are made to confirm the criteria found in the literature. We organized face-to-face meetings with people living in Ankara for the interviews and could reach out to 80 people due to Covid-19 limitations. We determine seven main and 23 sub-criteria confirmed by the literature survey and interviews that can be considered an important contribution of this study.

### 3. Methodology

In this study, AHP methodology is used to find the importance weights of online shopping website selection factors (main and sub-criteria). AHP is used in many studies for different purposes (i.e., marketing decisions, social identity issues, selection of the best outsourcing strategy). Davies (2001) advises how to adopt the AHP methodology to use in future marketing decisions. Hwang et al. (2007) are concerned with the make-or-buy decision model for manufacturing and procurement problems. They developed a web-based two-step approach using AHP for multi-attribute analysis. Lai and Ishizaka (2020) offer new insight into the application of multiple-criteria decision-making

methods (MCDM) to social identity issues in the context of talent management. MCDM is used to help a high-tech company identify potential talents in its sale and marketing team. Finally, Modak et al. (2019) propose an integrated Balanced Scorecard-Analytic Network Process approach to select the best outsourcing strategy for operational activities of the coal mining organization in India.

A questionnaire is prepared using Saaty's 1–9 scale (Table 1) and applied to volunteer people (including 80 people interviewed before) to determine the main and sub-criteria weights. Around 300 people who were the authors' colleagues, administrative staff, students, and students' friends and families were invited to be volunteers in this study. Those students study in different universities in Ankara, but their hometowns are located in different regions of Turkey. One hundred sixty positive replies were received. Face-to-face meetings with those volunteers are organized to explain the questionnaire's details and ensure the consistency of the replies. The criteria weights are found using the AHP methodology. Similarly, the authors contacted their project partners from Croatia, Romania, Slovenia, Poland, and exchange students at the authors' university to apply the questionnaire in an effort to apply a multi-cultural analysis. However, the only number of positive replies from Croatia is enough to analyze. We asked 78 people from Croatia and got 36 positive replies to attend our survey. Eventually, the questionnaire is applied to those Croatian people, and the criteria weights from Croatian perspective found using the AHP methodology. Hence, only a comparison of Turkey and Croatia is included in the study. A multi-cultural analysis can be done in future studies if enough positive replies are received.

Independent from the first questionnaire, we prepare a second questionnaire and apply it online to the customers living in different regions of Turkey who have shopped before from three trendy Turkish



**Table 5**

Main and Sub-Criteria Weights (Turkish and Croatian People).

Main Criteria	X	X*	Sub Criteria	Y	Y*	Z	Z*
WQ			Design	7.60%	12.73%	0.42%	1.44%
	5.47%	11.28%	Easy to Use, Access, and Efficiency	48.23%	51.70%	2.64%	5.83%
			Explanatory Information and Content	28.92%	25.62%	1.58%	2.89%
			Special Treatments	15.25%	9.95%	0.83%	1.12%
PM	8.67%	9.74%	Payment Variety	9.37%	20.89%	0.81%	2.04%
			Security and Security Policies	56.61%	62.97%	4.91%	6.14%
			Privacy and Privacy Policies	34.01%	16.14%	2.95%	1.57%
PV	16.15%	19.30%	Quality	39.79%	45.31%	6.43%	8.75%
			Price Range	23.20%	21.05%	3.75%	4.06%
			Different Sellers	7.96%	9.10%	1.29%	1.76%
			Campaigns and Discounts	29.04%	24.54%	4.69%	4.74%
DG	31.40%	20.03%	Return Possibilities	13.25%	39.14%	4.16%	7.84%
			Quality of Delivery	25.75%	13.59%	8.09%	2.72%
			Fast Delivery Time	22.63%	18.69%	7.10%	3.74%
			Guarantee Policies	38.36%	28.58%	12.04%	5.72%
FFA	8.26%	5.30%	Family Recommendation	33.76%	36.36%	2.79%	1.93%
			Friend Recommendation	66.24%	63.64%	5.47%	3.37%
PE	26.56%	31.30%	Bad Experiences	23.88%	29.95%	6.34%	9.37%
			Good Experiences	45.28%	56.44%	12.03%	17.67%
			Customer Support	30.84%	13.61%	8.19%	4.26%
A	3.49%	3.04%	Social media	66.27%	37.48%	2.31%	1.14%
			Other Advertisements Channels	23.45%	34.86%	0.82%	1.06%
			Television, Radio, and Newspaper	10.28%	27.66%	0.36%	0.84%

**Table 6**

Consistency Ratios.

Consistency Test	CR	CR*	Consistency Test	CR	CR*
Main Criteria	0.0298	0.0586	Delivery and Guarantee	0.0398	0.0357
Website Quality	0.0857	0.0448	Past Experiences	0.0386	0.0029
Payment	0.0366	0.0351	Advertisements	0.0980	0.0202
Methods					
Product Variety	0.0107	0.0330			

**Table 7**

Demographic Profile of the Participants.

Education	#	Income (TL)	#	The website you have shopped on before?	#
Primary and High school	61	0–3000	108	Only A	29
University	127	3001–5000	46	Only B	66
Master-PhD	42	5001–7000	34	Only C	4
		7001–10,000	13	A, B	20
		Above 10,000	29	A, C	7
				B, C	9
				A, B, C	95

online shopping websites. Two hundred thirty people (including 160 people to whom the first questionnaire was applied) participated in this questionnaire. SPSS Tool is used for our descriptive and inferential

statistical analysis. The details are given in the “Results and Analysis” section.

After estimating decision weights of the sample from Croatia using AHP methodology, we use that as a “what if” analysis for the Turkish online shopping websites A, B, and C. What-if analysis is a data-intensive exploration to inspect how changes in a set of input parameters of a model influence some outcomes. Hence, in our study, we include a “What-if analysis” in order to inspect how criteria weights and selection of the online shopping websites change concerning Turkish and Croatian people. For the details of the “What-if Analysis” simulation, the readers can refer to [Hung et al. \(2018\)](#)’s study in which they support what-if analysis by effective and efficient aggregation of data grids.

The following is a comprehensive explanation of the AHP methodology. AHP is among the most convenient methodologies to find the criteria weights. [Saaty \(1977\)](#) developed it for solving decision-making problems. It gives percentage distributions of decision points regarding the factors affecting the decision. AHP is based on one-to-one comparisons on a decision hierarchy, using a predefined comparison scale, both in terms of the factors affecting the decision and the significance of the decision points in terms of these factors. As a result, differences in importance turn into percentage distribution over decision points. The steps of AHP are described in the following paragraphs.

#### Step 1. Decision making problem

In this step, m number of decision points and n number of factors affecting the decision points are determined.

#### Step 2. Creating a cross-factor comparison matrix

**Table 8**  
Main and Sub-Criteria Determined for Online Shopping Websites.

Main C.	Sub-Criteria	Main Criteria	Sub-Criteria
Website Quality	Design	Delivery and Guarantee	Return Possibilities
	Easy to Use, Accessibility, and Efficiency		Quality of Delivery
	Explanatory Information and Content		Fast Delivery Time
	Special Treatments		Guarantee Policies
Payment Methods	Payment Variety	Family Friend Affect	Family Recommendation
	Security and Security Policies		Friend Recommendation
	Privacy and Privacy Policies	Past Experiences	Bad Experiences
Product Variety	Quality		Good Experiences
	Price Range		Customer Support
	Different Sellers	Advertisements	Social media
	Campaigns and Discounts		Other Advertisements
			Television, Radio, and Newspaper

**Table 9**  
Criteria Mean Considering ALL and A-B-C Participants.

CRITERIA	ALL	ALL	ALL	A-B-	A-B-	A-B-
	A	B	C	C	C	C
Website Design	3.13	3.70	2.58	3.25	3.82	2.62
Easy to Use, Accessibility, and Efficiency	3.32	3.84	2.61	3.45	3.84	2.68
Explanatory Information and Content	3.34	3.67	2.64	3.32	3.61	2.72
Special Treatments	2.95	3.42	2.62	3.02	3.34	2.73
Quality	3.25	3.65	2.66	3.40	3.60	2.84
Quality of Delivery	3.30	3.63	2.76	3.35	3.71	2.85
Fast Delivery Time	3.33	3.67	2.87	3.38	3.69	3.03
Family Recommendation	3.33	3.69	2.62	3.38	3.69	2.69
Friend Recommendation	3.14	3.77	2.64	3.25	3.82	2.78
Bad Experiences	2.67	2.67	2.48	2.53	2.64	2.72
Good Experiences	3.26	3.72	2.69	3.28	3.78	2.75
Customer Support	3.25	3.63	2.67	3.38	3.74	2.77
Social media	3.39	3.95	2.53	3.36	4.00	2.67
Television, Radio, and Newspaper	3.42	3.50	2.53	3.35	3.29	2.61
Other Advertisements	3.25	3.53	2.52	3.21	3.48	2.62
<b>AVERAGE</b>	<b>3.22</b>	<b>3.61</b>	<b>2.64</b>	<b>3.26</b>	<b>3.61</b>	<b>2.75</b>

The inter-factor comparison matrix, shown below, is a dimensional square matrix. The matrix components on the diagonal of this matrix are one since the relevant factor is compared with itself.

$$A = \begin{bmatrix} a_{11} & a_{12} \cdots & a_{1n} \\ a_{21} & a_{22} \cdots & a_{2n} \\ \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} \cdots & a_{nn} \end{bmatrix}$$

The comparison of the factors is made one to one and mutually according to their importance values. The factor scale in Table 1 is used for a one-to-one comparison of factors. If the first factor appears to be strongly important than the second factor, then the first row second column component ( $i = 1, j = 2$ ) of the comparison matrix will take the value of 5. Otherwise, if the strongly important preference is to be used for the second factor, the first row of the comparison matrix will take the value of  $1/5$  of the second column component. If the factors are equally important in the same comparison, then component 1 will be the value.

Comparisons are made for values that lie above the diagonal. For the components under the diagonal, it is natural to use Equation (1).

$$a_{ji} = \frac{1}{a_{ij}} \quad (1)$$

### Step 3. Determining percentage importance of factors

The comparison matrix shows the importance levels of factors relative to each other in a particular logic. However, column vectors forming the comparison matrix are used to determine the weights of these factors in the whole, and column B with nxn components is formed. Equation (2) is used for the calculation of column B.

$$b_{ij} = \frac{a_{ij}}{\sum_{i=1}^n a_{ij}} \quad (2)$$

The steps described above are repeated, and the C matrix below is created.

$$C = \begin{bmatrix} c_{11} & c_{12} \cdots & c_{1n} \\ c_{21} & c_{22} \cdots & c_{2n} \\ \vdots & \vdots & \vdots \\ c_{n1} & c_{n2} \cdots & c_{nn} \end{bmatrix}$$

The importance values of the factors relative to each other can be obtained using the C matrix. Then, the arithmetic mean of the row components forming the matrix C, as shown in Equation (3), is used to obtain the column vector W called the Priority Vector.

$$W_i = \frac{\sum_{j=1}^n c_{ij}}{n} \quad (3)$$

### Step 4. Measuring consistency in factor benchmarking

The realism of the results depends on the consistency in the one-to-one comparison between the decision-making factors. AHP proposes a process for measuring the consistency of these comparisons. The resulting Consistency Ratio (CR) and the found priority vector provide the possibility to test the consistency of the comparisons. AHP is based on the essence of the CR calculation by comparing the number of factors with a coefficient  $\lambda$  called the Basic Value. For the calculation of  $\lambda$ , the vector D is obtained from the matrix product of the vector W by the comparison matrix A.

$$D = \begin{bmatrix} a_{11} & a_{12} \cdots & a_{1n} \\ a_{21} & a_{22} \cdots & a_{2n} \\ \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} \cdots & a_{nn} \end{bmatrix} \times \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix}$$

**Table 10**  
Comparison of Criteria Means with Respect to Shopping Experience.

SUB-CRITERIA	79	151	40	190	115	115
	A-0	A-1	B-0	B-1	C-0	C-1
Website Design	2.66	3.37	2.95	3.85	2.26	2.90
Easy to Use, Accessibility, Efficiency	2.81	3.59	3.20	3.98	2.34	2.88
Explanatory Information and Content	3.03	3.51	3.13	3.78	2.42	2.86
Special Treatments	2.63	3.11	2.90	3.53	2.38	2.86
Quality	2.82	3.48	3.20	3.75	2.32	2.99
Quality of Delivery	2.95	3.48	3.05	3.75	2.56	2.97
Fast Delivery Time	3.03	3.49	3.43	3.72	2.59	3.15
Family Recommendation	2.81	3.60	3.28	3.78	2.45	2.78
Friend Recommendation	2.76	3.34	3.13	3.90	2.40	2.89
Bad Experiences	2.62	2.69	2.75	2.66	2.31	2.65
Good Experiences	2.87	3.46	3.05	3.86	2.43	2.94
Customer Support	2.90	3.43	2.95	3.77	2.46	2.89
Social media	3.14	3.52	3.65	4.01	2.31	2.76
Television, Radio, and Newspaper	3.25	3.51	3.40	3.52	2.42	2.64
Other Advertisements	3.19	3.28	3.38	3.57	2.39	2.64
<b>AVERAGE</b>	<b>2.90</b>	<b>3.39</b>	<b>3.16</b>	<b>3.69</b>	<b>2.40</b>	<b>2.85</b>

After calculating  $\lambda$ , the Consistency Index (CI) can be found using the Equation (4).

$$CI = \frac{\lambda - n}{n - 1} \quad (4)$$

In the last step, CR is obtained (Equation 5) dividing the CI by a standard correction value called Random Indicator (RI), shown in Table 2. The corresponding RI value to the number of factors is selected from Table 2.

In addition, a CR value less than 0.10 indicates that the comparisons made by the decision-maker are consistent. A CR value greater than 0.10 indicates either a calculation error in AHP or inconsistency in decision-making comparisons.

$$CR = \frac{CI}{RI} \quad (5)$$

*Step 5. Finding percentage importance at each decision point for each factor*

One-to-one comparisons and matrix operations are repeated for the number of factors. After each comparison, S column vectors are obtained, which show percentage distributions of the factors evaluated according to the decision point.

*Step 6. Finding result distribution at decision points*

The column vector L with m elements is obtained by multiplying W and S vectors. Column L gives the percentage distribution of decision points. This distribution also shows the order of importance of the decision points.

$$L = \begin{bmatrix} s_{11} & s_{12} \cdots & s_{1n} \\ s_{21} & s_{22} \cdots & s_{2n} \\ \vdots & \vdots & \vdots \\ s_{m1} & s_{m2} \cdots & s_{mn} \end{bmatrix} \times \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix} = \begin{bmatrix} l_{11} \\ l_{21} \\ \vdots \\ l_{m1} \end{bmatrix}$$

#### 4. Results and analysis

The results obtained from 2 questionnaires are given in the following

three sub-sections. In the first sub-section, we find the weights of the main and sub-criteria that affect the selection of online shopping websites from the perspective of Turkish and Croatian people separately using the AHP methodology. In the second subsection, we analyze the results of our second questionnaire using the SPSS tool. Finally, in the last subsection, we find the rankings of three online shopping websites considering criteria weights.

##### 4.1. Criteria weights

The first questionnaire in this study is applied to 160 people from different age groups, income levels, and gender. First, face-to-face meetings with participants are settled to ensure the consistency of replies. Then, people are asked to fill out a comparison table according to their opinions. Table 3 is used to compare the “Website Quality” main criterion with other main criteria. As an example, if a participant thinks that “Website Quality” is more important than “Payment Method”, she put a cross sign on the “More Important” column at the left side of Table 3.

The participants first compare all main criteria, and then they are asked to compare the sub-criteria of each main criterion using the same methodology explained above. Finally, AHP steps explained in the methodology section are applied to find the importance weights.

Fig. 2 shows the main criteria weights for Turkish people. The weight of each criterion in percentages is written on the chart. The top three main criteria with the highest weights are found as Delivery and Guarantee (31.40%), Past Experience (26.56%), and Product Variety (16.15%), respectively.

The results show that people in Turkey care for delivery and guarantee conditions. Their experience with online shopping websites will undoubtedly affect their decision for the next purchase. Product variety comes third, which affects their decision to choose which online shopping website to shop. The other four main criteria have weights below 10%. Although considerable amounts of the budget are used for the advertisements, interestingly the “Advertisement” criterion has the least weight (3.49%), which is a big surprise for us.

The same questionnaire is applied to 36 people in Croatia to analyze if the weights differ. Fig. 3 shows the main criteria weights for Croatian



**Table 11**  
Independent Sample T-test for website A with Respect to Shopping Experience.

INDEPENDENT SAMPLE T-TEST FOR WEBSITES A, B, and C		t-test for Equality of Means for A		t-test for Equality of Means for B		t-test for Equality of Means for C	
		Sig. (2- tailed)	Mean Difference	Sig. (2- tailed)	Mean Diff.	Sig. (2- tailed)	Mean Diff.
Website Design	Equal var. assumed	0	-0.713	0.000	-0.903	0.000	-0.635
	Equal var. not assumed	0	-0.713	0.000	-0.903	0.000	-0.635
Easy to Use, Access, Efficiency	Equal var. assumed	0	-0.779	0.000	-0.779	0.001	-0.539
	Equal var. not assumed	0	-0.779	0.000	-0.779	0.001	-0.539
Explanatory Info and Content	Equal var. assumed	0.003	-0.485	0.000	-0.654	0.002	-0.443
	Equal var. not assumed	0.001	-0.485	0.001	-0.654	0.002	-0.443
Special Treatments	Equal var. assumed	0.005	-0.48	0.001	-0.632	0.003	-0.478
	Equal var. not assumed	0.005	-0.48	0.005	-0.632	0.003	-0.478
Quality	Equal var. assumed	0	-0.654	0.005	-0.547	0.000	-0.670
	Equal var. not assumed	0	-0.654	0.008	-0.547	0.000	-0.670
Quality of Delivery	Equal var. assumed	0.001	-0.534	0.001	-0.697	0.008	-0.409
	Equal var. not assumed	0.001	-0.534	0.003	-0.697	0.008	-0.409
Fast Delivery Time	Equal var. assumed	0.004	-0.461	<b>0.138</b>	-0.297	0.000	-0.559
	Equal var. not assumed	0.003	-0.461	<b>0.132</b>	-0.297	0.000	-0.559
Family Recommendation	Equal var. assumed	0	-0.786	0.007	-0.504	0.029	-0.330
	Equal var. not assumed	0	-0.786	0.009	-0.504	0.029	-0.330
Friend Recommendation	Equal var. assumed	0	-0.578	0.000	-0.775	0.002	-0.487
	Equal var. not assumed	0	-0.578	0.000	-0.775	0.002	-0.487
Bad Experiences	Equal var. assumed	<b>0.683</b>	-0.068	<b>0.667</b>	0.092	0.028	-0.339
	Equal var. not assumed	<b>0.663</b>	-0.068	<b>0.651</b>	0.092	0.028	-0.339
Good Experiences	Equal var. assumed	0.001	-0.584	0.000	-0.808	0.001	-0.504
	Equal var. not assumed	0	-0.584	0.000	-0.808	0.001	-0.504
Customer Support	Equal var. assumed	0.001	-0.532	0.000	-0.824	0.006	-0.426
	Equal var. not assumed	0.001	-0.532	0.000	-0.824	0.006	-0.426
Social media	Equal var. assumed	0.02	-0.377	0.045	-0.361	0.002	-0.443
	Equal var. not assumed	0.02	-0.377	0.066	-0.361	0.002	-0.443
Television, Radio, and Newspaper	Equal var. assumed	<b>0.126</b>	-0.257	<b>0.554</b>	-0.116	<b>0.147</b>	-0.226
	Equal var. not assumed	<b>0.115</b>	-0.257	<b>0.529</b>	-0.116	<b>0.147</b>	-0.226
Other Advertisements	Equal var. assumed	<b>0.606</b>	-0.088	<b>0.337</b>	-0.193	<b>0.095</b>	-0.252
	Equal var. not assumed	<b>0.606</b>	-0.088	<b>0.306</b>	-0.193	<b>0.095</b>	-0.252

people.

Interestingly, different from Turkish people, Croatian people first care for their “past experiences”. “Delivery and guarantee” conditions of the online shopping websites affect the customers’ decisions for the next purchase. “Product variety” comes third for both Turkish and Croatian people to choose the online shopping website to shop. Website quality is more important for Croatian people than Turkish people, while the Family/friend effect is less important for Croatian people than Turkish people.

The sub-criteria weights are found by using the same steps. For example, Fig. 4 contains the sub-criteria weights of “website quality” main criterion for Turkish people. The “Easy to use, access and efficiency” sub-criterion has the highest weight (48.23%).

We find all sub-criteria weights for the corresponding main criteria (Turkish people), depicted in Table 4. The main criteria weights are given in Column X. Column Y shows the sub-criteria weights of each main criterion in terms of percentages. Column Z, which is the overall weight of the sub-criteria, is obtained by multiplying column X value

with column Y value.

“Easy to use (Accessibility and Efficiency)” has the highest percentage (48.23%) among the Website Quality’s sub-criteria. The highest sub-criteria weight scores of each main criterion are shaded with the gray in the Y column of Table 4. The online shopping websites in Turkey should consider those weights to improve their quality so as to attract attention and increase the number of customers.

The criteria weights of all 23 sub-criteria are given in Column Z. Guarantee Policies (12.04%), Good Experience (12.03%), and Customer Support (8.19%) are the most important three sub-criteria (shaded with orange color in Z column of Table 4) out of all. Therefore, our findings will be necessary for Turkey’s online shopping website owners to develop policies.

Table 5 depicts the main and sub-criteria weights for Turkish and Croatian people. Columns X, Y, and Z, show the criteria weights for Turkish people, while columns X\*, Y\*, and Z\* show the criteria weights for Croatian people. Again, in columns Y and Y\*, the highest sub-criterion scores of each main criterion are shaded with gray, and the

**Table 12**  
Mean Comparison with Respect to Shopping Experiences.

SUB-CRITERIA	N	29	20	95	7	66	9	4
	Website	A	A, B	A, B, C	A, C	B	B, C	C
Website Design	A	3.62	3.40	3.25	3.86	2.64	2.56	3.25
	B	3.03	3.60	3.82	2.71	4.02	3.56	2.75
	C	2.48	2.15	2.62	4.57	2.20	4.00	4.00
Easy to Use, Access, and Efficiency	A	4.03	3.45	3.45	4.00	2.88	2.67	2.00
	B	3.34	3.90	3.84	3.00	4.23	3.78	2.50
	C	2.59	2.10	2.68	4.43	2.30	3.56	3.25
Explanatory Information and Content	A	3.97	3.70	3.32	3.71	3.08	2.89	2.50
	B	3.31	3.55	3.61	2.86	4.05	4.11	2.25
	C	2.62	2.45	2.72	3.86	2.32	3.56	3.00
Special Treatments	A	3.41	3.30	3.02	2.57	2.71	2.33	2.00
	B	2.90	3.80	3.34	3.14	3.79	3.11	2.50
	C	2.93	2.25	2.73	3.71	2.18	3.44	3.25
Quality	A	3.62	3.55	3.40	3.71	2.82	3.00	2.50
	B	3.24	3.75	3.60	3.43	3.95	3.78	2.50
	C	2.48	2.10	2.84	4.14	2.32	3.44	3.50
Quality of Delivery	A	3.90	3.65	3.35	3.14	3.02	2.67	2.50
	B	3.03	3.75	3.71	3.00	3.86	3.33	3.25
	C	2.76	2.20	2.85	4.00	2.58	3.44	2.75
Fast Delivery Time	A	3.79	3.74	3.38	3.00	3.09	2.88	2.25
	B	3.52	3.63	3.69	3.43	3.80	3.67	2.75
	C	2.76	2.22	3.03	4.43	2.62	3.56	2.75
Family Recommendation	A	4.17	3.90	3.38	3.29	2.86	2.56	2.50
	B	3.38	3.30	3.69	3.00	4.11	3.33	3.00
	C	2.66	2.05	2.69	3.71	2.48	3.22	2.25
Friend Recommendation	A	3.69	3.35	3.25	3.00	2.89	2.11	2.00
	B	3.14	4.05	3.82	3.43	4.08	3.11	2.50
	C	2.79	2.00	2.78	4.00	2.35	3.00	3.25
Bad Experiences	A	3.14	2.90	2.53	2.43	2.67	2.56	2.00
	B	2.76	2.50	2.64	2.86	2.77	2.33	2.50
	C	2.21	2.35	2.72	2.43	2.35	2.22	2.50
Good Experiences	A	3.90	3.75	3.28	3.14	2.94	2.67	2.25
	B	3.24	3.75	3.78	2.86	4.06	3.44	2.00
	C	2.72	2.10	2.75	4.00	2.41	3.89	3.50
Customer Support	A	3.72	3.55	3.38	2.57	2.98	2.56	2.25
	B	3.14	3.80	3.74	2.57	3.85	3.56	2.25
	C	2.76	2.20	2.77	3.43	2.41	3.56	3.25
Social media	A	3.86	3.60	3.36	4.00	3.12	3.56	2.50
	B	3.66	3.80	4.00	4.00	4.14	3.67	3.00
	C	2.62	2.10	2.67	3.14	2.24	3.22	3.00
Television, Radio, and Newspaper	A	3.55	3.95	3.35	4.29	3.27	3.56	2.25
	B	3.38	3.40	3.29	3.86	3.89	3.33	2.75
	C	2.97	2.15	2.61	2.71	2.26	2.89	2.75
Other Advertisements	A	3.28	3.40	3.21	3.86	3.17	3.67	2.50
	B	3.38	3.40	3.48	3.71	3.74	3.56	2.75
	C	2.59	2.10	2.62	2.43	2.39	2.67	3.50

top three sub-criteria scores are shaded in orange in columns Z and Z\*. Interestingly, although the percentages may differ, the most important sub-criteria for each main criterion is the same for Turkish and Croatian people except “Delivery and guarantee” main criterion. While “guarantee policies” is the most important for Turkish people, it is “return policies” for Croatian people.

When columns Z and Z\* are compared, it is realized that the most critical sub-criterion is “Good Experiences” for both Turkish and Croatian people. However, its importance weight is higher for Croatian people (17.67%) than Turkish people (12.03%). Although the second and third most crucial sub-criteria for Turkish people are “Guarantee policies” and “Customer support”, they are “Bad experiences” and “Quality” for Croatian people. Hence, we can conclude that the importance of the criteria for selecting an online shopping website may differ for nations. Interestingly, the mutual point for both Turkish and Croatian people is that the least important factor that will affect their decision is “Advertisement”, although the shopping websites pay a considerable amount of money for the advertisements.

Consistency is an essential issue in AHP models. So, the consistency test is applied for seven main criteria and their sub-criteria, and the results are given in Table 6. CR and CR\* column values show the consistency ratios of Turkish and Croatian peoples’ replies, respectively. As seen in Table 6, all CR and CR\* values in this study are less than 0.10,

which indicates that the comparisons made by the decision-makers (Turkish and Croatian participants) are consistent.

#### 4.2. Ranking online shopping websites

This section covers our findings and analysis about ranking the online shopping websites. Section 4.2 is merely about the Turkish sample. Later in section 4.3, the Croatia sample is used as a validity instrument with a “What-if Analysis” simulation.

The idea of online shopping started with Amazon in 1994, and afterward, lots of websites stepped into the industry. According to the “Digital Türkiye 2019”’s e-commerce report, 39.3 million people shop online in Turkey, accounting for 48% of the total population. The most popular three online shopping websites are selected to analyze their popularity. We name the shopping websites as A, B, and C for privacy.

A second questionnaire to rank the three online shopping websites is applied. Although 246 participants replied to the questionnaire, after eliminating the missing and illogical answers, 230 replies were used in our analysis. The first part of the questionnaire is about demographic information. We ask the participants to indicate their education, income levels, and shopping experiences on websites A, B, and C. They are allowed to select more than one website if they have shopped on more than one website. The information related to participants’ demographic

**Table 13**  
ANOVA Multiple Comparison test for Website A.

Dependent Variable For Website A	I	J	Mean Difference (I-J)	Std. Error	Sig.
Website Design	A	B	0.984*	0.253	0.002
Website Design	B	ABC	-0.616*	0.182	0.014
Easy to Use, Accessibility, and Efficiency	A	B	1.156*	0.254	0.000
Easy to Use, Accessibility, and Efficiency	A	C	2.034*	0.609	0.017
Easy to Use, Accessibility, and Efficiency	A	BC	1.368*	0.435	0.031
Easy to Use, Accessibility, and Efficiency	B	ABC	-0.574*	0.183	0.031
Explanatory Information and Content	A	B	0.890*	0.256	0.011
Quality	B	ABC	-0.582*	0.177	0.020
Quality	A	B	0.803*	0.246	0.022
Quality of Delivery	A	B	0.881*	0.251	0.010
Family Recommendation	A	B	1.309*	0.263	0.000
Family Recommendation	A	BC	1.617*	0.450	0.007
Family Recommendation	B	AB	-1.036*	0.301	0.012
Family Recommendation	A	ABC	0.793*	0.250	0.029
Friend Recommendation	A	BC	1.579*	0.444	0.008
Friend Recommendation	A	B	0.796*	0.259	0.038
Good Experiences	A	B	0.957*	0.264	0.006

**Table 14**  
ANOVA Multiple Comparison test for Website B.

Dependent Variable For Website B	I	J	Mean Difference (I-J)	Std. Error	Sig.
Website Design	A	B	-0.981*	0.234	0.001
Website Design	A	ABC	-0.787*	0.222	0.009
Website Design	B	AC	1.301*	0.417	0.033
Easy to Use, Accessibility, and Efficiency	A	B	-0.882*	0.215	0.001
Easy to Use, Accessibility, and Efficiency	B	C	1.727*	0.496	0.011
Easy to Use, Accessibility, and Efficiency	B	AC	1.227*	0.383	0.026
Explanatory Information and Content	B	C	1.795*	0.522	0.012
Explanatory Information and Content	A	B	-0.735*	0.226	0.022
Explanatory Information and Content	C	BC	-1.861*	0.609	0.040
Special Treatments	A	B	-0.891*	0.245	0.006
Quality of Delivery	A	B	-0.829*	0.256	0.023
Family Recommendation	A	B	-0.727*	0.233	0.033
Family Recommendation	B	ABC	0.806*	0.267	0.044
Friend Recommendation	A	B	-0.938*	0.244	0.003
Good Experiences	B	C	2.061*	0.565	0.006
Good Experiences	A	B	-0.819*	0.244	0.016
Good Experiences	C	ABC	-1.779*	0.560	0.028
Customer Support	B	AC	1.277*	0.423	0.044
Customer Support	A	B	-0.711*	0.237	0.047
Television, Radio, and Newspaper	B	ABC	0.599*	0.176	0.014

profiles and shopping experiences is specified in Table 7. We realize that 95 participants have shopped on all websites.

The second part of the questionnaire evaluates three online shopping websites concerning sub-criteria determined in the first step. We ask the following question for each sub-criterion:

- Please rate the online shopping websites A, B, and C from 1 to 5 (1 lowest and 5 highest) in terms of .... (name of the sub-criterion).

We select 15 sub-criteria (shaded in gray in Table 8) among 23 to prepare the second questionnaire. The other eight sub-criteria (shown without shading in Table 8) are excluded in the second questionnaire since three online shopping websites do not differ concerning those sub-

**Table 15**  
ANOVA Multiple Comparison test for Website C.

Dependent Variable For Website C	I	J	Mean Difference (I-J)	Std. Error	Sig.
Website Design	B	AC	-2.374*	0.411	0.000
Website Design	AB	AC	-2.421*	0.454	0.000
Website Design	B	BC	-1.803*	0.367	0.000
Website Design	AC	ABC	1.950*	0.405	0.000
Website Design	A	AC	-2.089*	0.435	0.000
Website Design	AB	BC	-1.850*	0.415	0.000
Website Design	A	BC	-1.517*	0.394	0.003
Website Design	BC	ABC	1.379*	0.361	0.003
Website Design	B	C	-1.803*	0.532	0.014
Website Design	C	AB	1.850*	0.566	0.021
Easy to Use, Accessibility, and Efficiency	B	AC	-2.126*	0.445	0.000
Easy to Use, Accessibility, and Efficiency	AB	AC	-2.329*	0.492	0.000
Easy to Use, Accessibility, and Efficiency	AC	ABC	1.744*	0.439	0.002
Easy to Use, Accessibility, and Efficiency	A	AC	-1.842*	0.472	0.002
Easy to Use, Accessibility, and Efficiency	AB	BC	-1.456*	0.450	0.023
Easy to Use, Accessibility, and Efficiency	B	BC	-1.253*	0.398	0.031
Explanatory Information and Content	B	AC	-1.539*	0.413	0.005
Explanatory Information and Content	B	BC	-1.237*	0.369	0.016
Explanatory Information and Content	AB	AC	-1.407*	0.456	0.037
Special Treatments	B	AC	-1.532*	0.469	0.021
Special Treatments	B	BC	-1.263*	0.419	0.045
Quality	AB	AC	-2.043*	0.485	0.001
Quality	B	AC	-1.825*	0.439	0.001
Quality	A	AC	-1.660*	0.465	0.008
Quality	AB	BC	-1.344*	0.443	0.043
Quality	AC	ABC	1.301*	0.433	0.046
Quality of Delivery	AB	AC	-1.800*	0.502	0.007
Quality of Delivery	B	AC	-1.424*	0.455	0.032
Fast Delivery Time	AB	AC	-2.206*	0.506	0.000
Fast Delivery Time	B	AC	-1.813*	0.451	0.002
Fast Delivery Time	A	AC	-1.670*	0.478	0.010
Fast Delivery Time	AC	ABC	1.397*	0.445	0.031
Family Recommendation	AB	AC	-1.664*	0.494	0.015
Friend Recommendation	AB	AC	-2.000*	0.502	0.002
Friend Recommendation	B	AC	-1.652*	0.454	0.006
Good Experiences	AB	BC	-1.789*	0.449	0.002
Good Experiences	AB	AC	-1.900*	0.492	0.003
Good Experiences	B	BC	-1.480*	0.398	0.005
Good Experiences	B	AC	-1.591*	0.445	0.008

criteria.

We use SPSS to analyze the questionnaire. Table 9 depicts the means of responses for each website for the related sub-criterion. “ALL” columns in Table 9 show the means obtained from the responses of all participants (230 participants) without considering which website the participant has shopped on before. “A-B-C” columns show the means obtained from the participants who have shopped from all three websites before (95 participants).

For all sub-criteria, website B is the most popular website for the participants without considering which website they have shopped on. Website A and C follow it, respectively. However, when the results obtained from the participants who have shopped from all three (A-B-C) websites before being compared, we see that website B again is the most popular for all sub-criteria except “Bad Experiences” and “TV, Radio and Newspaper” in which website A is the most popular. Eventually, all participants think that the most popular online shopping website is B whether or not they have shopped on from website B. There are assignable differences between the scores of the three websites so that they can be ranked as B, A, and C, respectively.

In the next step of our analysis, we categorize the participants as if

**Table 16**  
Ranking of Online Shopping Websites.

MAIN CRITERIA	$W_i$	SUBCRITERIA	$W_{ij}$	A		B		C	
				$S_{ijA}$	$WS_{ijA}$	$S_{ijB}$	$WS_{ijB}$	$S_{ijC}$	$WS_{ijC}$
Website Quality	5.47%	Website Design	7.60%	3.13	0.01	3.70	0.02	2.58	0,01
	5.47%	Easy to Use, Access, Efficiency	48.23%	3.32	0.09	3.84	0.10	2.61	0,07
	5.47%	Explanatory Info and Content	28.92%	3.34	0.05	3.67	0.06	2.64	0,04
	5.47%	Special Treatments	15.25%	2.95	0.02	3.42	0.03	2.62	0,02
Payment Methods	8.67%	Payment Variety	9.37%	4.00	0.03	4.00	0.03	4.00	0,03
	8.67%	Security and Security Policies	56.61%	4.00	0.20	4.00	0.20	4.00	0,20
	8.67%	Privacy and Privacy Policies	34.01%	4.00	0.12	4.00	0.12	4.00	0,12
Product Variety	16.15%	Quality	39.79%	3.25	0.21	3.65	0.23	2.66	0,17
	16.15%	Price Range	23.20%	4.00	0.15	4.00	0.15	4.00	0,15
	16.15%	Different Sellers	7.96%	4.00	0.05	4.00	0.05	4.00	0,05
	16.15%	Campaigns and Discounts	29.04%	4.00	0.19	4.00	0.19	4.00	0,19
Delivery and Guarantee	31.40%	Return Possibilities	13.25%	4.00	0.17	4.00	0.17	4.00	0,17
	31.40%	Quality of Delivery	25.75%	3.30	0.27	3.63	0.29	2.76	0,22
	31.40%	Fast Delivery Time	22.63%	3.33	0.24	3.67	0.26	2.87	0,20
	31.40%	Guarantee Policies	38.36%	4.00	0.48	4.00	0.48	4.00	0,48
Family Friend Affect	8.26%	Family Recommendation	33.76%	3.33	0.09	3.69	0.10	2.62	0,07
	8.26%	Friend Recommendation	66.24%	3.14	0.17	3.77	0.21	2.64	0,14
Past Experiences	26.56%	Bad Experiences	23.88%	2.67	0.17	2.67	0.17	2.48	0,16
	26.56%	Good Experiences	45.28%	3.26	0.39	3.72	0.45	2.69	0,32
	26.56%	Customer Support	30.84%	3.25	0.27	3.63	0.30	2.67	0,22
Advertisements	3.49%	Social media	66.27%	3.39	0.08	3.95	0.09	2.53	0,06
	3.49%	Television, Radio, and Newspaper	23.45%	3.42	0.03	3.50	0.03	2.53	0,02
	3.49%	Other Advertisements	10.28%	3.25	0.01	3.53	0.01	2.52	0,01
Total				3.49	3.48	3.74	3.73	3.11	3.13
				$S_A$	$WS_A$	$S_B$	$WS_B$	$S_C$	$WS_C$

they have shopped from websites A, B, C, or not. Table 10 shows the means according to our categorization. The first row of the table shows the number of responses for each category. A-1 and A-0 columns refer to the participants whether they have shopped or not on website A, respectively. This explanation is also valid for B-1 and B-0, C-1 and C-0. We realize that website B is the most popular website since 190 participants out of 230 have shopped on this website before.

Interestingly people give higher points to the websites that they have shopped before. This is valid for the customers of all online shopping websites (A, B, and C) in the study. However, the scores of B-0 and B-1 columns for “fast delivery time” are very relative values (3.43 and 3.72, shaded in gray in Table 10) which means almost everyone (who shopped or not shopped from website B) agrees that website B delivers the products fast. The results inform us how online shopping websites need to attract the attention of their potential customers. If a customer shops from a website, she will most probably continue to shop from the same website. We advise the online shopping website managers to offer different promotions for their potential new customers to convince them to place their first order. We find it interesting that people assign lower points for websites they have never shopped on before.

We apply an independent sample *t*-test using the SPSS with a confidence level of 95% to analyze if there are significant differences between

the customers' opinions who shopped or not shopped from these websites. The results for the three websites are depicted in Table 11. Only the related parts of the *t*-tests (Sig.2-tailed and Mean Difference) for websites A, B, and C are included in Table 11. The values on the “Sig (2 tailed)” columns show whether there are significant differences between customers' opinions concerning each criterion. A value less than 0.05 indicates the significant difference between customers' opinions for the related criterion. For example, considering the criterion “bad (past) experiences”, there is no significant difference between the opinions of participants who shopped or not shopped on website A since the “sig.2-tailed” value is 0.683, which is greater than 0.05. The gray shaded values in Table 11 indicate no significant differences between participants' opinions. We realize that for all criteria, the participants think differently for the websites they shopped or not shopped before. However, there is no significant difference between participants' opinions for the “TV, Radio, Newspaper” and “Other Advertisements” criteria.

Further descriptive analysis is applied to analyze the participants' opinions with different shopping experiences. The means obtained from the scores of all participant types are given in Table 12. The number of participants for each type is given in the first row, and their shopping experiences are given in the second row. For example, 29 participants have shopping experience only on website A, while 95 participants have

**Table 17**  
Ranking of Online Shopping Websites (Croatian).

MAIN CRITERIA	$W_i^*$	SUBCRITERIA	$W_{ij}^*$	A		B		C	
				$S_{ijA}$	$WS_{ijA}^*$	$S_{ijB}$	$WS_{ijB}^*$	$S_{ijC}$	$WS_{ijC}^*$
	11.28%	Website Design	12.73%	3.13	0.04	3.70	0.05	2.58	0.04
Website Quality	11.28%	Easy to Use, Access, Efficiency	51.70%	3.32	0.19	3.84	0.22	2.61	0.15
	11.28%	Explanatory Info and Content	25.62%	3.34	0.10	3.67	0.11	2.64	0.08
	11.28%	Special Treatments	9.95%	2.95	0.03	3.42	0.04	2.62	0.03
Payment Methods	9.74%	Payment Variety	20.89%	4.00	0.08	4.00	0.08	4.00	0.08
	9.74%	Security and Security Policies	62.97%	4.00	0.25	4.00	0.25	4.00	0.25
	9.74%	Privacy and Privacy Policies	16.14%	4.00	0.06	4.00	0.06	4.00	0.06
Product Variety	19.30%	Quality	45.31%	3.25	0.28	3.65	0.32	2.66	0.23
	19.30%	Price Range	21.05%	4.00	0.16	4.00	0.16	4.00	0.16
	19.30%	Different Sellers	9.10%	4.00	0.07	4.00	0.07	4.00	0.07
	19.30%	Campaigns and Discounts	24.54%	4.00	0.19	4.00	0.19	4.00	0.19
Delivery and Guarantee	20.03%	Return Possibilities	39.14%	4.00	0.31	4.00	0.31	4.00	0.31
	20.03%	Quality of Delivery	13.59%	3.30	0.09	3.63	0.10	2.76	0.08
	20.03%	Fast Delivery Time	18.69%	3.33	0.12	3.67	0.14	2.87	0.11
	20.03%	Guarantee Policies	28.58%	4.00	0.23	4.00	0.23	4.00	0.23
Family Friend Affect	5.30%	Family Recommendation	36.36%	3.33	0.06	3.69	0.07	2.62	0.05
	5.30%	Friend Recommendation	63.64%	3.14	0.11	3.77	0.13	2.64	0.09
Past Experiences	31.30%	Bad Experiences	29.95%	2.67	0.25	2.67	0.25	2.48	0.23
	31.30%	Good Experiences	56.44%	3.26	0.58	3.72	0.66	2.69	0.47
	31.30%	Customer Support	13.61%	3.25	0.14	3.63	0.15	2.67	0.11
Advertisements	3.04%	Social media	37.48%	3.39	0.04	3.95	0.04	2.53	0.03
	3.04%	Television, Radio, and Newspaper	34.86%	3.42	0.04	3.50	0.04	2.53	0.03
	3.04%	Other Advertisements	27.66%	3.25	0.03	3.53	0.03	2.52	0.02
Total				3.49	3.46	3.74	3.70	3.11	3.10
				$S_A$	$WS_A$	$S_B$	$WS_B$	$S_C$	$WS_C$

shopping experience on all three (A, B, C) websites. There are three rows for each criterion which refer to the means obtained from participants' answers for websites A, B, and C. To give an example, for the "website design" criterion, the highest mean (3.86) for website A is obtained from participants who have shopped from websites A and C while the mean obtained from participants who have only shopped from website A is 3.62.

In general, the participants (customers, in other words) assign higher points for the websites that they have shopped on before. Interestingly, although the ranking of websites is B, A, and C according to participants' answers who have shopped from three of them (recall scores in Table 9), this is not valid for the participants who have shopped on only one website. They give the highest points for the websites that they have shopped before. For example, even though the general ranking of website C is third, it is first according to the customers who have only shopped from website C.

ANOVA test with a confidence level of 95% is applied using the SPSS to analyze if there are significant differences between the customers' opinions who have different shopping experiences. Tables 13, 14, and 15 show the multiple comparison analysis of means obtained from the participants' answers for websites A, B, and C. If the "Sig." column

values in the tables are less than 0.05, we accept that there is a significant difference between customers' opinions for the related criterion. For brevity, in Tables 13, 14, and 15, we only include the information of related criteria in which I and J type participants think differently so that "Sig." column values are less than 0.05.

Table 13 only includes the criteria for which participants' opinions significantly differ for website A. There are eight criteria and 17 significant differences in Table 13. We realize that the most significant differences are between participant types A and B (see columns I and J) for the criteria given in Table 13. For example, the mean difference between A and B type customers for the criterion "Friend Recommendation" is 1.309, which is greater than 0.05. Therefore, we can conclude that the customers of website A (who have only shopped on website A) disagree with customers of website B (who have only shopped on website B) while evaluating website A. However, the highest mean difference in Table 13 is 2.034, which is found between A and C type participants for the criterion "Easy to Use, Accessibility, and Efficiency".

Table 14 only includes the criteria for which participants' opinions significantly differ for website B. There are 10 criteria and 20 significant differences in Table 14. Nine of the significant differences are between customer types A and B. We can conclude that the customers of website



**Table 18**

Comparison when the score of criteria are changed.

Turkish Perspective	S <sub>A</sub>	S <sub>B</sub>	S <sub>C</sub>	Ranking without weights	WS <sub>A</sub>	WS <sub>B</sub>	WS <sub>C</sub>	Ranking with weighted scores
Scores from Table 16	3.49	3.74	3.11	B-A-C	3.48	3.73	3.13	B-A-C
Trial 1	3.38	3.74	3.30	B-A-C	3.28	3.73	3.46	B-C-A
Trial 2	3.64	3.68	3.11	B-A-C	3.74	3.63	3.13	A-B-C
Trial 3	3.49	3.74	3.40	B-A-C	3.48	3.73	3.74	C-B-A
Trial 4	3.50	3.64	3.23	B-A-C	3.47	3.48	3.38	B-A-C
Croatian Perspective	S <sub>A</sub>	S <sub>B</sub>	S <sub>C</sub>	Ranking without weights	WS <sub>A</sub> *	WS <sub>B</sub> *	WS <sub>C</sub> *	Ranking with weighted scores
Scores from Table 17	3.49	3.74	3.11	B-A-C	3.46	3.70	3.10	B-A-C
Trial 1*	3.38	3.74	3.30	B-A-C	3.37	3.70	3.24	B-A-C
Trial 2*	3.64	3.68	3.11	B-A-C	3.57	3.66	3.10	B-A-C
Trial 3*	3.49	3.74	3.40	B-A-C	3.46	3.70	3.65	B-C-A
Trial 4*	3.50	3.64	3.23	B-A-C	3.44	3.34	3.48	C-A-B

A disagree with customers of website B while evaluating website B. Three significant mean differences are between participant types B and AC (see columns I and J). So, while evaluating website B, customers who have only shopped from websites A and C disagree with customers who have only shopped from website B for “Website design”, “Easy to use, accessibility and efficiency”, and “Customer support” criteria. The highest mean difference (2.061) is between B and C type customers for the criterion “Good Experiences”. Eventually, inconsistency between opinions of different participant types for website B is more significant than website A’s.

Table 15 only includes the criteria for which participants’ opinions are significantly different for website C. There are 10 criteria and 39 significant differences in Table 15. When website C is considered, it is realized that there are significant mean differences between almost all types of participants (see columns I and J). So, customers do not agree with each other while evaluating website C. For example, the highest mean difference (2.329) is between AB and AC customer types for the criterion “Easy to Use, Accessibility, and Efficiency”. Eventually, inconsistency between opinions of different participant types for website C is more significant than websites A and B’s.

We realize that there are significant differences between customers’ opinions about the online websites analyzed in this study. Although the ranking according to the opinions’ of the customers who have shopped from all three websites is B, A, and C, the customers who have shopped only from one website think that their website is the best compared with the other two. So, a website manager should outline marketing policies and create special offers to attract customers who shop on other websites.

#### 4.3. Weighted ranking of online shopping websites

We use main and sub-criteria weights found in the first step and scores of three online shopping websites obtained from the second questionnaire to find the rankings of the online shopping websites. Eq.6 and Eq.7 are used to find the weighted criteria scores and the ranking of three online shopping websites.

Formula to find the weighted score ( $WS_{ijk}$ ) of website k considering main criterion i and sub-criterion j:

$$WS_{ijk} = W_i * W_{ij} * S_{ijk} \quad (6)$$

Where  $WS_{ijk}$  is the weighted score of website k considering main criterion i and sub-criterion j,  $W_i$  is the weight of the main criterion i,  $W_{ij}$  is

the weight of main criterion i’s sub-criterion j, and  $S_{ijk}$  is the score of website k for the main criterion i and sub-criterion j (for every  $i = 1$  to  $m$ ,  $j = 1$  to  $n$ , and  $k = A$  to  $C$ , in this study  $m = 7$  and  $n = 23$ ).

Formula to find the overall weighted score of website k:

$$WS_k = \sum_{j=1}^n WS_{ijk} \quad (7)$$

for every  $k = A$  to  $C$ .

The results found using equations (6) and (7) are depicted in Table 16. There are two kinds of  $S_{ijk}$  scores for the online shopping websites in Table 16: the scores shown in italic letters and gray shading are assigned by us, and the other scores without shading are obtained using the second questionnaire.

The following is the explanation of how the scores in italic letters and gray shading are assigned: Due to legal regulations, internet technologies, and payment options in Turkey, there are not any significant differences between websites A, B, and C considering the “Payment Variety”, “Security and Security Policies”, “Privacy and Privacy Policies”, “Return Possibilities”, and “Guarantee Policies” criteria. Thus we assign 4 as the  $S_{ijk}$  scores. There are thousands of suppliers, sellers, and manufacturing companies in Turkey that those websites have cooperation which enables those three websites to offer almost similar kinds of price ranges, campaigns, and discounts. So, we again assign 4 as the  $S_{ijk}$  scores for the “Price Range”, “Different Sellers”, “Campaigns, and Discounts” criteria.

The weighted ranking of online shopping websites is found as B, A, and C with the scores 3.73, 3.48, and 3.13 (blue shaded scores in Table 16). The scores of online shopping websites A, B, and C without weighting are 3.74, 3.49, and 3.11. The ranking of websites does not change with or without weighting the scores with the current results obtained from the second questionnaire.

We replace the main and sub-criteria weights found for Turkish people ( $W_i$  and  $W_{ij}$  columns in Table 16) with the main and sub-criteria weights found for Croatian people ( $W_i^*$  and  $W_{ij}^*$  columns in Table 17) to analyze if the weighted scores of websites A, B, and C will change with the effect of cross-cultural differences. Table 17 depicts the new results found using equations (6) and (7). The assumptions for the gray shaded cells in Table 16 are also applied in Table 17. The weighted ranking of online shopping websites is found as B, A, and C, with the scores 3.70, 3.46, and 3.10 (last row of Table 17). However, the scores of online shopping websites B, A, and C without weighting are 3.74, 3.49, and 3.11. The ranking of websites does not change with or without

weighting the scores from the Croatian perspective. However, weighted scores ( $WS_{ijA}$ ,  $WS_{ijB}$ ,  $WS_{ijC}$ ) of three websites in Table 16 perspectives differ from the weighted scores ( $WS_{ijA}^*$ ,  $WS_{ijB}^*$ ,  $WS_{ijC}^*$ ) of three websites in Table 17 which can be considered as cross-cultural differences between Turkey and Croatia.

We believe that if the second questionnaire scores of the websites were different, then the ranking of websites might be changed for weighted or not weighted criteria scores. For example, when just the scores of three websites for two criteria, “Quality of Delivery” and “Fast Delivery Time” are changed, then the results depicted in Table 18 are obtained that cause a difference in the rankings with or without weighting the scores. Therefore, we apply the following four trials to show and prove the importance of weighted scores.

- Trial 1: We assign 2.00 and 5.00 as the scores of websites A and C for two criteria (Quality of Delivery and Fast Delivery Time),
- Trial 2: We assign 5.00 and 3.00 as the scores of websites A and B, for two criteria (Quality of Delivery and Fast Delivery Time),
- Trial 3: We only assign 5.00 as the score of website C for three criteria (Quality of delivery, Fast delivery time, and Good past experience) without changing the scores of websites A and B.
- Trial 4: We assign 3.00, 2.00, and 4.00 as the scores of websites A, B, and C, respectively, for two criteria (Bad experiences, Good experiences)

Table 18 depicts the four trials’ non-weighted ( $S_A$ ,  $S_B$ , and  $S_C$ ) and weighted ( $WS_A$ ,  $WS_B$ , and  $WS_C$ ) scores. The original values transferred from Tables 16 and 17 are shaded in yellow. The values on Trial 1, 2, 3, and 4 rows of Table 18 are the scores considering the criteria weights obtained from Turkish participants. The Trial 1\* to 4\* rows of Table 18 (shaded in gray) are the scores found considering the criteria weights obtained from Croatian participants.

Although the ranking of three websites does not change without applying the criteria weights, when the criteria weights (Turkish perspective) are considered, the ranking of three websites changes to B-C-A in Trial 1, A-B-C in Trial 2, C-B-A in Trial 3 (see Ranking with weighted scores column of Table 18). When the criteria weights (Croatian perspective) are considered, the only change in the ranking of three websites is obtained in Trial 4\*, C-A-B. We will for sure face different rankings of websites from the perspective of Turkish and Croatian participants when more trials are applied. So, slight changes in the scores of websites cause changes in the ranking of online shopping websites if the weights of criteria are considered. The scores obtained from the second questionnaire give a general sense of online shopping websites without focusing on criteria weights. However, criteria weights are significant to find more realistic rankings. This is very important for the decision-makers of advertisement and marketing companies if they are planning to select the most popular websites to reach out to more customers via their advertisements. It is also essential for the suppliers and manufacturers since they prefer to cooperate with the most popular online shopping websites to sell their products. The criteria weights are also significant for the online shopping website owners to learn more about the factors behind customers’ decisions to select the most convenient websites to shop. For example, when website C applies related improvements for the criteria “Quality of delivery”, “Fast delivery time” and “Good past experience” and increases its scores to 5.00 for those three criteria, then website C becomes first among three websites (see Trial 3). Hence, when the owners of website C make the related improvements just for those three criteria, their website becomes the most popular among the three websites. This is also valid for Croatian online shopping website owners. The online shopping websites which operate in different countries must consider the cross-cultural changes while deciding how to attract the customers’ attention.

## 5. Conclusion

Online shopping websites are trendy nowadays due to the Covid-19 Pandemic. People prefer to stay at home and shop online rather than go to shopping malls or supermarkets to save time and prevent diseases. Therefore, the share of online websites in the market has increased rapidly, which makes the market more competitive for online shopping websites.

We propose a three-step methodology for ranking online shopping websites. There are studies about the same concept using different names. However, those studies focus on either finding the criteria weights or sorting/selecting shopping websites. Unlike those studies, our mixed-method research improves the reliability of selecting/sorting the online shopping websites since better estimations can be made with our compact model, which determines the criteria, finds their weights, and rates the online shopping websites. Our study is the first study in which not only the literature is reviewed to determine the criteria but also interviews with people are made to confirm the criteria found searching the literature. We apply the following steps to find answers for the decision process that lies behind selecting the online shopping website to shop:

- The criteria that affect the decision process are determined by searching the literature in detail and interviewing 80 people.
- A face-to-face questionnaire is applied to 160 people from Turkey and 36 people from Croatia, and the weights of the criteria are found using the AHP methodology.
- Another questionnaire is applied to 230 people who have online shopping experiences. Finally, the scores of the three most popular online shopping websites are found based on those people’s shopping experiences.
- “How the customers score the websites” that they have shopped or have not shopped before are analyzed using SPSS to understand customers’ opinions about online shopping websites. The customers who have online shopping experiences are potential customers of all online shopping websites. Therefore, their opinions about the online shopping websites that they shopped before and have not shopped before are significant for the managers to develop improvement strategies.
- The three most popular online shopping websites are ranked using the second questionnaire scores and the criteria weights.

To satisfy the customer demands and attract the attention of possible future customers, online shopping website owners should consider the process behind selecting the best online shopping website. The decision process can be explained as follows. To begin with, the criteria behind selecting an appropriate online shopping website and their importance weights must be considered to understand the customers’ online shopping website selection process. In addition, the customers’ scores and rates for the abilities of online shopping websites concerning each criterion must be considered. Furthermore, the website owners must consider the weighted scores to clarify the decision process behind selecting the online shopping website to place the following order. Finally, cross-cultural changes must be considered by the international online shopping website owners to be more competitive in the market. Thus, focusing on customers’ opinions and their decision process, the managers of online shopping websites can improve the service quality of their websites to increase the number of customers.

We believe that our three-step methodology is essential for the decision-makers of advertisement and marketing companies if they are planning to select the most popular websites to reach out to more customers via their advertisements. Furthermore, our methodology has the potential to be used by the suppliers and manufacturers to sort or select the online shopping websites to sell their products on. We point out the factors that lie behind the decisions of customers to select the most convenient websites to shop, which we believe be helpful for the online

shopping website owners.

For future studies, more online shopping websites can be ranked by using our methodology. The third part of our methodology can be replaced by other multi-criteria decision methodologies such as TOPSIS to find the rankings of online shopping websites based on the scores obtained from the second questionnaire. Our first questionnaire for finding the criteria weights can be applied to other nations to analyze other cross-cultural differences while finding criteria weights.

### CRedit authorship contribution statement

**Zafer Yilmaz:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing.

### Declaration of Competing 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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