

Mühendislik Öğrencilerinin Seyahat Tercihlerine Göre Sınıflandırılması

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Öz

İstanbul'da yükseköğrenim okumakta olan öğrenci sayısı 2017-2018 eğitim-öğretim yılında yaklaşık 1 milyona ulaşmıştır. Bu sayı bazı ülkelerin nüfusundan daha fazladır. Bu öğrencilerin bir kısmının Türkiye'nin dört bir yanından geldiği de bilinen bir gerçektir. Bu öğrenciler, düzenli olarak kendi memleketlerine seyahat etmektedir ve seyahat tercihleri de seyahat firmaları tarafından başlıca unsurlardan biri olarak görülmektedir. Bu çalışma; bahsedilen seyahat firmalarının, yükseköğrenim öğrencilerine yönelik pazarlama amaçlı çalışmalarında kullanabileceği bir içgörü sunmaktadır. Bu çalışmanın amacı Marmara Üniversitesi'nde öğrenim görmekte olan mühendislik öğrencilerinin şehirlerarası seyahat tercihlerini araştırmaktır. Bu çalışmada, 260 mühendislik öğrencisine 26 soru ve 9 bölümden oluşan bir anket uygulanmıştır. Demografik bilgilerin haricinde, öğrenciler; en çok seyahat edilen şehirler, tercih edilen seyahat türü, seyahat sırasında tercih edilen firmalar, seyahat bileti satın alma tercihleri ve şehirlerarası seyahat ederken karşılaştıkları problemler hakkında sorular yanıtladılar. Dikkat edilmesi gereken bir nokta, bu çalışma için sadece kategorik değişkenlerin kullanılmış olduğu dikkate alınmalıdır ve öğrencilerin seyahat tercihleri ile ilgili tutumlarının sonuç olarak dikkate alınmadığı göz önünde bulundurulmalıdır. İlk olarak anket verisinde yapılan analizler; betimsel istatistiksel analizler ve ardından çeşitli değişkenlerin bağımsızlık durumu için yapılan chi-kare testlerinden oluşmaktadır. Sonrasında yapılan analizler Hiyerarşik Dendogram, Yığılma Tablosu ve K-Means algoritmasını içermektedir. Yığılma Tablosu için Ward's linkage kullanılmıştır. Dirsek noktası 222. noktada işaretlenmiştir. Bu değeri kullanarak, K-means algoritmasındaki küme sayısı 6 olarak belirlenmiştir. Son olarak, mühendislik öğrencileri 6 küme içerisinde sınıflandırılmıştır ve bu kümelerin özellikleri verilmiştir.

Anahtar kelimeler

Sınıflandırma; K-means algoritması; Kümeleme; Seyahat Tercihleri

Classification of Engineering Students for Traveling Preferences

Abstract

Higher education students in Istanbul was nearly one million in 2017-2018 academic year, which is more than some countries' population. It is known that a portion of them are coming to Istanbul from all around Turkey. These student travel to their hometowns regularly, and their preferences are thought to be essential for traveling companies. This research offers an insight to these companies when they provide campaigns for marketing purposes to university students. The aim of this paper is to investigate intercity travelling preferences of engineering students in Marmara University. A survey with 9 sections and 26 questions is conducted on 260 engineering students. Apart from demographics, the students answered questions on their most frequently visited cities, preferred mode of transportation, companies they choose while traveling, ticket purchase preferences, and problems that they come across during intercity travel. Note that, only categorical variables are collected for this study and students' attitude on choosing the traveling mode isn't projected hereby. Former analysis conducted on survey data is descriptive statistical analysis, following are chi-square tests for

Keywords

Classification; K-means algorithm; Clustering; Traveling Preferences

independence of several cross variables. Latter analysis consists of Hierarchical Dendogram, Agglomeration Schedule and K-means algorithm. Ward's linkage is used for Agglomeration Schedule. Elbow point is indicated at 222nd point, using this value the number of clusters for K-means algorithm is selected 6. Finally, the engineering students are classified into 6 clusters and their cluster characteristics are provided.

1. Introduction

This study is researched for determination of traveling preferences and their reasons with conducting an online survey to the respondents from engineering students who are from different departments in Marmara University.

The results from the respondents (students) whose families are living in another city are important because these students generally travel intercity more than other students and it is expected that their rate of consciousness is higher in traveling decisions.

The main aims of the study are finding what affects the decisions of students on traveling especially in intercity travels (i.e. money, time, distance, service quality, etc.), classifying the students according to their traveling preferences (i.e. preferring airway, railway or road) and preparing a valuable research on that topic which can be helpful to tourism companies such as airlines, bus companies, etc. In addition, this research offers an insight to these tourism companies about when they make campaigns to reach more students and make much money.

On the topic of traveling preferences there are limited number of valuable studies which can be helpful to the tourism companies in Turkey. This problem causes unconscious campaigns and waste of money which target the young people between 18 and 25 years old. As an illustration, if a company make a discount on tickets at the rate of 50% in first week of the January to the students who are registered to their loyalty program, their expectations about the increase in sales will be failed probably because majority of the students won't travel during their final exams period.

While applying the survey, the main challenge that is met are the participants who give answers

without consistency and accuracy. In order to prevent related problems, the number of questions in the survey is a wide area about intercity traveling. The survey researched customer preferences in many aspects.

The rest of the paper is as follows. Section two presents the literature review. Section three gives a brief information about methodology and analysis conducted. Section four consist of survey parts and each part gives the descriptive analysis about the participants. Section five explains clustering application and shows the variables that are used in clustering. Section six provides information about the six clusters' characteristics and Section seven concludes the study.

2. Literature Review

Keskin (2007) studied about the factors that are affecting the intercity traveling preferences of university students within the scope of least squares method and Tobit model. In the data, the main variables as distance between university and the hometown, grade, grade point average (GPA), and gender of the student, size of the family, and household income. Also, Acikalın (2014) examined the traveling preferences of the university students and the demographic, economic effects on these preferences and the long-distance, short-term traveling preferences. Results of the surveys has three main factors: i) demographics of the participants ii) transportation vehicles iii) important factors on the preferences Inner city and upstate traveling preferences were examined in detail. And on different continent, Slabbert and Van Der Merwe (2012) studied about the travel behavior of South African tourism students. Main focus areas on the survey is demographic characteristics,

holiday preferences, travel types, and motivations on traveling.

Chiou and Chen (2010) investigated the service expectation and perception, passenger satisfaction, airline image and behavioral intentions of the Low Cost Carriers (LCC) services. Then, validated results compared with the Full Service Carriers (FSC). And on this topic, Lin and Huang (2015) aimed to develop and evaluation model to determine the relative weights of the factors influencing passenger choice of LCCs through Analytic Network Process (ANP) during group decision-making. ANP was utilized to solve multi-criteria decision-making problems in which the criteria affect passenger choice of LCCs. On this topic, Buaphiban and Truong (2017) examined how Southeast Asian passengers' attitudes and behaviors affect their purchase of LCC tickets. Lu (2017) searched that low cost and full service carries in Taiwan and compared them in many aspects. Data was collected from an online survey which is made before by different company and assessed the potential of principal component analysis with biplot technique to define different passengers based on their preferences of services and valuations of the importance of factors. Koklic et al. (2017) investigated relationship between customer satisfaction and service quality. Authors compared two airline types: LCC and FSC.

Shields, P. O. (2011) aimed to determine the impact of wanderlust on past travel profiles, attitudes toward travel destinations for business and leisure. Also impact of gender on travel related attitudes and behaviors was the another aim.

Valdes (2015) investigated what effects on the air travel demand for Middle Income Countries (MICs). Data of 32 countries during the period between 2002 and 2008 were used.

Losada et al. (2016) aimed to identify the variables that influence the travel frequency of Spanish seniors, one of the most important collectives for the tourism industry given its high travel frequency which depends on variables determining travel participation. Tomsic et al. (2016) investigated the relations between the old users who are using the

Ljubljana city buses, their traveling habits, and their physical (dis)abilities.

Celikkol et al. (2017) examined the demand and usage of High-Speed Rail (HSR). Aim of the survey was clarifying travel preferences of HSR users. The survey includes questions about socio-demographic data (gender, age, household income, occupation, etc), the rating of 6 factors (travel time, cost, safety, punctuality, comfort, and environmental sensitivity) with the 4 levels of importance, traveling modes depending on the purpose, and HSR usage.

Graham and Metz (2017) prepared a paper which aimed to analyze the characteristics of infrequent flyers and the reasons for their travel habits, using the United Kingdom (UK) as a case study. In this research, data from the UK, Germany, Belgium, and Netherlands was used.

Yaylalı and Dilek (2017) examined the factors affecting the airline company preferences of the persons in domestic travels. The factors were subjected to the 5-point Likert analysis. For all of the airline companies; ticket prices, along with timely departure-arrival, safety, comfort, and cancellation status of the flights were factors that having the highest averages.

Katona et al. (2017) used in this research based on a previous research a multimodal technic. Routing algorithm was developed and prepared to recognize and take into account the habits of the travelers, to reach this a model was constructed which involves these parameters.

De Vos (2018) investigated that travel mode is affected by travel related attitudes of people. According to collected data, people are separated with their socio-economic and demographic characteristics.

Kouwenhoven and de Jong (2018) searched for empirical evidence to support that the value of travel time can theoretically be defined as the opportunity cost of travel minus the direct utility from spending the time during the trip. The topics which analyzed are effect of finding a shorter trip useful and a longer trip very inconvenient, effect of

having devices available during a trip and effect of being able to spend travel time in a useful way.

18 articles were analyzed and summarized. Generally, the articles are searched for answers to these types of questions:

- What exactly do they want to research about travelling preferences?
- Which methods are used by researchers?
- How do they use different methods for their data?
- How do they select their respondents?
- How do they categorize the respondents?
- How do they create a survey about travelling preferences?

In general, answers to such questions were sought. The answers found shed light on us for this study. It was understood which methods are used in the articles. Considered issues were taken in the creation of the questionnaire created. In these surveys, it was seen which questions categorized the respondents.

3. Methodology

In this study, intercity travelling preferences Marmara University is investigated with an empirical survey. The survey is designed after a literature review of previous studies. The survey is focused on demographic information, most frequently visited cities, preferred mode of transportation, companies they choose while traveling, ticket purchase preferences, and problems that they come across during intercity travel. The 26 questions are prepared with that considerations and survey is prepared and started to apply on respondents who are engineering students in Marmara University. The survey is applied with Google Forms and answered by 260 respondents between December 2018 and March 2019. The descriptive analysis is applied after the application which includes preprocessing of data in order to make proper analysis. For the descriptive analysis part, some inferences are obtained, and results are examined with chi-square tests for independence of several cross variables. Finally,

clustering analysis is applied on the data set in order to group students according to their preferences. The analysis includes Hierarchical Dendrogram, Agglomeration Schedule and K-means algorithm. Ward's linkage is used for Agglomeration Schedule. The methodology is shown in (Figure 3.1).

4. Data

Survey consists of 8 sections and 26 questions. 260 students who are studying at Marmara University Faculty of Engineering participated in the survey. The results of the questionnaire include the personal information of the students, their income status, the cities they travel, the reasons for traveling, their travel frequencies, travel mode and the campaigns preferred.

4.1. Personal Information

This section contains 6 questions which include gender, age, living area, grade, personal and family income to find out participants' demographic information (Figure 4.1.1 and Figure 4.1.2).

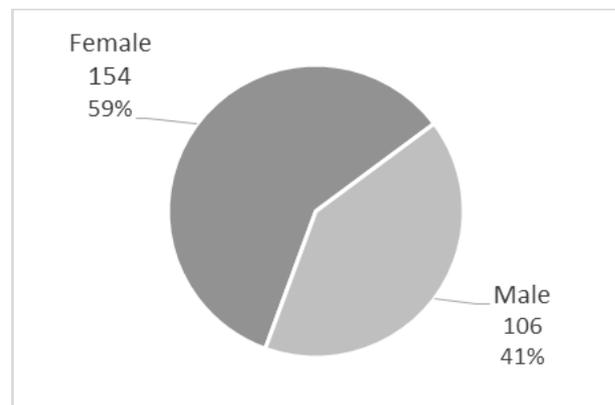


Figure 4.1.1. Distribution of Gender

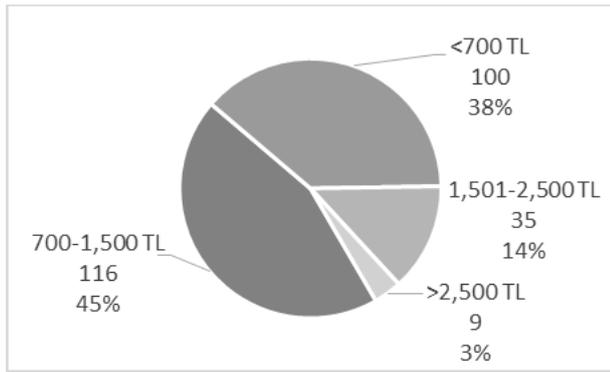


Figure 4.1.2. Distribution of Personal Income (TL)

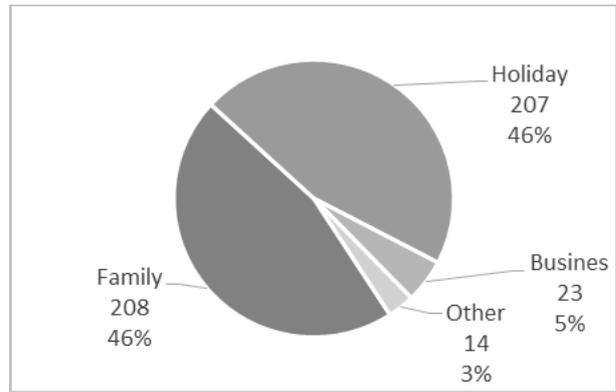


Figure 4.3.1. Traveling Reasons

4.2. Traveling Regions

In this section, most three visited cities are surveyed. Since there are 81 cities in Turkey, wide variety of cities are collected. Therefore, the cities are grouped according to their regions (Table 4.2.1).

Table 4.2.1. The most visited regions

Regions	Frequency	Percentage
Marmara	103	40 %
Aegean	56	21 %
Black Sea	34	13 %
Mediterranean	29	11 %
Central Anatolia	29	11 %
Null	7	3 %
Eastern Anatolia	2	1 %

4.3. Traveling Reasons

In this section, the traveling reasons of respondents and their traveling motivations are requested. Respondents could select more than one reason (Figure 4.3.1).

4.4. Transportation Preferences

This section contains 4 questions which include travel mode, reasons to choose that travel mode, the time they prefer to travel and car sharing preferences (Figure 4.4.1 and Figure 4.4.2).

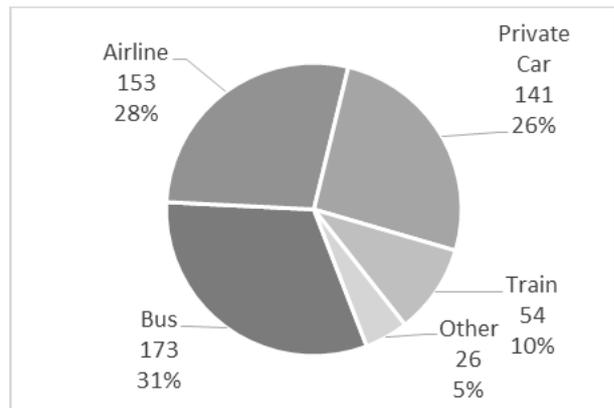


Figure 4.4.1. Travel Mode

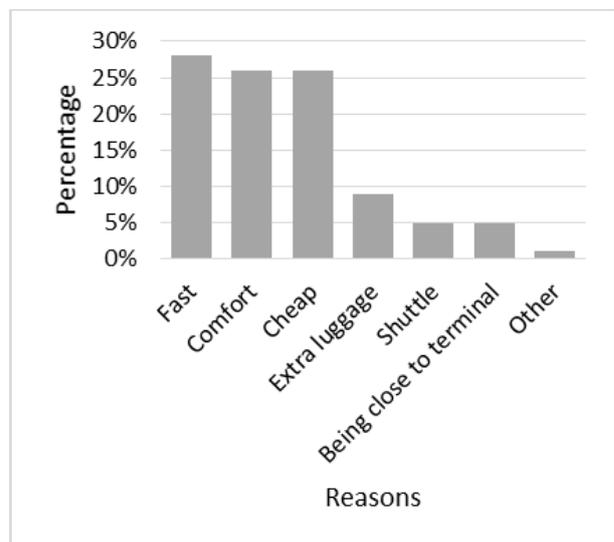


Figure 4.4.2. The reasons to choose that travel mode

4.5. Travel Frequency and Purchasing Types

In this section, five questions are asked which are about ticket purchasing type, preferences about search engines, payment choice, traveling frequency and traveling period (Figure 4.5.1 and Figure 4.5.2).

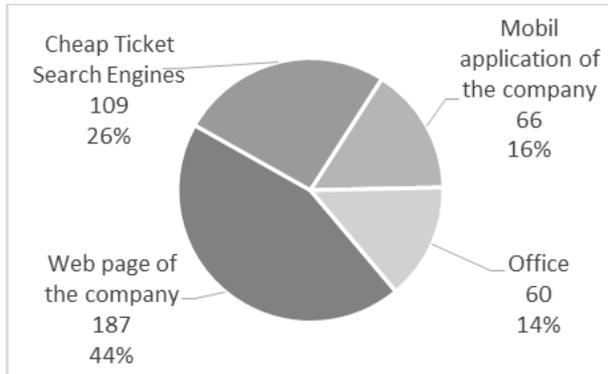


Figure 4.5.1. Ticket Purchasing Types

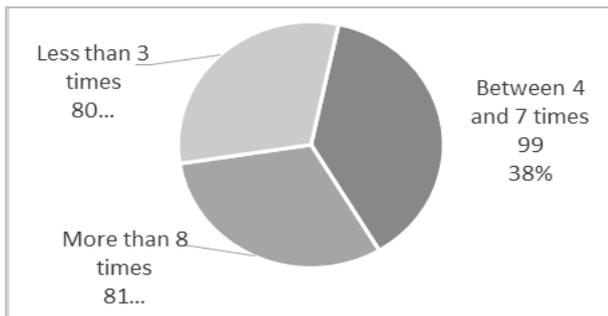


Figure 4.5.2. Traveling Frequency (in a year)

4.6. Airline Company Preferences

This section is about respondents' airline company preferences and the reasons to choose that company (Figure 4.6.1 and Table 4.6.1).

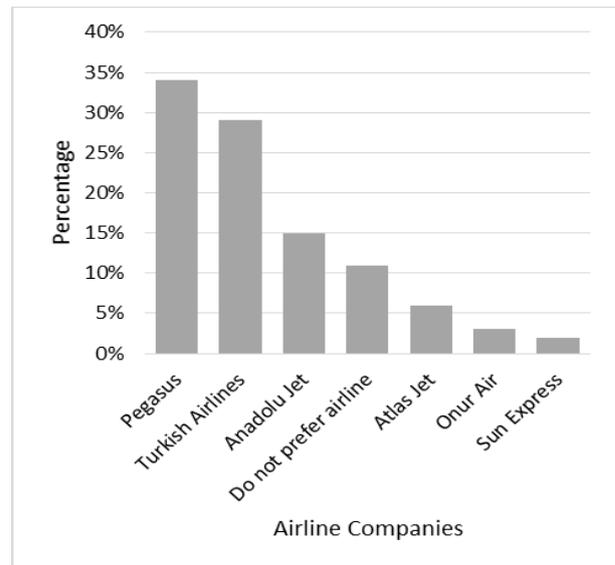


Figure 4.6.1. Airline Company Preferences

Table 4.6.1. The reasons to choose that company

	Frequency	Ratio
Ticket Price	168	39 %
Customer Relationship	77	18 %
Do not prefer airline	52	12 %
Catering	51	12 %
No Delay	47	11 %
Free Seat Selection	29	7 %
Lounge Service	5	1 %

4.7. Bus Company Preferences

This section is about respondents' bus company preferences and the reasons to choose that company. (Table 4.7.1 and Figure 4.7.1)

Table 4.7.1. Bus Company Preferences

	Frequency	Ratio
Kamil Koç	142	31 %
Pamukkale	102	22 %
Metro	55	12 %
Ulusoy	52	11 %

Other	45	10 %
Nilüfer	34	7 %
Do not prefer	32	7 %

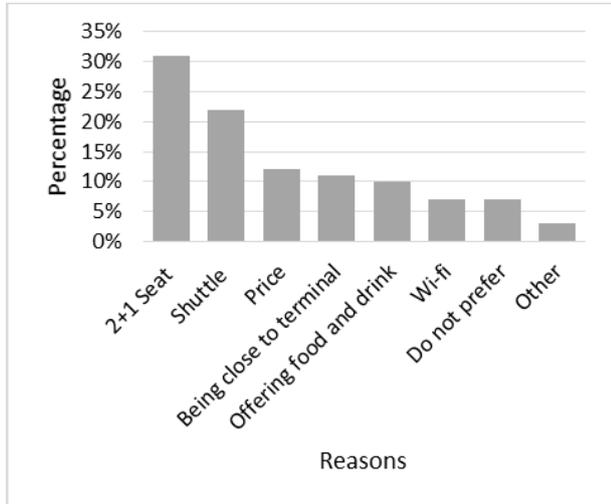


Figure 4.7.1. The reasons to choose related company

4.8. Campaigns and Problems

This section contains four questions about the being informed by the campaigns, variety of campaigns, reservation dates and traveling problems (Table 4.8.1 and Figure 4.8.1).

Table 4.8.1. Campaign Types

Campaigns	Frequency	Ratio
Two-way ticket	104	40 %
Early reservation	76	29 %
Mobile application	44	17 %
Loyalty program	19	7 %
Mile campaign	12	5 %
Null	5	2 %

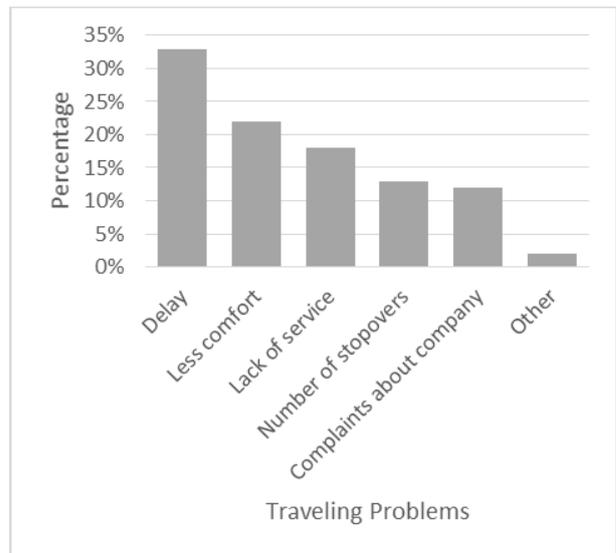


Figure 4.8.1. Traveling Problems

5. Clustering Application

Clustering is the best-known data mining method used to classify observations into homogeneous groups (Giudici and Figini (2009)). In this study, clustering is applied on the data set in order to group students according to their traveling preferences. Hierarchical Dendrogram, Agglomeration Schedule and K-means algorithm are implemented for clustering purposes.

From the survey questions 15 variables are selected for analysis. (Table 5.1) Note that, 260 students answered the survey, however due to missing values 228 of them are used in clustering analysis. First a Hierarchical Dendrogram is produced, continuing with an Agglomerative Schedule using Ward’s linkage method. In order to determine the number of clusters an Agglomeration Graph is drawn in Figure 5.1. The Elbow point in Figure 5.1. is used to decide on the number of clusters. It is clear that the breaking point is on 222th point. After this point, fast increments are observed and 228-222=6 clusters are appropriate for this study. Hence, 4 and 5 clusters with k-means is also analyzed and revealed that with 6 clusters a more suitable distribution of the students is obtained.

Table 5.1. Variables and their options

Variable	Alternative Choices	Other
Gender	Female, Male	
Age	18-20, 21-23, Above 23	
Living Area	Dormitory, Separate house, With family, With relatives	After first exam week, After final exam week, Public holiday, Summer holiday
Grade	Prep class, 1st grade, 2nd grade, 3rd grade, 4th grade	Turkish Airlines, Pegasus, Atlas Jet, Onur Air, Sun Express, AnadoluJet, I do not travel by airline
FamIncome	< 2000 TL, 2000-5000 TL, 5001-8000 TL, > 8000 TL	
PerIncome	< 700 TL, 700-1500 TL, 1501-2500 TL, > 2500 TL	No delay, Catering, Price, Customer relationship, Lounge, Free seat selection, I do not travel by airline
Trav1stRegion	Marmara, Aegean, Black Sea, Mediterranean, Central Anatolia, East Anatolia, Southeastern Anatolia	Pamukkale, Kamil Koç, Nilüfer, Uludağ, Ulusoy, Metro, Çanakkale Truva, Vivalines, I do not travel by bus
Trav1stReason	Family visit, Vacation, Business trip, Other	
Transport1st	Bus, Airline, Train, Private car, Other	Catering, Price, Shuttle service, Easy access, 2+1 Seat selection, Wi-Fi, Meal Service
Transport1stReason	Comfort, Velocity, Price, Being close to terminal or airport, Extra luggage, Shuttle service, Other	Family and friends, Internet, TV advertisement, Newspaper
TravTime	Night, Day, Both	
CarSharing	Yes, No, I do not travel by car	Early reservation, Return-ticket advantage, Mile campaign, Membership program, Special offer for mobile app
TicBuy1st	Company's website, Ticket engine, Mobilapp, Agency	
TicEng1st	Skyscanner, ucuzabilet, aerobilet, obilet, turna.com, kiwi.com, I do not use ticket engines	0-2 weeks ago, 3-5 weeks ago, More than 5 weeks ago
PayChoice	Cash, Credit card (One), Credit card (Installment), Transfer/EFT, BKM Express,	Delay, Lack of service, Low comfort, Excessive number of breaks, Complaints about facilities

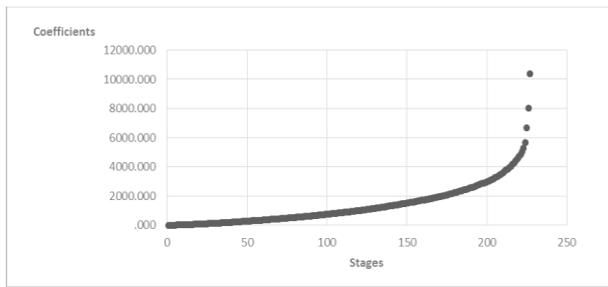


Figure 5.1. Agglomeration Graph

6. Cluster Characteristics

In this section, 228 students are classified using 15 different variables into 6 clusters. Table 6 with the help of found correlations in each cluster, engineering student’s answers about traveling preferences are seen that in which points they grouped together and according to findings, clusters are interpreted.

Marmara region is the most visited region for the Cluster 1, Cluster 2, Cluster 4, and Cluster 5. However, it is not traveled region for the Cluster 3 and Cluster 6. Cluster 3 and Cluster 6 are generally divided by three regions which are Black Sea, Mediterranean and Central Anatolia (Figure 6.1).

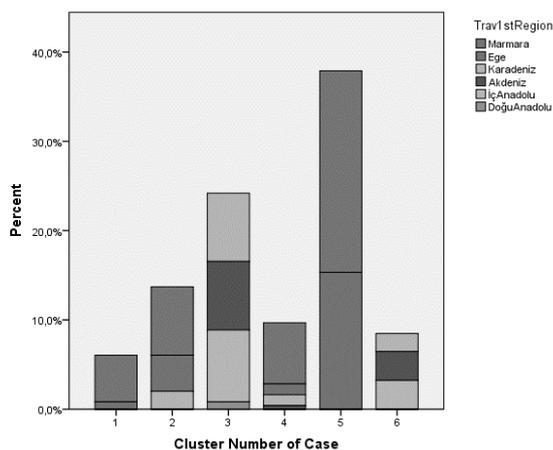


Figure 6.1. Traveled regions in each cluster

All kind of family incomes have distributed to the each of the six clusters. 2,000-5,000 TL is the dominant family income for all clusters. The highest ratio of family income which is more than 8,000 TL belongs to Cluster 5 (Figure 6.2).

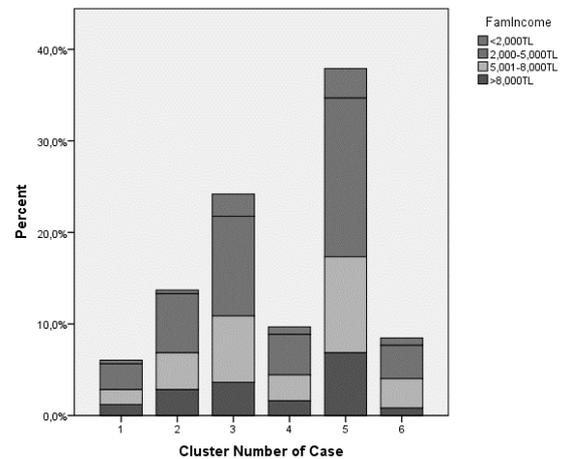


Figure 6.2. Family income in each cluster

Generally, <700 TL & 700-1,500 TL are distributed to the each of the six Clusters. Personal Income that is more than 2,500 TL is only found in Cluster 2, Cluster 3, and Cluster 5 with low percentage. There are no students with personal income over 2500 TL notwithstanding there are students with family income over 8000 TL in the Cluster 1 (Figure 6.3).

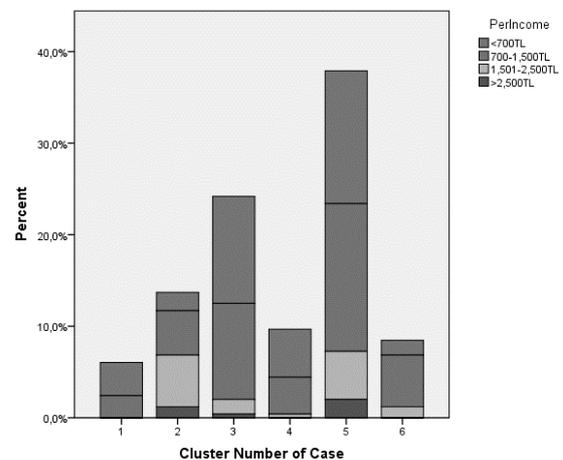


Figure 6.3. Personal income in each cluster

Bus and plane are the most preferred transportation type except Cluster 4. Because Marmara Region and Aegean Region is close to the Istanbul, bus is the most used transportation type for Cluster 1, Cluster 2, and Cluster 5. Private Car is the dominant travel mode for the Cluster 4 (Figure 6.4).

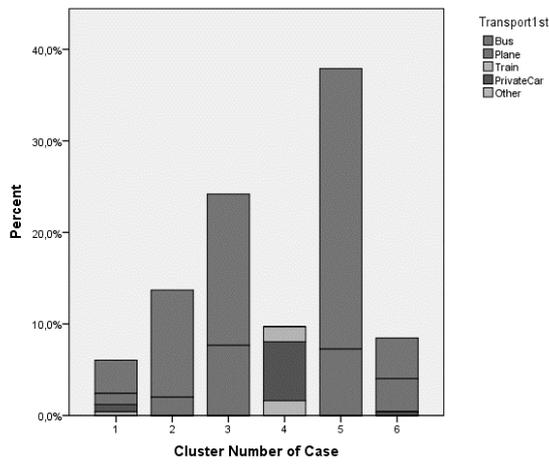


Figure 6.4. Preferred transportation in each cluster

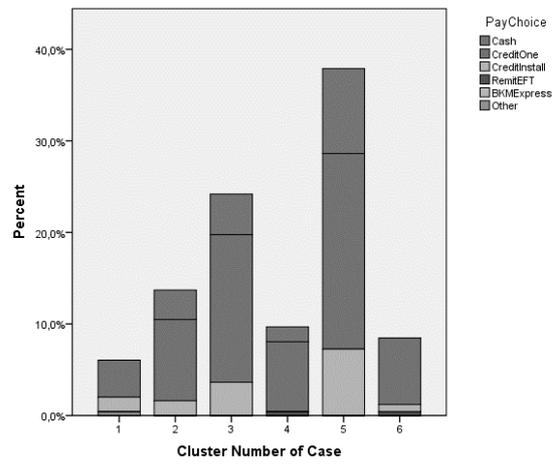


Figure 6.6. Payment choice in each cluster

The option of web sites of the companies has the maximum percentage for each cluster. Agency option is not be included in Cluster 1 and Cluster 6. (Figure 6.5).

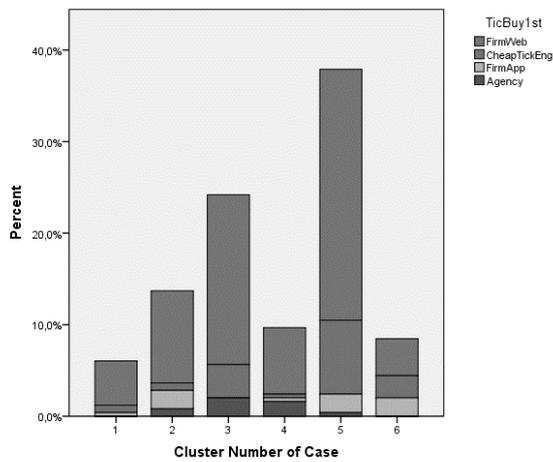


Figure 6.5. Ticket purchasing way in each cluster

Credit card for single payment is used dominantly for each Cluster. Cash option is not be included in Cluster 1 and Cluster 5. Remit/EFT and other options is rarely used (Figure 6.6).

Most of the students prefer traveling at summer. All the options are available in each cluster with certain percentages (Figure 6.7).

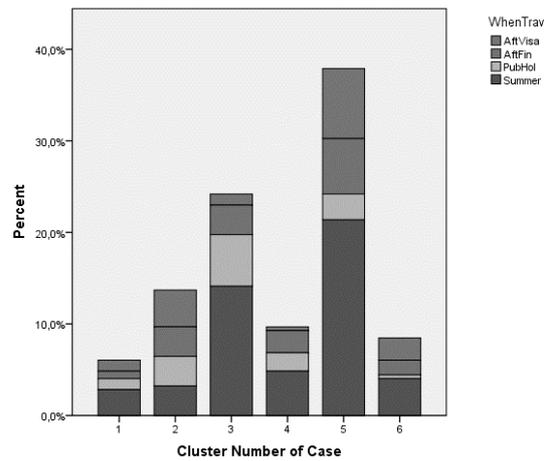


Figure 6.7. Traveling period in each cluster

Traveling frequency is equally distributed between less than 3 and 4-7 at all Clusters except at Cluster 2. All kind of traveling frequency equally likely distributed at Cluster 4 and most of the people who are at Cluster 4 generally pay their tickets by credit card with single payment (Figure 6.8).

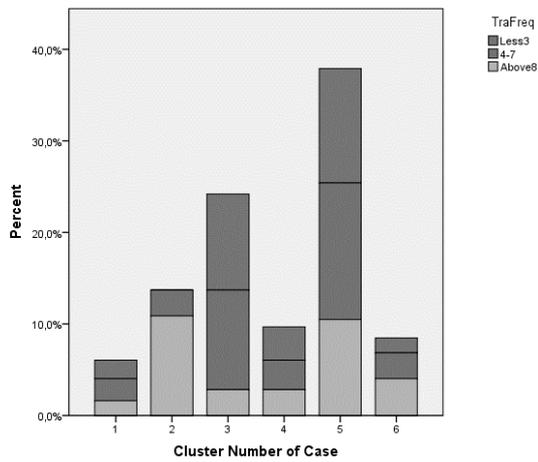


Figure 6.8. Traveling frequency in each cluster

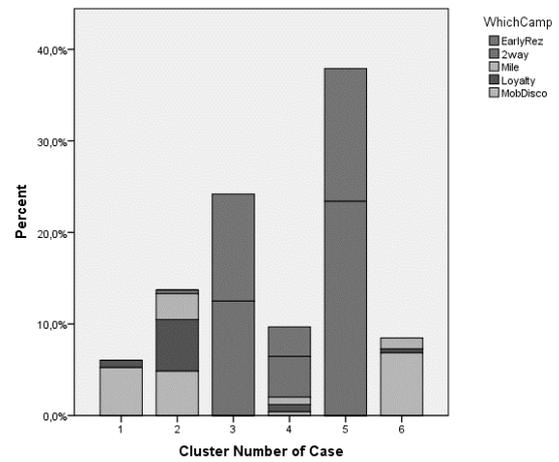


Figure 6.10. Preferred campaigns in each cluster

Internet is the favorite platform that people being aware of the campaigns in each cluster. The second option is from family and friends as seen (Figure 6.9).

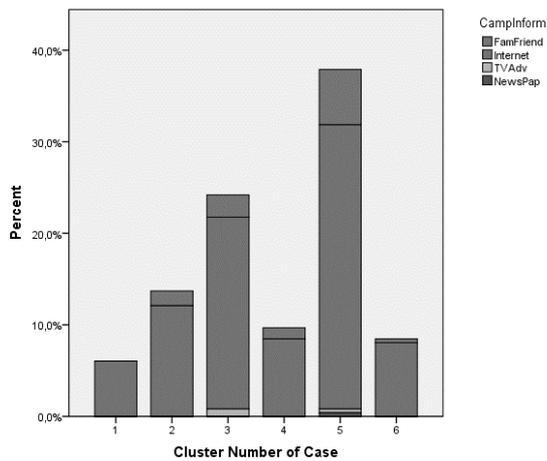


Figure 6.9. Platforms to hear campaigns in each cluster

Late arrive is the basic traveling problem for each of Cluster. Because bus is not preferred in Cluster 4, there is no stop over problem in Cluster 4 (Figure 6.11).

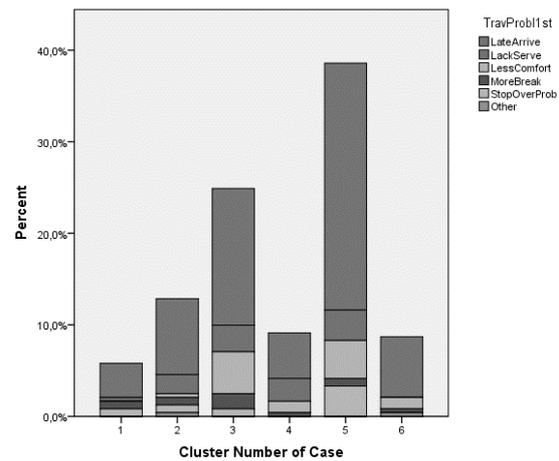


Figure 6.11. Traveling problems in each cluster

Early reservation and 2-way tickets campaigns are equally distributed and fundamental choices for the Cluster 3 and Cluster 5. Most of the people who are at Cluster 3 and Cluster 5 prefer traveling at summer. This means that most of them use plane at summer. Special discounts for mobile application is favorite campaign for Cluster 1, Cluster 2 and Cluster 6 (Figure 6.10).

Buying tickets 0-2 weeks ago, before traveling is the dominant behavior. Ratios of buying tickets above 5 weeks ago are higher in Cluster 3 and Cluster 5. It is connected by early reservation and 2-way tickets campaigns (Figure 6.12).

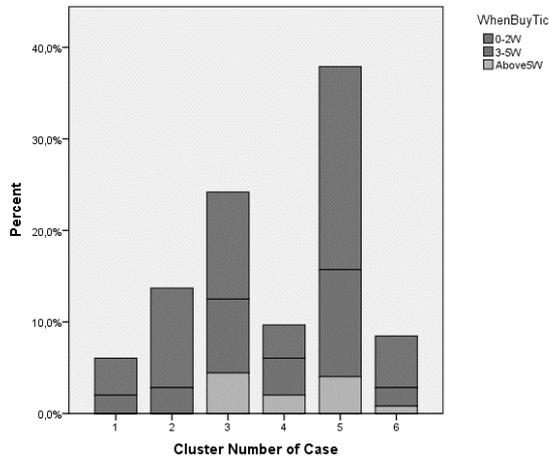


Figure 6.12. Time to buy tickets in each cluster

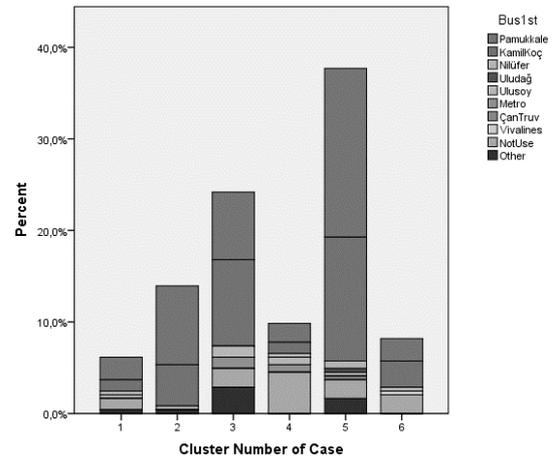


Figure 6.14. Preferred bus companies in each cluster

Turkish Airlines is the favorite airline company for each Cluster. Ratio of people who do not use air plane in Cluster 2 and Cluster 5 is high. Because, Marmara region has the highest ratio at most traveled region chart in Cluster 2 and Cluster 5. There is no any flight from Istanbul to any city which is located at Marmara region (Figure 6.13).

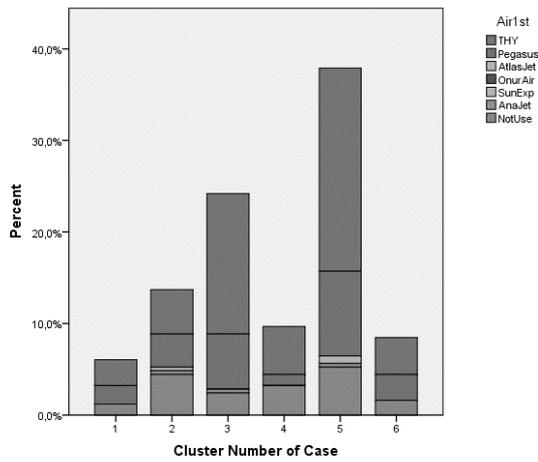


Figure 6.13. Preferred airline companies in each cluster

Pamukkale and Kamil Koç are the dominant bus companies for each Cluster. Çanakkale Truva is widely used in Cluster 4 (Figure 6.14).

As a result of the information obtained from the survey, 72.5% of students buy their tickets from firms' web site. 64% of these students' payment way is cash or remit. Payment by credit card with one installment is preferred payment choice with 68.9% by participants who are using firms' web site, cheap ticket engine or companies' mobile application. Payment by credit card with one installment is the most preferred payment type for all clusters. Cluster 1 has only 15 members. Most of the members are gathered in Cluster 5 with 37.9%. 79.4% of students who are in Cluster 2 travel more than 7 times in a year. No one who uses cheap ticket engine and agency to buy ticket, travel more than 8 time in a year. In Cluster 4, no one prefers bus and plane for the first transportation choice. Marmara and Aegean regions are the most traveled regions for participants who are in Cluster 5 and whose the most demanded transportation mode is bus or plane. Students who are in Cluster 5 do not prefer special discounts for mobile phone campaigns. 67.7% of participants who are in Cluster 5, prefer loyalty and mile campaigns. It is seen that no student who belongs to Cluster 1 uses 2-way and early reservation campaigns. In addition, only one student who belongs to Cluster 2 and use 2-way and early reservation campaigns, prefers bus and plane. 60 people who all of arxe in Cluster 3 and prefer bus or plane for the first traveling mode and use 2-way or early reservation campaigns go to Central Anatolia, Mediterranean, Black Sea or

Eastern Anatolia. The cluster characteristics are provided in (Table 6.1).

7. Conclusion

The starting point of this study was preparing a resource to tourism companies in Turkey with reference to customers that are traveling regularly over the year. In this manner, university students are selected as the framework. Istanbul which includes many universities that have students from every city of Turkey is selected for main working area. Then, students on Marmara University engineering faculty are selected as sample group to application of survey.

The survey was consisting of 26 questions in 8 sections and applied to 260 respondents from Marmara University Engineering Faculty students. The information such as personal information, preferred traveling modes, companies, problems, etc. is collected.

Discrete statistics methods and clustering are applied on the data set in order to group students according to their traveling preferences. Hierarchical Dendrogram, Agglomeration Schedule and K-means algorithm are implemented for clustering purposes.

The discrete statistics methods are resulted with some answers to questions of how students are traveling, where they are going, how they are buying tickets, which campaign types are affecting them, what problems they are facing with, etc. The clustering methods are resulted with 6 clusters which includes engineering students that have more similar characteristics to each other.

After deciding cluster numbers by using agglomeration graph, their characteristics are investigated by examining and deciding dependent and independent variables. Also 50 parent nodes and 10 child nodes are applied in CHAID method on clusters.

When the first traveling mode is taken a dependent variable, it is observed that 66.5% of participants choose bus. 50% of students who are in Cluster 1, Cluster 3, Cluster 6 and whose family income is less

than 2,000 TL choice is bus. In addition, ratio of students who are in Cluster 2 and Cluster 5 pay tickets with credit one is 81.3%. These whose traveled first region is Marmara, Black Sea and Aegean do not prefer train, private car and other.

Moreover, first ticket buying option is selected as a dependent variable, 72.5% of respondents are observed that they prefer firm's website to buy a ticket and among the whose choice is credit install, credit one or other for buying ticket, 74.5% of them prefer web sites. Also these whose first travel preferences are bus, private car or train prefer firm web site as 80.5% to buy a ticket.

Respondent's answer observed that they prefer credit one as 65.9% as a payment choice when payment choice is selected as dependent variable and 68.9% of respondents who use firm website, cheap ticket engine motors or firm's application to find tickets prefer credit one as a payment choice. In cluster 4 and 6, people choices for payment is observed as 89.8% as a favor of credit one and in cluster 2, 5 and 3; credit one has a ratio of 63.3%. Among whose first transportation choice is bus or plane, it is got that none of the respondent's prefer remit EFT or other options than cash, credit one or credit install.

When traveling frequency is selected dependent variable, frequency of between 4 or 7 has a ratio of 38.1%. In cluster 1, 5, 4 and 6; 37.7% of respondents are observed that they travel between 4 or 7 in a year and among whose personal income is between 700 TL and 1500 TL, 42.9% of them travel between 4 or 7. Also people who use cheap ticket engine or agency to buy a ticket travel less than 3 times in year with 72.2%.

Among persons whose first traveling choice is bus or plane, 42.7% of them form cluster 5 when cluster number of case is selected as dependent variable and in cluster 5; 69.5% of respondents is observed that they prefer Marmara or Aegean region for traveling. Also in cluster 3, 72.2% of people prefer Central Anatolia or Mediterranean to travel and among whose first choice is firm web site or agency to buy a ticket consist of 84.6% of cluster 3. 67.7% of respondents are observed that

they prefer current company to travel because of loyalty and mile points. Also in cluster 1, 2, 3, 5 and 6; none of the respondents prefer private car or train as a first choice of transportation. Among whose first choice for transportation is bus or plane in cluster 5, 98.9% of them prefer Marmara or Aegean as a first selected traveling region. 39.5% of people who are in cluster 6 prefer company for mobile discounts and 54.5% of respondents in cluster 5 prefer company because of 2-way tickets and early reservation choices.

The university students consist a major customer group for bus and plane traveling companies who visit hometown frequently. Both type of companies can provide discounts and campaigns for students especially at the beginning, mid and end of semester. Most of the students use internet and mobile applications for ticket purchasing. Apart from these, the companies may keep campaigns through these tools with 2-way tickets, early reservation, loyalty programs, and free traveling with mile. The majority of students whose hometown is far away from İstanbul (Black Sea, Mediterranean, and East Anatolia) use private car. Hence, their choice can be analyzed further. Moreover, as a future work this study can be extended with the application of survey to more students from different universities in Turkey in order to find out different characteristics for the traveling preferences of university students.

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8. References

Açıkalın, S., 2014. Türkiye’de Üniversite Öğrencilerinin Seyahat Türü Tercihlerinin İncelenmesi. *Anadolu Üniversitesi Sosyal Bilimler Dergisi*, 14(3).

Buaphiban, T., & Truong, D., 2017. Evaluation of passengers’ buying behaviors toward low cost carriers in Southeast Asia. *Journal of Air Transport Management*, 59, 124-133.

Celikkol-Kocak, T., Dalkic, G., & Tuydes-Yaman, H., 2017. High-Speed Rail (HSR) Users and Travel

Characteristics in Turkey. *Procedia Engineering*, 187, 212-221.

Chiou Y., Chen Y., 2010. Factors influencing the intentions of passengers regarding full service and low-cost carriers: A note. *Journal of Air Transport Management* 16, 226-228.

De Vos, J., 2018. Do people travel with their preferred travel mode? Analysing the extent of travel satisfaction. *Transportation research part A: policy and practice*, 117, 261-274.

Graham, A., & Metz, D., 2017. Limits to air travel growth: The case of infrequent flyers. *Journal of Air Transport Management*, 62, 109-120.

Giudici, P., & Figini, S., 2009. Applied data mining for business and industry (pp.147-162). Chichester: Wiley.

Katona G., Juhasz J., Lenart B., 2017. Travel based multiroute planning. *20th EURO Working Group on Transportation Meeting*, EWGT 2017, 4-6 September 2017, Budapest Hungary.

Keskin, D., 2007. Üniversite Öğrencilerinin Ulaşım Tercihleri Üzerinde Etkili Olan Faktörlerin Belirlenmesi: Karadeniz Teknik Üniversitesi Örneği. *Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 28.

Koklic, M. K., Kukar-Kinney, M., & Vegelj, S., 2017. An investigation of customer satisfaction with low-cost and full-service airline companies. *Journal of Business Research*, 80, 188-196.

Kouwenhoven, M., & de Jong, G., 2018. Value of travel time as a function of comfort. *Journal of Choice Modelling*, 28, 97-107.

Lin, H. F., & Huang, Y. W., 2015. Factors affecting passenger choice of low-cost carriers: An analytic network process approach. *Tourism Management Perspectives*, 16, 1-10.

Losada N., Alén E., Domínguez T., Juan V., Nicolau L., 2016. Travel frequency of senior tourists.

Lu, J. L., 2017. Segmentation of passengers using full-service and low-cost carriers—Evidence from Taiwan. *Journal of air transport management*, 62, 204-216.

Shields, P. O., 2011. A case for wanderlust: travel behaviors of college students. *Journal of Travel & Tourism Marketing*, 28(4), 369-38.

Slabbert, E., Saayman, M., & Van Der Merwe, P., 2012. Travel behaviour of South African tourism students. *South African Journal for Research in Sport, Physical Education and Recreation*, 34(1), 137-151.

Tomsic M., Sevsek F., Rugels D., 2016. Traveling habits and perceived limitations of older city bus users. *Promet – Traffic & Transportation*, Vol. 29, 2017, No. 4, 425-431.

- Valdes, V., 2015. Determinants of air travel demand in Middle Income Countries. *Journal of Air Transport Management*, **42**, 75-84.
- YAYLALI M., DİLEK Ö., 2017. Havayolu ulaşımında tüketici tercihlerine etki eden faktörlerin belirlenmesi. *Uluslararası Ekonomi, İşletme, Politika Dergisi*, **1(2)**, 75-88.