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STRATEGIC ANALYSIS OF INDIVILDUALS' SMARTPHONE PREFERENCES THROUGH CHAID ALGORITHM

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Abstract

The global smartphone market is one of the most dynamically developing markets with high competition. The presence of high-tech products in the smartphone market forces companies to act more cautiously and strategically. The success of companies depends on their level of meeting the demands of smartphone users. To this end, this study aims to determine the factors that are affected by the smartphone preferences of individuals and the effect level of these factors on company strategies. For this purpose, in this study, a survey was conducted in the TRA2 Region located in the east of Turkey. The obtained data from the survey was evaluated using the CHAID algorithm. In the study, it was seen that smartphone users liked the Apple the most in terms of perceived service quality. In addition, it has been observed that the highest level of expectation in terms of expected service quality is concentrated on the Apple brand. On the other hand, the most preferred Xiaomi was found to have the lowest brand loyalty.

Keywords: *Apple, CHAID Algorithm, Smartphone, The Global Smartphone Market.*
JEL Classification: *C38, C83,D12,D22,M21*

CHAID ALGORİTMASI İLE BİREYLERİN AKILLI TELEFON TERCİHLERİNİN STRATEJİK OLARAK İNCELENMESİ

Öz

Küresel akıllı telefon piyasası, yüksek düzeyde rekabetin olduğu en dinamik gelişen pazarlardan biridir. Akıllı telefon piyasasında yüksek teknoloji ürünlerinin yer alması, firmaları daha temkinli ve stratejik hareket etmeye zorlamaktadır. Firmaların başarılı olmaları, akıllı telefon kullanıcılarının taleplerini karşılama düzeylerine bağlıdır. Bu çalışmada, bireylerin akıllı telefon tercihlerinde hangi faktörlerden etkilendiği ve bu faktörlerin firma stratejilerine etki düzeyinin ne olabileceğinin tespit edilmesi amaçlanmıştır. Bu amaç doğrultusunda TRA2 Bölgesi'nde bir anket yapılmıştır. Anketlerden elde edilen veriler, CHAID algoritması kullanılarak değerlendirilmiştir. Çalışmada, akıllı telefon kullanıcılarının algılanan hizmet kalitesi bakımından en çok Apple'ı beğendikleri görülmüştür. Ayrıca beklenen hizmet kalitesi bakımından da en yüksek beklenti düzeyinin Apple markası üzerinde yoğunlaştığı gözlemlenmiştir. Diğer yandan ençok tercih edilen Xiaomi'nin en düşük marka sadakatine sahip olduğu tespit edilmiştir.

Anahtar Kelimeler: *Apple, Akıllı Telefon, CHAID Algoritması, Küresel Akıllı Telefon Piyasası*
JEL Sınıflandırması: *C38, C83,D12,D22,M21*

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1. Introduction

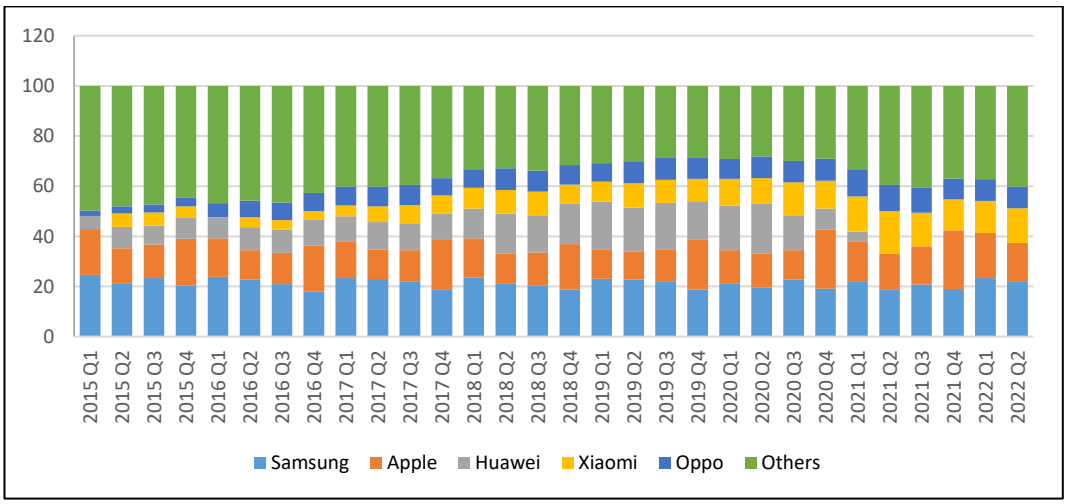
Smartphones, a product of advanced technology, have components such as a processor, display panels, cameras, memory, and battery. They perform functions such as taking pictures and videos, editing documents, providing telecommunication services, and listening to music. These devices also provide e-mail, video calls, information search, product buying and selling, service reservation, and location-based services with an internet connection (J. Park & Han, 2013; Liao & Hsieh, 2013; Filieri & Lin, 2017; N. Park, Kim, Shon, & Shim, 2013).

Smartphones are becoming an integral part of the daily life of consumers in both developed and developing countries. In many countries, especially the use of smartphones exceeds the time spent on computers and the Internet (Filieri & Lin, 2017). The smartphone market share is also expanding rapidly worldwide, and it is expected that 5.9 billion people will own a smartphone by 2025 (J. Kim, Lee, & Lee, 2020).

The smartphone market has witnessed great struggles in the last decades due to the expansion of the smartphone industry and the increase in competitiveness. Besides, there have been significant player changes in the smartphone market, especially between 2010 and 2012. In this period, smartphone brands such as Nokia, HTC, and Sony have been relatively withdrawn from the market, and world giants such as Samsung, Apple, and Huawei, which became more influential and are expected to engage in great challenges in the future, have become more popular.

Apple, one of the most important players in the smartphone market, captured the highest market share in the second quarter of 2011 and rose to first place. However, Apple's first place ended when Samsung captured a market share of 28.8% in the first quarter of 2012. In the following periods, Samsung has always been in first place. On the other hand, Huawei, an important competitor against Samsung and Apple, started to make itself felt in the world market in 2012 and entered the smartphone trade war by capturing a market share of 8.6% in the second quarter of 2015. In addition to Huawei, Xiaomi and Oppo, two important Chinese smartphone brands, also joined the smartphone trade war in this period (Statista, 2022).

Figure 1: **Distribution of Market Shares of Companies in the Global Smartphone Market**

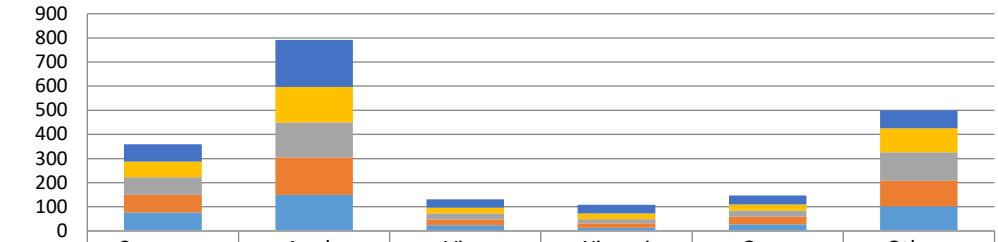


Source: Statista, 2022.

Figure 1 shows the distribution of market shares of companies in the global smartphone market in the period 2015 Q1-2022 Q2. In the context of these data, in the second quarter of 2015, Samsung has a share of 21.3%, Apple comes with a rate of 13.9%, Huawei with 8.6%, Xiaomi with 5.3%, Oppo with 2.8%, and other small smartphone brands with 48.1%. Until the

second quarter of 2022, there were severe fluctuations in the market shares of other smartphone brands except for Samsung. By increasing its market share quickly, Huawei took second place from Apple in the second half of 2018 and almost always occupied second place until the last quarter of 2020. On the other hand, due to the increase in market shares of Xiaomi and Oppo in the 2019 Q1-2020 Q3 period, Chinese smartphone brands reached the highest market shares in the world market. However, the US-China trade war, which started in 2018 and where the highest tariffs were applied by 2020, caused Huawei to lose its market share and leave the second place to Apple. Xiaomi and Oppo, on the other hand, managed to maintain their relative market shares in this process. However, as a result of Huawei's failure in the smartphone trade war, the Apple managed to reach the highest market shares in its history. On the other hand, Samsung managed to come to the present day without breaking the average 20% trend.

Figure 2: **Annual Revenue Distribution of Companies in the Global Smartphone Market (Billion Dollars)**



	Samsung	Apple	Vivo	Xiaomi	Oppo	Others
2021	72	196	34	36	37	73
2020	64	146	24	24	25	99
2019	73	145	25	18	26	118
2018	74	156	25	18	31	106
2017	76	149	23	13	28	102

Source: Counterpoint, 2022).

Figure 2 shows the cumulative annual revenue distribution of firms in the global smartphone market. In the light of this data, it is observed that Apple has the highest share between 2017-2021. In second place are other companies with small market shares. It is particularly remarkable that Samsung has a large market share compared to Apple, and although it generally maintains its market share, it does not even reach almost half of Apple's annual revenue. The biggest reason for this is that both Apple smartphones are more expensive than other brands, and the income level of the consumer group addressed by the Apple market share is high. On the other hand, while China's big three have increased their annual revenues by around 67% over the last five years, Apple has increased by around 31%. Moreover, Samsung has not increased its annual revenue in the last five years, while other smaller smartphone companies have seen their annual revenue decline by approximately 28%. Given all these results, it can be said that the trade war between smartphone companies is very contentious.

Today, smartphones are regarded as indispensable products for most individuals at all levels, regardless of gender, age, occupation, and education (Persaud & Azhar, 2012). This case causes the demand for smartphones to continually increase, and the competition between giant companies intensifies. To increase their market share and maintain their success, companies need to make the best use of the opportunities they find in the global market and eliminate the threats they face, which is only possible with a correct strategy (Polat & Akan, 2020). In particular, a good strategy for smartphone brands depends on knowing the level of satisfaction that individuals have with the smartphones they use and the service quality they perceive from smartphones. In addition, it is of great importance for individuals to learn the service quality they

expect from smartphones and to analyze their smartphone brand preferences well. Considering that Turkey ranks fourteenth in the global smartphone market with 62.5 million users and that smartphone models are constantly being renewed and the demand for them continues to increase, it is seen that Turkey has an important place in the smartphone market. In this context, it can be considered that studies to be conducted in Turkey will be of great importance. In this study, it is aimed to determine the service quality that individuals perceive and expect from smartphones, what are the main factors in smartphone brand preferences and how these factors will affect firm strategies. For this purpose, a survey was conducted on university employees and students in the TRA2 Region. The data obtained from the surveys were evaluated within the framework of two decision trees using the CHAID algorithm.

2. Literature Review

Various national and international studies were carried out related to the smartphone market. A summary of some of these studies, which are thought to contribute to our study, is presented below under three headings.

2.1. Perceived Service Quality

Perceived quality is defined as customers' perception of the overall quality or superiority of a product or service relative to relevant alternatives and its intended purpose (Shrestha, Kadel, & Mishra, 2023). At the same time, the perceived service quality of smartphone brands is a dimension of brand equity that helps smartphone marketing. However, the perceived service quality of smartphone brands is not the tangible quality of smartphones. Because perceived service quality is influenced by various factors such as demographic characteristics, cognitive emotions, psychographic characteristics and emotional factors (J. Yoo, 2020). In the studies, it has been observed that factors such as memory capacity, camera quality, portability, screen size, design feature, color matching, dust and water resistance, ram and processor feature, fast charging feature, battery durability, connection, and speed performance are effective on the perceived service quality of smartphones (Polat ve Akan, 2020; Salim, 2022; Varun Kiran, 2022). In addition, Jaisinghani (2017) identified four main factors affecting individuals' perceived smartphone service quality. These factors are named as aesthetic appeal, economy, elitism and add-ons, respectively. In particular, Gallart-Camahort, Fiol and García (2023) observed that the perceived service quality of smartphone brands has a significant effect on individuals' purchase intention.

2.2. Expected Service Quality and Preference

Brand preference is one of the most important marketing measures of a brand's strength in the market (Rajagopal, 2010). Maheswari (2015) observed that factors such as advertising, appearance, brand image and friend recommendation are important factors in smartphone brand preference. In their study, Ting et al. (2011) found that factors such as social needs, social influences, ease of use and convenience have a positive effect on the smartphone purchase behavior of university students in Malaysia. Liu and Liang (2014) observed in their study that 71% of the participants were willing to spend more money to buy their favorite smartphone. They also stated that the logo of the brand is the most important criterion when individuals buy smartphones and that the amount of product sales largely depends on the brand. In their study, Filieri and Lin (2017) examined the repurchase behavior of young Chinese consumers for smartphone brands. In the study, it was emphasized that China is the world's largest smartphone consumer market and Chinese consumers' repeat purchase of smartphone brands is of great importance for smartphone companies. As a result, it is observed that brand popularity, design appeal, and perceived quality have a significant impact on young Chinese consumers' repurchase behavior.

Kim et al. (2015) tested the relationship between the socio-demographic characteristics of individuals in South Korea and their use of smartphones and smartphone applications. In general, it was observed that there was a significant relationship between socio-demographic characteristics and the use of smartphones and smartphone applications. In particular, it has been observed that young, educated, and high-income individuals prefer smartphones and smartphone applications more. Taner (2013) concluded that individuals' smartphone preferences in Kastamonu are determined according to the criteria of social need, social pressure, and making life easier.

Oh and Park (2020) observed that smartphone users are influenced by both the media and peers when they decide to replace their smartphones. They also stated that the multifaceted nature of smartphone users' smartphone replacement and behavioral intentions increases competition among smartphone companies and triggers sustainable growth in the market. As seen in the studies, it is understood that many factors determine the service quality that individuals expect from companies and that these factors vary according to socio-demographic characteristics.

2.3. Brand Equity and Competition

The widespread use of smartphones among people around the world has led to the entry of many new companies into the smartphone market. This situation causes the competition between companies in the smartphone market to intensify. In addition, the increase in smartphone manufacturers gives smartphone users the opportunity to choose many brands (Shrestha et al., 2023). In a competitive environment, brand equity is one of the most important factors that make companies successful. Brand equity is related to the emergence of different, interrelated, and continuous marketing results of a product or service (Keller, 1993). In other words, brand equity refers to the increased utility and value provided by the brand name of a product. Brand equity gives a firm a sustainable competitive advantage and marketing success (B. Yoo & Donthu, 2001). Competing and sustaining success is only possible with a good strategy.

Cecere et al. (2015) observed that firms in the smartphone market, especially Samsung and Apple, pursue very different innovation strategies and within this framework, they resort to product differentiation. On the other hand, it has been observed that product differentiation characterizes competition and no dominant design emerges in the products. It is also stated that the smartphone market is largely innovative in terms of new product introductions and design diversity, which makes the competition more fierce every day.

Neto et al. (2017) analyzed three smartphone brands (Apple, Nokia and Samsung) in an incomplete information dynamic game framework by pairing them sequentially. In the study, first Apple-Nokia and then Apple-Samsung were paired and Bayesian Nash equilibrium was found for both games respectively. Comparing both dynamic games, it was found that Samsung was more successful than Nokia against Apple's aggressive innovation strategies. It is also concluded that survival in the smartphone industry depends on adopting innovative strategies. In Huang and Jitphrasong's (2017) study, it is stated that the mobile communication industry in China is developing rapidly and China is the largest smartphone market in the world with 900 million smartphone users. In addition, the study emphasizes that Xiaomi has achieved great success with its excellent marketing strategy and has achieved a rapid rise. On the other hand, six important strategies were emphasized in the study by identifying Xiaomi's strengths, weaknesses, threats, and opportunities. These are respectively, product, price, advertising, distribution, channel, and promotion strategies. In this context, it is concluded that Xiaomi is successful in its strategies and this success sets an example for other domestic companies.

Ersöz et al. (2017) found that the most effective first factor in individuals' smartphone preferences is price and the second factor is memory capacity. Doğan et al. (2015) evaluated firm strategies using zero-sum and non-zero-sum games. The study concluded that Samsung should

improve its prices and promotions and Apple should improve its hardware features. Polat and Akan (2020) analyze the competition between İPhone, Samsung, and Huawei, which are the leading brands in the smartphone market, using game theory methods. In this study, in which zero-sum and non-zero-sum games are used, the best strategies of the opponents against each other are determined. According to the zero-sum game results, it is observed that İPhone and Huawei meet the expectations in terms of external appearance, and technical and hardware features, while Samsung meets the expectations only in terms of external appearance features. On the other hand, it is reported that not all smartphone brands meet expectations in terms of prices and campaigns. According to the non-zero-sum game results, it has been determined that Samsung's best strategy against İPhone and Huawei is appearance, and İPhone's best move against Samsung and Huawei is technical features. In addition, it has been reported that Huawei's best response strategy against İPhone and Samsung is the outer design strategy.

Karlıdağ (2017) discusses the patent wars and intellectual property rights of smartphone companies in their study. The research emphasizes that patents should be a tool that provides the development of science and technology by rewarding innovations. However, it has been highlighted in the smartphone market that patents are used to seize the market and even exclude rival companies from the game. It has also been argued that patents are a tool used to reinforce US hegemony, especially in the smartphone market. The study also reported that the İPhone attaches different consumer groups with its operating system and applications.

The study by Fan and Yang (2020), it is aimed to determine how the oligopolistic structure of the smartphone market affects the smartphone market in the USA. For this purpose, a model is developed for the supply and demand of smartphones, and some predictions were made. In the study, it is concluded that the product variety in the US smartphone market is low, and this situation reduces the competitive fever between the companies. In addition, in the study, it is concluded that the decrease in competition between companies reduces both the number and variety of products and the total welfare.

Tabassum and Ahmed (2020) focus on Xiaomi's position in the Indian smartphone market in their study. The study uses the SWOT analysis, and it is especially emphasized that Xiaomi produces low-cost but high-featured smartphones. On the other hand, it was concluded that Xiaomi, which ranks first in the Indian smartphone market, should focus on improving its product quality, advertising and distribution network in order to be even more successful in an increasingly fierce competitive environment. Besides, it is underlined that Xiaomi is likely to be a game changer in the smartphone market shortly, thanks to its innovative strategies.

In the literature, the global smartphone market has been analyzed on both brand and consumer basis. In the studies where many different analysis methods are used, it is seen that macroeconomic data are also used along with the data obtained from surveys. It is observed that very important results are obtained in studies using different methods. Looking at the studies as a whole, it is seen that the smartphone market will expand further and competition will intensify. In addition, it is revealed that smartphone users do not pity brands with poor perceived and expected service quality in the smartphone market. The only way for smartphone brands to survive and compete is to respond to the demands of smartphone users in the best way possible. This is evidenced by the fact that smartphone brands that fail to do so are erased from the smartphone market.

It is understood that the smartphone market, which has been closely followed by the society and occupies an important place in the world trade especially since 2008, will be the subject of many studies. Contrary to the studies in the literature, in this study, individuals' smartphone brand preferences are examined in the context of many factors. On the one hand, the service quality that individuals perceive from the smartphones they use and on the other hand, individuals' smartphone expectations are discussed on the basis of brand. In this context, the

factors affecting individuals' smartphone preferences are strategically analyzed on the basis of brand.

3. Methodology

In this part of the study, the purpose, significance, scope, sample of the research, the methods used in the research, and the means of the data are discussed.

3.1. Purpose and Significance of the Research

The smartphone market has a significant market share in global trade. According to the report published by Fortune Business Insights in 2022, the size of the global smartphone market is estimated to increase to 457.18 billion dollars in 2021, 488 billion dollars in 2022, and 792.51 billion dollars by 2029 (Fortune Business Insights, 2022). The smartphone market is an excellent strategy battleground where competition is fiercely increasing, and companies that cannot keep up with it are doomed to disappear from the market. In this market, smartphone companies are producing smartphones, which are the most important and most prevalent needs of the world's population, keeping up with the needs of rapidly changing smartphone users. Considering the last two decades, various companies have disappeared from the global smartphone market and been replaced by new ones.

On the other hand, the report published by Newzoo in 2022 stated that there are 62.5 million smartphone users in Turkiye. This report shows that the country has an essential place in the global smartphone market (Nezoo, 2023). Hence, this study aims to determine the factors that affect the smartphone preferences of individuals in Turkiye and the effect level of these factors on company strategies. For the study, an empirical application was made on the smartphone preferences of the students studying at the universities in the TRA2 Region and the academic and administrative staff working there. The fact that no study has been conducted with this method and framework on the smartphone market so far makes this study unique.

3.2. Scope, Sample, and Method of the Research

Survey data was used in the study. In the questionnaire, six questions were included to determine the smartphone preferences and demographics of the participants. Additionally, two scales consisting of 15 questions were included to test the service quality perceived and expected by the participants from smartphone brands (Doğan et al., 2015; Polat & Akan, 2020). The students studying at the universities in the TRA2 Region and the academic and administrative staff working in these universities were determined as the research population. On the other hand, the sample set was 972 participants with a 97% confidence level and a 3% margin of error (p=0.25). However, within the scope of the research, 1,100 questionnaires were collected from the population, and 97 of these questionnaires were eliminated since they did not meet the standards. As a result, 1,003 survey data were used in the study. The data obtained in the study were evaluated with two different decision trees using the CHAID algorithm.

3.3. CHAID Algorithm

The CHAID algorithm is one of the oldest classification methods developed by Kass (1980). It is a decision tree modeling method which means Chi-square automatic interaction detection(Antipov & Pokryshevskaya, 2010). This algorithm is a highly reliable and widely used method. CHAID algorithm decision tree analysis is an advanced statistical method that details the e-effect relationship between dependent and independent variables (Şata, 2018). Unlike regression analysis, non-parametric CHAID does not require distribution assumptions such as normality and linearity (Hébert, Collin-Vézina, Daigneault, Parent, & Tremblay, 2006). It is a suitable method for nominal, sequential, and continuous data. The algorithm acts according to the merge, split, and stop steps in the decision tree creation process (Akin, Eyduran, & Reed, 2017).

The decision tree is one of the most used data mining approaches for classification and prediction since it is easy to interpret and understand (Chien & Chen, 2008; Karadas & Kadırhanogullari, 2017). A decision tree is a method that consists of roots, branches, and leaves and divides the data into subgroups as it goes from top to bottom. The decision tree consists of the root, parent, child, and terminal nodes. While the dependent variable is located at the root node, the independent variables are located at other nodes (Rashidi, Ranjitkar, & Hadas, 2014; Akin et al., 2017).

The CHAID algorithm uses the Chi-Square test, which allows more than two splits in the decision tree and helps determine the best split at each stage (Nisbet, Miner, & Yale, 2018; Ercan & Irmak, 2017). In the decision tree obtained by the CHAID algorithm, the number of independent variable categories depends on whether the Chi-square test result is significant or not. The most important independent variable in the resulting tree is located at the parent's node. In the decision tree, when there is no significant relationship between the dependent and independent variables, the node ends, and this node becomes the terminal node (Chung, Oh, Kim, & Han, 2004; S. S. Kim, Timothy, & Hwang, 2011). As a result, the decision tree obtained by the CHAID algorithm is interpreted as a whole in the context of the independent variables branching from the top node to the terminal node under the dependent variable.

After the decision tree is obtained, the overall accuracy value of the CHAID classification analysis is checked. The following table and formula are used to calculate this value (Kadirhanoğulları, Konu Kadirhanoğulları, Kara, & Kumlay, 2021; Bilgin, 2021):

Table 1: **Criteria Used in the Evaluation of Tests**

Test Result	(+)	(-)	Total
Test (+)	a(TP)	b(FN)	a+b
Test (-)	c(FP)	d(TN)	c+d
Total	a+c	b+d	a+b+c+d

TP: True positive; FP: False positive; FN: False negative; TN: True negative.

$$\text{Accuracy (\%)} = \frac{TP+TN}{TN+TP+FN+FP} * 100$$

4. Data Analysis And Findings

In the study, first of all, the reliability analysis of the scales was conducted. In Table 2, Cronbach's Alpha coefficient values of four factors of perceived service quality of smartphones are given. In light of these values, it was determined that the cost and equipment factor is quite reliable, and the external appearance and technical features factors are highly reliable. On the other hand, Cronbach's Alpha coefficient values for the four factors of expected service quality of smartphones are given in Table 3. In the context of these values, it was found that the cost and appearance factors are quite reliable, and the hardware and technical features factors are highly reliable(Del Rosario & White, 2005).

Table 2 shows the distribution of perceived service values of smartphone users by smartphone brands. The data in the table suggest that Apple is in the first place, followed by Xiaomi and Samsung in terms of appearance factor. In particular, it is observed that the Apple is very good in terms of color harmony. In terms of technical features, it is observed that Apple is the first, followed by Xiaomi and Samsung. However, all brands are relatively weak in terms of water and dust resistance, RAM, processor, and memory performance, and Apple is slightly better than other brands. Additionally, other smartphone brands are not very good in terms of water and dust resistance.

Looking at the hardware features of smartphone brands, users suggest that Xiaomi is the best brand, and the weakest brand is Apple and Huawei in terms of fast charging. In terms of battery durability, the best brand is Xiaomi, and Apple, Samsung, and Huawei are relatively less favored. It is seen that the lowest level of satisfaction for smartphone brands is due to smartphone prices.

It is observed that the Apple, which has a high level of satisfaction in terms of many features, has the lowest satisfaction level in terms of price. Besides, the lowest satisfaction in perceived service quality is due to the campaign and promotion strategies of the companies.

Table 2: **The Quality of Service Perceived by Smartphone Users from their Existing Smartphones**

	Items	*Mean*	*Apple*	*Samsung*	*Huawei*	*Xiaomi*	*Other Brands*	*Cronbach's Alpha*
Appearance	What is the screen size of your smartphone?	3.84	4.01	3.70	3.35	4.00	3.67	0.804
	What is the design feature of your smartphone?	3.74	4.21	3.56	3.49	3.75	3.58	
	How is the color harmony of your smartphone?	3.94	4.33	3.80	3.88	3.90	3.81	
Technical	What is the screen resolution of your smartphone?	3.77	4.21	3.64	3.37	3.78	3.57	0.891
	What is the front camera resolution of your smartphone?	3.50	4.09	3.26	3.16	3.45	3.37	
	What is the rear camera resolution of your smartphone?	3.68	4.29	3.43	3.41	3.67	3.50	
	What is the fast-charging feature of your smartphone?	3.13	3.56	3.02	3.07	3.10	2.89	
	What is the battery durability of your smartphone?	3.49	3.64	3.23	3.16	3.70	3.44	
Hardware	What is the dust and water resistance of your smartphone?	3.59	3.99	3.33	3.26	3.69	3.47	0.776
	What is the memory performance of your smartphone?	3.74	3.66	3.50	3.62	3.99	3.79	
	What is the RAM and processor performance of your smartphone?	3.57	3.40	3.36	3.30	3.81	3.70	
	What is the connection and speed performance of your smartphone?	3.58	4.02	3.39	3.33	3.59	3.44	
	What is the video recording and playback performance of your smartphone?	3.61	4.07	3.44	3.26	3.61	3.47	
Price	What is the price level of your smartphone?	3.21	3.08	3.15	3.32	3.30	3.22	0.685
	What is the promotions and campaigns of your smartphone?	2.88	2.84	2.84	2.92	2.89	2.96	

Table 3 presents data on the quality of service that smartphone users expect from smartphone brands. In light of these data, the highest expectation is expected from the Apple brand in terms of the appearance features factor. Besides, smartphone users especially have very high expectations from the design features of the Apple brand. On the other hand, it is observed that users have the lowest expectations from Huawei and other smartphone brands in terms of appearance features. Moreover, smartphone users have high expectations from all smartphone brands in terms of technical features. In particular, users of smartphones want their smartphones to have a large memory and perform well. Besides, users who want to buy phones from other smartphone brands have relatively lower expectations of these smartphones.

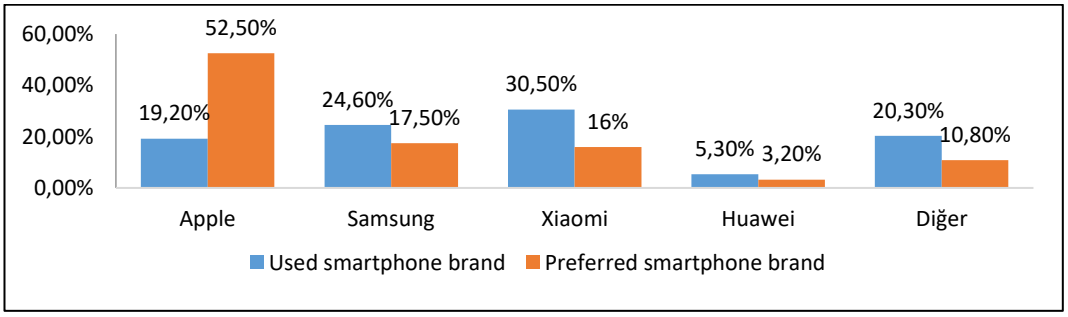
In terms of hardware features, smartphone users have high expectations from all brands, and they have even higher expectations from Apples. It is also observed that smartphone users mostly want their smartphones to be highly resistant to water and dust in terms of hardware features. On the other hand, the users express that phone prices are of high importance when buying a new phone. However, the campaign and promotion expectations are relatively low.

Table 3: **The Quality of Service that Smartphone Users Expect from Smartphone Brands**

	Items	*Mean*	*Apple*	*Samsung*	*Huawei*	*Xiaomi*	*Other Brands*	*Cronbach's Alpha*
Appearance	How important is screen size to you when buying a new smartphone?	4.09	4.13	4.14	3.75	4.07	3.92	0.727
	How important is the design for you when buying a new smartphone?	4.22	4.33	4.18	3.96	4.12	3.91	
	How important is color harmony to you when buying a new smartphone?	3.99	4.11	3.98	3.62	3.89	3.68	
Technical	How important is screen resolution to you when buying a new smartphone?	4.47	4.49	4.40	4.40	4.50	4.40	0.864
	How important is front camera resolution to you when buying a new smartphone?	4.49	4.57	4.40	4.50	4.46	4.30	
	How important is the rear camera resolution for you when buying a new smartphone?	4.58	4.64	4.48	4.59	4.60	4.38	
	How important is fast charging for you when buying a new smartphone?	4.57	4.64	4.39	4.65	4.56	4.49	
	How important is battery durability for you when buying a new smartphone?	4.64	4.70	4.51	4.71	4.68	4.49	
	How important is the resistance to dust and water when buying a new smartphone?	4.56	4.65	4.37	4.62	4.57	4.35	
	How important is memory performance to you when buying a new smartphone?	4.61	4.66	4.58	4.59	4.63	4.39	
Hardware	How important are RAM and processor performance to you when buying a new smartphone?	4.72	4.76	4.65	4.84	4.71	4.62	0.835
	How important is connection and speed performance to you when buying a new smartphone?	4.63	4.73	4.52	4.53	4.60	4.43	
	How important is video recording and playback performance to you when buying a new smartphone?	4.55	4.65	4.39	4.37	4.45	4.52	
Price	How important is the price level to you when buying a new smartphone?	4.46	4.43	4.46	4.46	4.60	4.37	0.651
	How important is the promotions and campaigns to you when buying a new smartphone?	4.08	4.12	3.95	4.25	4.21	3.91	

In Figure 3, the distribution of smartphone brands that smartphone users use and the brands they would prefer if they buy a new smartphone is given.

Figure 3: **Distribution of Smartphone Brands that Smartphone Users Are Using and Considering Buying when They Decide to Buy a New Smartphone**



Based on these data, 19.20% of 1003 smartphone users use Apple, 24.60% Samsung, 30.50% Xiaomi, 5.30% Huawei, and 20.30% other brand smartphones. On the other hand, it is seen that if smartphone users bought a new smartphone, 52.50% would buy Apple, 17.50% Samsung, 16% Xiaomi, 3.20% Huawei, and 10.80% other brand smartphones.

Table 4 shows the distribution of smartphone brands that smartphone users use and that they think to buy when they decide to buy a new smartphone according to some variables. In the study, it was seen that both the distribution of the smartphone brands they use and the smartphone brands they consider to buy when they decide to buy a new smartphone have a significant difference based on four independent variables. Considering the gender variable, Xiaomi brand smartphones are primarily used. In the case of purchasing a new smartphone, it is suggested that both male and female participants will mostly prefer the Apple brand.

Table 4: **Distribution of Smartphone Brands According to Some Variables that Smartphone Users Are Using and Considering Buying When They Decide to Buy a New Smartphone**

		Apple		*Samsung*		*Huawei*		*Xiaomi*		*Other*		*Analy.*	
	Variables	*Current*	*New Preference*	*Current*	*New Preference*	*Current*	*New Preference*	*Current*	*New Preference*	*Current*	*New Preference*	*Pearson Chi-Square*	
Gender	**Male**	116	253	123	95	18	8	168	106	86	49	20.946*	27.426**
	Female	77	274	124	81	35	24	138	54	118	59		
Status	**Academic Staff**	50	48	71	54	9	9	32	49	26	28	108.321*	119.025**
	Administrative Staff	22	40	50	31	4	2	14	27	23	13		
	Associate Degree Student	65	251	72	52	23	16	156	58	103	42		
	Undergraduate Student	44	162	50	38	16	5	98	26	46	23		
	Graduate Student	12	26	4	1	1	0	6	0	6	2		
Income	**Less than 2.000₺**	71	324	105	75	29	15	202	57	113	49	109.339*	89.458**
	2.001₺-5.000₺	18	42	10	8	4	3	15	10	22	6		
	5.001₺-10.000₺	21	47	6	7	5	3	31	10	14	10		
	10.001₺-20.000₺	54	70	68	47	13	10	36	51	37	30		
	More than 20.000₺	29	44	58	39	2	1	22	32	18	13		
Age	**Less than 25**	107	408	115	86	35	16	241	70	146	64	86.210*	114.446**
	25-30	12	27	13	10	5	2	17	11	9	6		
	31-40	21	28	37	19	5	9	21	32	17	13		
	More than 40	53	64	82	61	8	5	27	47	32	25		
	Total	193	527	247	176	53	32	306	160	204	108		

* Pearson Chi-Square value in the current smartphone context (p<0,000).

** Pearson Chi-Square value in the context of new smartphone preference (p<0,000).

When examined in the context of the status variable, associate and undergraduate students use the Xiaomi brand the most, while the academic and administrative staff use the Samsung brand the most. In the case of purchasing a new smartphone, it is observed that administrative staff and student groups will most likely prefer an Apple. Unlike other groups, academic staff

does not seem to have a serious change in their preferences if they buy a new smartphone. It is observed that only Samsung smartphone users will mainly prefer the Xiaomi brand in this case.

In the context of the income variable, the participants whose income is less than 2.000₺ mostly use the Xiaomi smartphone brand. It is observed that the participants with an income level of more than 20,000₺ mostly use Samsung and, respectively, Apple and Xiaomi. On the other hand, if a new smartphone is purchased, all income groups will most likely prefer the Apple, and especially participants with an income level of less than 2.000₺ will prefer the Apple at a high level. When examined in terms of the age variable, the participants under 25 use Xiaomi the most, while those over 30 use Samsung. On the other hand, when purchasing a new smartphone, results similar to the income variable was obtained.

In the study, two decision trees were obtained in the first stage. In the first decision tree, new smartphone preference was taken as dependent; current smartphone ownership, status, gender, age, and monthly income level were considered independent variables. In this decision tree model, CHAID, Exhaustive CHAID, CRT, and QUEST algorithms were tested, respectively, and the first decision tree was created using the CHAID algorithm, which gives the highest accuracy among these algorithms. Besides, the accuracy value of the decision tree was found to be 91.5%. The first decision tree obtained within the scope of the study is given in Figure 4. The resulting decision tree consists of 21 nodes, 13 terminal points, and three depths. At the main node of the decision tree, there is the new smartphone preferences dependent variable. On the other hand, the first branching independent variable under the decision tree was the current smartphone preferences (X^2= 261; p=0,000). In other words, the most important variable that determines the preferences of smartphone users when they buy a new smartphone is their current smartphone.

In the decision tree, it is observed that five nodes emerge under current smartphone ownership. Looking at the Apple node first, 19.2% (193) of current smartphone users are using Apple. It is observed that 81.3% (157) of Apple users state that they will use Apple again if they choose a new smartphone. In this case, the Apple brand holds a high level among its users. 6.2% (12) of the remaining Apple users prefer Samsung, 1% (2) Huawei, 7.8% (15) Xiaomi, and 3.6% (7) other smartphone brands. They seem to have declared that they will. Moreover, it was observed that the status variable branched under the Apple node (X^2= 25,617; p=0,001). In this branch, it was determined that the first root consists of academic staff, and the second root consists of administrative staff and student groups. When the roots are examined in order, in the first root, it is seen that 60% (30) of the academicians who used Apple before will still prefer Apple, and in the second root, 88.8% of the administrative staff and student groups using Apple will still prefer Apple. In this case, it can be said that the Apple is more popular among administrative staff and student groups.

When the Samsung node is examined, it is seen that 24.6% (247) of the smartphone users are Samsung smartphone users. If Samsung smartphone users buy a new phone, it is observed that 39.7% (98) will prefer Apple, 36.8% (91) will prefer Samsung again, 1.6% (4) Huawei, 11.7% (29) Xiaomi, and 10.1% (25) will prefer other smartphone brands. Considering the new phone preferences of Samsung smartphone users, Samsung has a retention of only 36.8% of its users, and Samsung users will tend to the Apple brand at a high rate. On the other hand, it was determined that the monthly income level independent variable branches under the Samsung node (X^2= 54,150; p=0,000). Besides, three nodes were formed under the monthly income variable. When the nodes are examined respectively, it is seen that 59% of Samsung smartphone users with a monthly income of less than 2000 and 2000 will prefer Apple, and 23.8% will prefer Samsung. At the same time, considering that those with an income level of less than 2000₺ are university students, it can be concluded that university Samsung users will prefer Apple at a high rate despite their low-income level. On the other hand, Samsung users with high income, that is, academic and administrative staff will still prefer Samsung with almost 50% of their new smartphone preferences.

Figure 4: **Decision Tree Obtained in the Context of New Smartphone Preferences Dependent Variable and Current Smartphone Ownership, Status, Gender, Age, and Monthly Income Level Independent Variables**

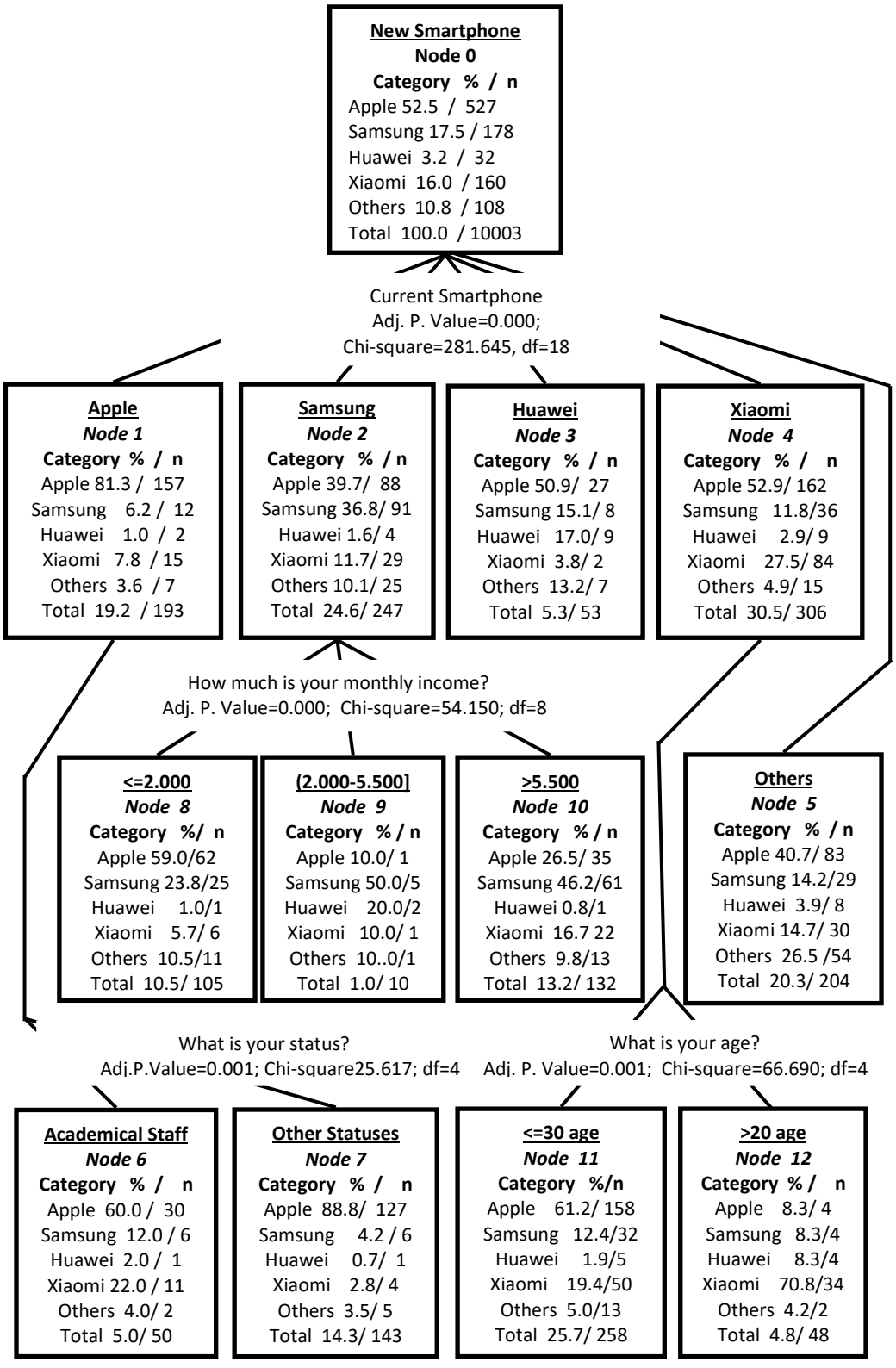
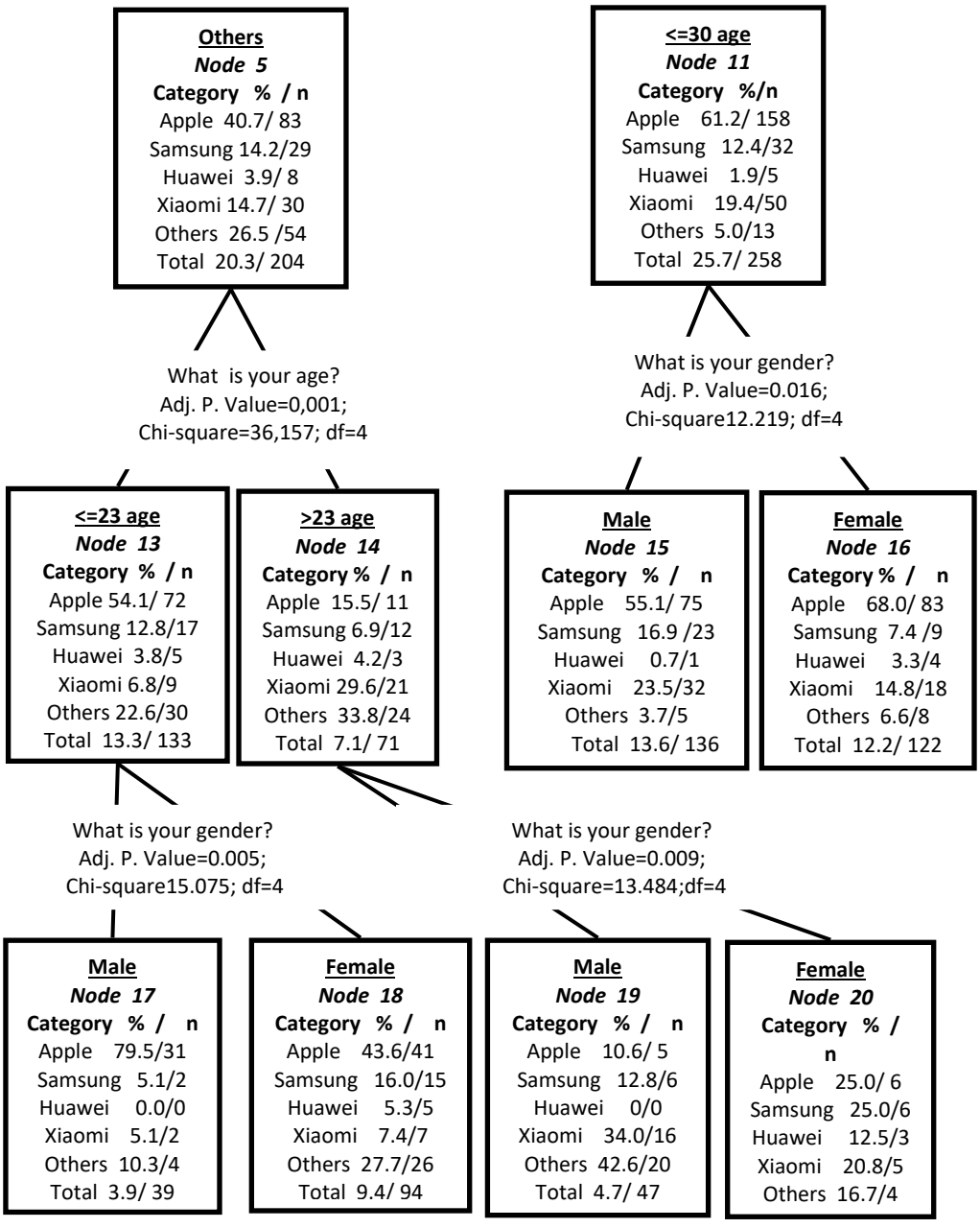


Figure 4(Continued): **Decision Tree Obtained in the Context of New Smartphone Preferences Dependent Variable and Current Smartphone Ownership, Status, Gender, Age, and Monthly Income Level Independent Variables**



Considering the Huawei node, 5.3% (53) of smartphone users are Huawei smartphone users. If Huawei smartphone users considered buying a new phone, 50.9% (27) would buy Apple, 15.1% Samsung, 17% (9) Huawei again, 3.8% (2) Xiaomi, and 13.2% (7) would prefer other smartphone brands. Considering these results, Huawei users will move away from their brands and turn to Apple at high levels and other brands at low levels.

The Xiaomi node shows that 30.5% (306) of smartphone users are Xiaomi smartphone users. If Xiaomi smartphone users considered buying a new phone, 52.9% (162) would prefer Apple, 11.8% Samsung, 2.9% (9) Huawei, 27.5% (84) Xiaomi again, and 4.9% (15) would prefer other smartphone brands. On the other hand, it was determined that the age variable branches under

the Xiaomi root (X^2= 66,690; p=0,000). The age variable consists of two nodes, 30, under 30, and over 30 years old. In the 30 and under 30 nodes, 61.2% of the 258 Xiaomi smartphone users would prefer Apple, and only 19.4% would prefer Xiaomi. In this case, it can be interpreted that the Xiaomi brand cannot hold on to young staff and university students who use Xiaomi and that these users may turn to Apple at a high level. Besides, it was determined that the gender variable branched under the 30 and 30 nodes (X^2= 12,219; p=0,000). Looking at the gender branches and nodes, it is observed that female Xiaomi users prefer Apple more. In the 30+-year-old node, 70.8% of 48 Xiaomi smartphone users will still prefer the Xiaomi brand.

When the other smartphone brands node is observed, it is seen that 20.3% (204) of smartphone users are users of other smartphone brands. If other smartphone brand users bought a new phone, 40.7% (83) would buy Apple, 14.2% (29) Samsung, 3.9% (8) Huawei, 14.7% Xiaomi, and 28.5% (54) would prefer other smartphone brands again. It was determined that the independent age variable branched under the other smartphone brands node (X^2= 38,157; p=0,000). The age variable consists of two nodes, 23, under 23, and over 23 years old. In the 23 and under 23 nodes, it is seen that 54.1% of 133 other smartphone users prefer Apple, and only 22.6% prefer other smartphone brands. It was determined that the gender variable also branches under this node (X^2= 15,075; p=0,000). Looking at the gender branches and nodes, it is observed that female users prefer Apple more. When the over-23 node is examined, 33.8% of other smartphone users prefer the same brand, and 29.6% prefer Xiaomi.

In the second decision tree, the new smartphone preference was the dependent variable, while the factors related to the existing smartphone ownership and perceived and expected smartphone service value were the independent variables. In this decision tree model, CHAID, Exhaustive CHAID, CRT, and QUEST algorithms were tested, respectively, and the second decision tree was created by using the CHAID algorithm, which gives the highest accuracy among these algorithms.

Besides, the accuracy value for the decision tree was found to be 89%. The second decision tree obtained within the scope of the study is given in Figure 5. The resulting decision tree consists of 22 nodes, 13 terminal points, and three depths. The second decision tree was first branched with the current smartphone ownership independent variable, as in the first decision tree (X^2= 222,404; p=0,000). In the first branch of this decision tree, respectively, Apple, Samsung, Huawei, Xiaomi, and other smartphone brands node is formed.

On the other hand, it was observed that the perceived hardware features under the Apple node were formed, which is the first node of the first branch (X^2= 15,611; p=0,012). In other words, the most effective factor that will affect the preferences of Apple smartphone users when they buy a new smartphone is the perceived hardware features. Two nodes were formed under the detected hardware properties in terms of 3 and less than 3, and more than 3 values. When these nodes are examined, it is seen that 147 out of 191 Apple users stated that the hardware feature value they perceived from the Apple was more than 3, and 44 stated that they were 3 and less than 3. 86.4% of Apple users who are satisfied with the perceived hardware features will still prefer Apple, and it is also observed that even 68.2% of dissatisfied users will prefer Apple again.

About the Samsung node, it was seen that the expected hardware specifications branched (X^2= 29,275; p=0,000). In other words, the most determining factor in Samsung smartphone users' preferences for a new smartphone is the expected hardware features. On the other hand, after the expected hardware specifications, two nodes were formed in terms of more than 4.75, 4.75, and less than 4.75.

Figure 5: **Decision Tree in the Context of New Smartphone Preferences Dependent Variable and Current Smartphone Ownership, Perceived and Expected Intelligent Service Quality Independent Variables**

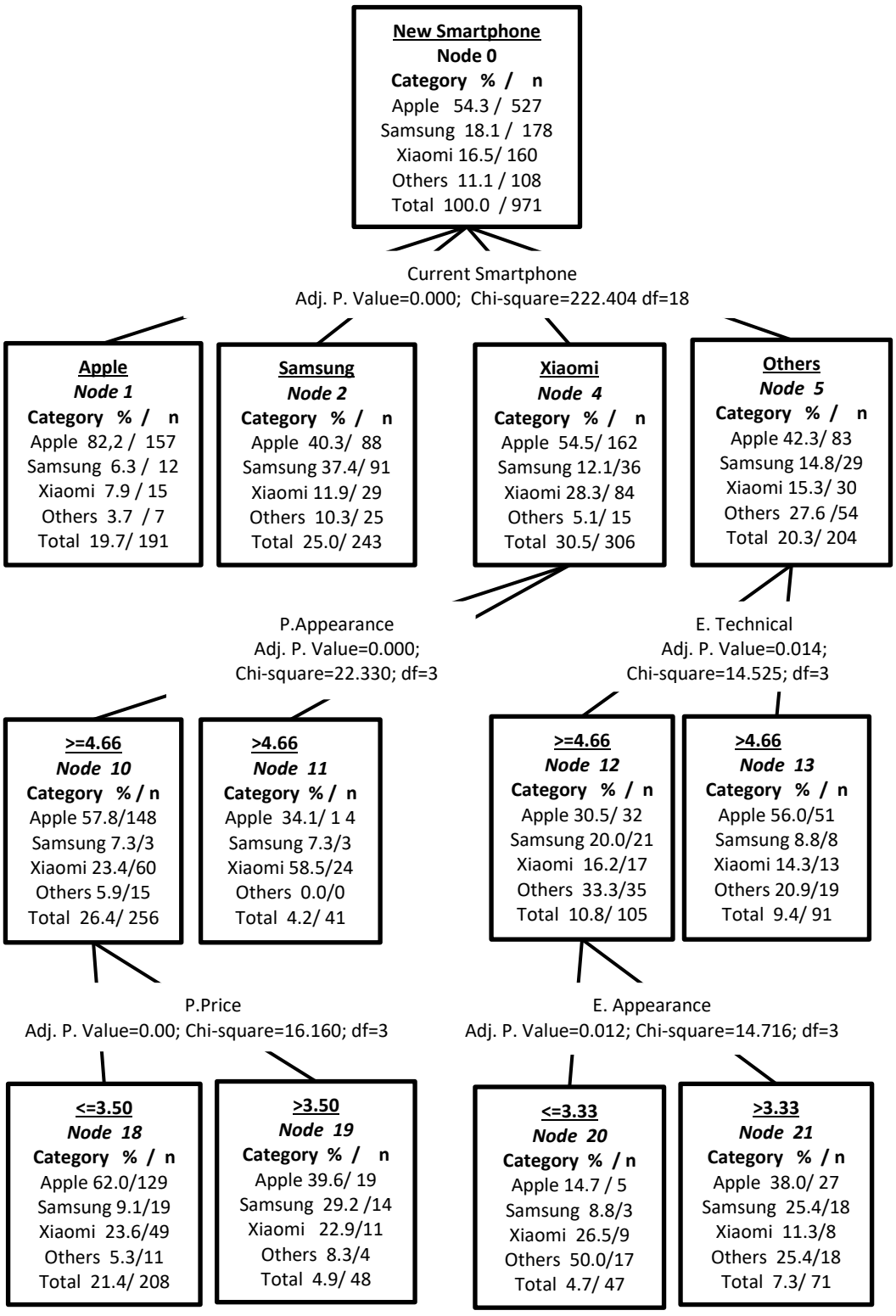
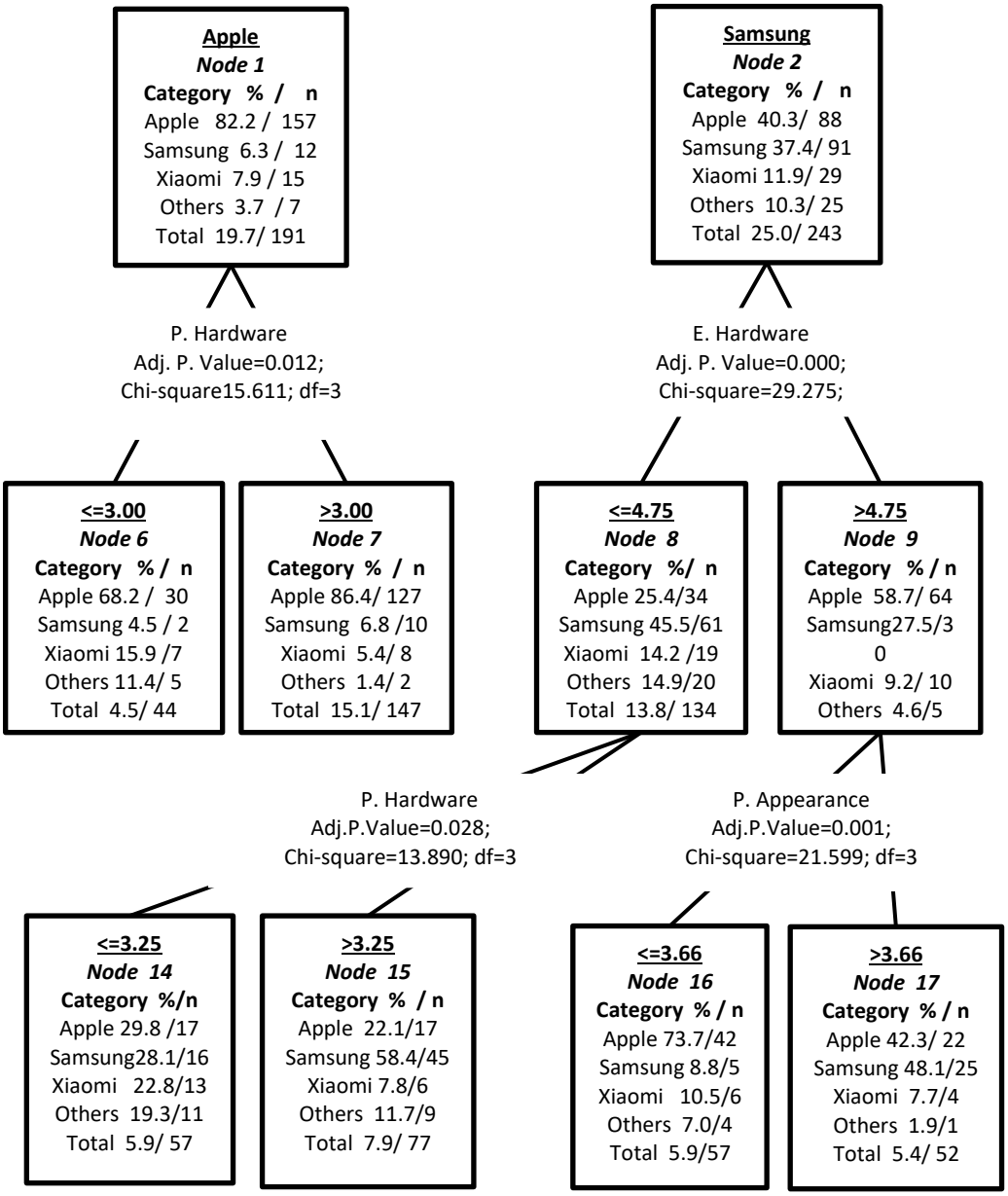


Figure 5(Continued): **Decision Tree in the Context of New Smartphone Preferences Dependent Variable and Current Smartphone Ownership, Perceived and Expected Intelligent Service Quality Independent Variables**



When the nodes are examined, it is indicated that 58.7% of the 109 Samsung users who expect high-level hardware features will prefer Apple, and 27.5% will prefer Samsung. Besides, it is observed that the perceived appearance factor branches below more than 4.75 (high satisfaction) nodes, and 73.7% of the 57 users who are not satisfied with Samsung's perceived appearance service will prefer Apple. In the second node, 45.5% of 134 Samsung users who have expected hardware specifications of 4.75 and less than 4.75 will prefer Samsung, and 25.4% will prefer Apple. It is suggested that the detected hardware features branch out from under this node, and 29.8% of users who do not like Samsung's hardware features will prefer Apple.

When the Xiaomi node is evaluated, it is suggested that the perceived appearance characteristics factor branched into different parts (X^2= 22,330; p=0,000). In other words,

Xiaomi's perceived external appearance will be the most decisive factor in the choice of a new smartphone by Xiaomi smartphone users. On the other hand, more than 4.66, 4.66, and less than 4.66 nodes were formed under the perceived appearance features. Moreover, 58.5% of 41 users who highly appreciate the appearance features of the Xiaomi smartphone will prefer Xiaomi again, and 34.1% will prefer Apple. It is observed that 57.8% of 256 Xiaomi users, who see the appearance features of the Xiaomi smartphone as 4.66 and less than 4.66, will prefer Apple, 23.4% will prefer Xiaomi, and 12.9% will prefer Samsung. In addition, the perceived price factor branched under this node, and 62% of 208 Xiaomi users who do not like Xiaomi's price strategy will prefer Apple.

When the other smartphones node was examined, it was seen that the expected technical features factor branched (X^2= 14,525; p=0,000). In other words, it can be said that the most determining factor of smartphone preferences of "other smartphone brands" users is the expected technical features. Additionally, under the expected technical specifications, more than 4.66 nodes, 4.66, and less than 4.66 nodes were formed. It is seen that 56% of 91 users who expect high-level technical features from other smartphone users will prefer Apple, and 20.9% will prefer the same brand. Of the 105 users of other brands who expect technical features of 4.66 and less than 4.66 from other smartphone users, 33.3% of them will still prefer the same brand, 30.5% will choose Apple, 20% will select Samsung, 16.2% will prefer Xiaomi. At the same time, it is seen that the expected appearance features branched out under this node, and users with high appearance expectations mostly prefer Apple.

5. Conclusion

Smartphones, on the one hand, are increasingly in demand with their constantly renewed models, and on the other hand, they are a product that causes strategic trade wars between giant companies. The global smartphone market, worth approximately 500 billion dollars today, is estimated to reach a value of approximately 800 billion dollars by 2029. The smartphone market is a significant strategy trade battleground where competition among giant companies is increasing, and companies that cannot keep up with it are doomed to disappear from the market. In this field of the trade war, giant smartphone companies such as Samsung, Apple, Huawei, Xiaomi, Oppo, and Vivo have exhibited great challenges in the last decade. In this process, especially Huawei has caught a good upward trend since 2012 and became a great competitor to Samsung by taking second place to Apple in 2019. However, with the effect of the US-China trade war, Huawei suddenly lost its importance in the world smartphone market in 2020. Today, a fierce struggle continues between Samsung, Apple, and Chinese giant companies (Xiaomi, Oppo, and Vivo).

The number of smartphone users in the world is continuously increasing. Worldwide, China ranks first with 910.14 million users, India second with 647.53 million users, and the USA third with 249.29 million users. Turkiye is in fourteenth place with 62.5 million users. In light of these data, Turkiye also has a vital place in the smartphone market. In this context, it can be said that studies on smartphone preferences in Turkey will be of great importance for the strategies of smartphone companies.

This study focused on three main objectives. The first is to evaluate the service quality perceived by individuals from the smartphones they use in the context of the brand. Second, to identify the factors that affect individuals' smartphone preferences. The third is to determine how these factors can have an impact on firm strategies. For the study, the survey data obtained from the TRA2 Region were first evaluated using Frequency analysis and the Chi-Square independence test. Then, the data were interpreted with two different decision trees obtained using the CHAID algorithm. The main results from the study are summarized below:

- It has been observed that smartphone users like the Apple the most in terms of perceived service quality.

- In terms of expected service quality, it was observed that the highest level of expectation focused on the Apple brand.
- It has been determined that smartphone users mostly use Xiaomi (30.50%).
- It has been observed that smartphone users will mostly prefer the Apple (52.50%) in their new smartphone preferences.
- It has been observed that smartphone users with low-income levels mostly use the Xiaomi brand. On the other hand, it has been observed that smart phone users with high income levels mostly use Samsung and Apple brands.
- It has been determined that the most important variable that determines the preferences of smartphone users in case they buy a new smartphone is the current smartphone they are using.
- It was concluded that Apple smartphone users are more loyal to their brand than other smartphone users.
- It has been observed that smartphone users using different brands will most likely prefer the Apple in their new smartphone preferences.
- It has been determined that the most effective factor that will affect the preferences of Apple smartphone users when they buy a new smartphone is the perceived hardware features.
- It has been concluded that the most decisive factor in Samsung smartphone users' preferences for a new smartphone is the expected hardware features.
- It has been observed that perceived appearance features will be the most determining factor in Xiaomi smartphone users' preference for a new smartphone.
- It has been determined that the most determining factor in the smartphone preferences of "other smartphone brands" users is the expected technical features.

The perceived and expected service quality of smartphone brands determines the brand value of smartphone brands on the one hand and brand preference on the other. In a competitive environment, brand equity is one of the most important factors that make companies successful. Brand equity refers to the increased utility and value provided by the brand name of a product. Brand equity gives the firm a sustainable competitive advantage and marketing success. Brand preference is one of the most important marketing measurements that show the strength of a brand in the market. Smartphone firms can compete in the smartphone trade war to the extent that they value brand equity and brand preference. Especially in this framework, they can be successful by developing the best strategy against their competitors. In this context, when the results are analyzed as a whole, it is observed that Apple is successful. In case Apple brings its price level to more reasonable levels, its market share in Turkey will increase significantly. Samsung has the highest brand loyalty after Apple. Samsung is liked in terms of its external appearance features, but it does not meet the expectations in terms of hardware features. It would be an important move for Samsung to improve its hardware features. Although Xiaomi is the most popular smartphone brand, it has the lowest brand loyalty. Especially the fact that its price is more reasonable causes its demand to be high. However, Xiaomi's emphasis on hardware and technical features in addition to its price strategy will further increase its brand value.

It is thought that the results obtained in the study will set an important example for many future studies. In addition, in this study, only one region of Turkey was taken as the main study group. In future studies, taking Turkey in general or even different countries as the main study group will make important contributions to the smartphone market.

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