

# Sentiment Analysis and Net Brand Reputation Comparison for Electric Cars in Turkey via Youtube Comments

(Research Article)

*Youtube Yorumları Üzerinden Türkiye'deki Elektrikli Arabalara Yönelik Duygu Analizi ve Net Marka İtibarlarının Karşılaştırılması*

Doi: 10.29023/alanyaakademik.1576206

Engincan YILDIZ<sup>1</sup>, Hande AYHAN GÖKCEK<sup>2</sup>, Ahmet Esad YURTSEVER<sup>3</sup>

<sup>1</sup> Dr. Öğr. Üyesi, İstanbul Gelişim Üniversitesi, enyildiz@gelisim.edu.tr, Orcid No: 0000-0003-2549-3473

<sup>2</sup> Dr. Öğr. Üyesi, İstanbul Gelişim Üniversitesi, hayhan@gelisim.edu.tr, Orcid No: 0000-0001-6349-3023

<sup>3</sup> Dr. Öğr. Üyesi, İstanbul Gelişim Üniversitesi, aeyurtsever@gelisim.edu.tr, Orcid No: 0000-0001-9845-3785

## ABSTRACT

There are many electric vehicle users in today's Turkey. These vehicle users can share their positive or negative experiences through social media platforms. Social media analyses have an important place in measuring the reactions towards electric vehicles and understanding the perspective of the society. Within the scope of the research, based on the electric car sales ranking data in Turkey in 2023, the posts made for a total of 10 electric car brands were analysed. In the study, in order to understand consumer perception towards electric cars, sentiment analysis of YouTube comments of 10 brands was taken into consideration and net brand reputation scores were revealed. The names of the relevant electric car brands were searched as keywords on YouTube and the comments under the videos were obtained by data mining method. The comments on the brands were categorised into two classes as positive and negative. When the NBR score results calculated according to these comments are evaluated, it is determined that TOGG is the brand with the highest net brand reputation.

## Keywords:

Net Brand Reputation,  
Brand Reputation,  
Consumer Behavior,  
Sentiment Analysis

## Received:

30.10.2024

## Accepted:

08.08.2025

## ÖZET

Günümüz Türkiye'sinde birçok elektrikli araç kullanıcısı vardır. Bu araç kullanıcıları yaşadıkları olumlu veya olumsuz deneyimleri sosyal medya platformları aracılığıyla paylaşabilmektedir. Elektrikli araçlara yönelik tepkilerin ölçülmesi ve toplumun bakış açısının anlaşılabilmesi için sosyal medya analizleri önemli bir yer tutmaktadır. Araştırma kapsamında, 2023 yılında Türkiye'deki elektrikli otomobil satış sıralaması verilerine dayanarak toplamda 10 elektrikli araba markasına yönelik yapılan paylaşımlar analiz edilmiştir. Çalışmada, elektrikli otomobillere yönelik tüketici algısını anlamak için 10 markanın YouTube yorumlarının duygu analizi dikkate alınmış ve net marka itibarı puanları ortaya konulmuştur. İlgili elektrikli araba markalarının isimleri anahtar kelime olarak Youtube üzerinden aratılmış ve videoların altındaki yorumlar veri madenciliği yöntemi ile elde edilmiştir. Markalara yönelik yapılan yorumlar olumlu ve olumsuz olmak üzere iki sınıfa ayrılmıştır. Bu yorumlara göre hesaplanan NBR puanı sonuçları değerlendirildiğinde, TOGG'un en yüksek net marka itibarına sahip marka olduğu belirlenmiştir.

## Anahtar Kelimeler:

Net Marka İtibarı,  
Marka İtibarı, Tüketici  
Davranışı, Duygu  
Analizi

## 1. INTRODUCTION

Electric vehicles have become a rapidly growing and popular sector around the world in recent years. In this sense, 2023 is considered to be an important year for Türkiye's electric car market. This change occurs not only in response to world climate change, but also as a response to developing and changing consumer preferences and changing dynamics of the market. The increase in electric car sales in Türkiye may be linked to infrastructure developments such as charging stations and increased consumer awareness about the environmental benefits of electric vehicles. This study provides interesting insights into consumer behavior and brand perception. Net brand reputation, which is an important measurement in understanding consumer sentiment, provides a more comprehensive understanding of how electric vehicle manufacturers are perceived in the market, as more information will be given in the following sections.

The basis of this study is electric vehicles. By analyzing consumer comments on YouTube, this research shows the net brand reputation figures of the top ten brands in electric car sales in Türkiye in 2023, showing competitive conditions in a different way.

This study not only examines the quantitative and qualitative aspects of electric car sales in Türkiye in 2023, but also examines the quantitative aspects of brand reputation. This two-pronged strategy provides a comprehensive analysis of the market, highlighting both statistical trends and consumer sentiments. As Türkiye's participation in the electric car market continues, understanding the dynamics of this market is thought to be very important for companies that want to advance and be successful in this rapidly growing sector. The aim of this study is to conduct a comprehensive analysis of the sentiment and net brand reputation (NBR) scores regarding the 2023 Türkiye electric car sales ranking data from the data obtained from YouTube consumer comments.

Most people in Türkiye go to social networking sites to read, comment or share content. These interactions significantly influence customers' behavior and perceptions. As a result, consumer reviews are invaluable to businesses that use these platforms to improve their presence and reputation in the marketplace. Brands should take advantage of the power of social media to positively influence social perception. This is not only useful but necessary in today's internet age.

The focus of this study is to examine the emotional content of YouTube comments on ten different electric car brands to determine consumer perceptions. In the analysis, comments were divided into positive and negative categories through sentiment analysis. These findings were then used to determine each brand's net brand reputation (NBR) scores. This is a quantitative indicator of reputation as perceived by consumers. TOGG has the highest net brand reputation score and the highest value for sales in 2023 among the brands examined. TOGG has a mostly positive perception among consumers, as reflected in the YouTube comments examined. These data not only highlight consumer sentiment towards electric car brands in Türkiye, but also provide a basis for marketers and researchers to learn more about and improve brand reputation through sentiment analysis of social media content. This study contributes to a more in-depth understanding of how electric car brands are perceived in the Turkish market, revealing consumer attitudes and their impact on brand reputation. The findings are considered useful for brands that want to improve their reputation and adapt their marketing strategies to better meet customer expectations and preferences.

Understanding brand reputation is crucial as every business significantly influences consumer decisions and its position in the market. In the modern business world, social networks are known to be very effective in increasing brand value. These platforms provide rich consumer feedback and participation that can guide brands to build stronger connections with their target audiences and develop new strategies. It is thought that with this research, future marketers and researchers can obtain important information about consumers' perception of various electric car brands in Türkiye. This study also aims to predict future trends and consumer attitudes towards electric vehicles and does this by examining the emotions expressed by consumers through their comments.

## 2. CONCEPTUAL FRAMEWORK

### 2.1. Electric Car Industry

The rapidly growing transportation sector today consumes more than half of the world's oil resources. Considering current oil consumption and trends in crude oil resources, world oil resources are expected to be largely depleted by 2038 (Ehsani, et al., 2018). Therefore, it seems inevitable to replace non-renewable energy sources with renewable energy sources and to use energy-saving technologies. Electric vehicles have begun to be comprehensively evaluated as a potential solution to reduce traffic-related environmental problems, and production has begun to increase day by day (Hajimiragha et al., 2010). Electric vehicles are perceived as a key technology in the automotive industry that will contribute to sustainable development with lower greenhouse gas emissions, less air pollution for people, and new business opportunities with positive social impact (Günther, et al., 2015: p.220).

At the latest point in the electric vehicle industry; With improvements in power electricity, energy storage and support, plug-in hybrid electric vehicles provide competitive driving range and fuel economy compared to internal combustion engine vehicles. The efficiency of rechargeable electric vehicles operating with optimized control strategies or using the energy management system concept can be significantly increased (Ding et al., 2017: p.49). Electric vehicles in current use can be classified into three main types (Özbay, 2020: p.37). Most of the time, the first type that comes to mind is All Electric vehicles that get their energy entirely from batteries. Due to the latest developments in battery technology, interest in these vehicles is increasing. However, the most widely used class today is Hybrid Electric vehicles, which combine both an internal combustion engine and an electric motor. The third category is Fuel Cell Electric vehicles that operate using hydrogen energy (Ehsani et al., 2018).

The number of studies in the literature on electric vehicles is increasing day by day. Wang et al. (2022), conducted a critical review on thermal management technologies for motors in electric cars. Danielis et al. (2020), studied the electric car preferences of drivers in Italy. In another study, Knobloch, et al. (2020), studied net emissions reductions from electric cars and heat pumps.

## 2.2. Sentiment Analysis

Sentiment analysis is essentially a text processing process that aims to determine the class that the text to be analyzed wants to express emotionally. The first studies on sentiment analysis are generally called emotional polarity and aim to classify the text as positive, negative, or neutral (Seker, 2016: p.21).

Many different sentiment analysis models are used in various fields. To give examples of these areas: sales forecasts (Fan et al., 2017), product ratings (Çalı & Balaman, 2019), opinion polls (O'Connor et al., 2010), voting results prediction (Wang et al., 2012), and examining investor behavior in the securities market (Baker & Wurgler, 2007). In studies on marketing, it is frequently used in subjects such as the opinion and voice of customers (Aguwa et al., 2017) and social media analysis on digital platforms (Ceron et al., 2014).

The widespread use of internet networks and social media allows individuals to express and interpret their thoughts about others or institutions easily and clearly. People who sometimes cannot share their true feelings and thoughts for different reasons in their daily lives can express themselves more easily by using social media as a tool, turning social media and similar platforms into a data source that can give sharper and more realistic results for emotion analysis (Kaynar, et al., 2016: p.235). This opportunity is becoming increasingly widespread and enables the emergence of a content-rich environment. This situation reveals the importance of analyzing and using big data collected from the internet to obtain meaningful insights and has become a subject of intense research in recent years (Tokcaer, 2021: p.1514).

Even for the simplest decisions, individuals often seek to understand the feelings and perspectives of others who have had similar experiences with a product or service. Bloem (2017), found that 84% of internet users consider online reviews as personal recommendations, and 68% make a decision after reading 1-6 online reviews. Comments about any product on social media platforms play an important role in shaping purchasing behavior and influencing attitudes and tendencies towards that product, especially for brands and other users (Tuzcu, 2020: p.1).

There are many studies in the literature on sentiment analysis. Singh et al. (2020), conducted a study with sentiment analysis through social media reviews and comparative analysis. In yet another study, Nandwani and Verma (2021), conducted a review of sentiment analysis and emotion detection from text. In his study, Pandian (2021), made performance evaluations and comparisons using deep learning techniques in sentiment analysis.

## 2.3. Brand Reputation

Reputation is an important concept for institutions as well as individuals. Reputable people and institutions gain influence and opportunities in many areas of society. In gaining reputation, it is necessary to convey the reasons for the actions taken through successful communication with the target audience and to ensure that the discourses are consistent with the actions taken (Karapınar, 2018: p.132). Brands, which are complementary to the products and services offered to customers, are among the elements that determine the identity of the product, distinguish it from other products in the market, and add value. For this reason, brands are among the important factors affecting customers' preferences (Durmaz & Ertürk, 2016: p.84). Brand reputation can help consumers make choices, especially when there is a lack of information about the product (Román & Sanchez-Siles, 2018). Considering that the concept of reputation, which can be evaluated as a whole of positive and negative thoughts about a brand, also includes the meaning of trust (Diker & Koçyigit, 2017), having a strong brand reputation is critical for companies that want to create a sustainable advantage against their competitors (De Chernatony, 1999). The integration of artificial intelligence tools into specific processes within the field of communication has brought artificial intelligence and communication closer together by enabling more effective audience monitoring and the identification of reputation-related outcomes (Yıldız & Uzunçarşılı Soydaş, 2023: p.63).

The benefits that brands provide to customers are also considered the psychological reward of owning brands that are status symbols. Branded products convey a sense of prestige and are often perceived as being of higher quality than their unbranded counterparts. Additionally, previously used branded products influence future purchasing beliefs and attitudes. In summary, customers assume that they minimize the risks associated with branded products (Aydoğdu & Sağtaş, 2023: p.2198). When it comes to brand reputation, businesses can give reliable messages through promotional strategies, but the quality and performance of their products play a very important role in shaping this concept. It is difficult to dramatically change a brand's reputation quickly because people tend to categorize brands and have established opinions about them (Shapiro, 1983). If a consumer's expectations, influenced by positive reviews from other customers, are met, the brand's reputation is strengthened. Conversely, the brand's current reputation will influence predictions of its future actions (Veloutsou & Moutinho, 2009: p.315). Failure to meet consumer expectations may damage trust and damage the reputation of the brand (Bakır and Safarzade, 2020: p.154).

There are different studies on many different topics in the literature regarding brand reputation. Especially if we look at recent studies by Foroudi (2019), on brand performance, which examined the effects of brand reputation, brand name and logo, brand awareness, and brand attitude. Vuong & Bui (2023), revealed in their study how important the role of corporate social responsibility activities is in employees' perceptions of brand reputation and brand value. Another study attempted to measure real-time brand reputation through social media usage (Rust et al., 2021). According to the findings of the study conducted by Jurisic & Azevedo (2011), brand reputation appears to be a critical factor in the consumer-brand relationship. To create a successful consumer-brand relationship, businesses should consider their brand reputation and carry out strengthening efforts in this direction. In the study of Ablak & Sağlam (2022), examined of the mediating role of brand reputation, examined the effect of the use of famous people in advertisements on consumers' behavioral intentions. Rahman et al. (2022), introduced a BERT-based deep learning approach for analyzing brand reputation through social media, demonstrating a significant improvement in accuracy over previous models. Their research emphasizes the growing importance of real-time reputation monitoring in the digital era. Similarly, Yazdi et al. (2024), conducted a bibliometric analysis of brand loyalty research spanning 28 years, identifying emerging trends such as brand love, consumer-brand identification, and social media's role in shaping brand perception. Another study highlights the impact of brand reputation on customer satisfaction and loyalty, showing that a positive reputation enhances consumer trust and engagement, while a negative reputation can lead to a decline in market share (Açıkgöz et al., 2024). Some other study on brand reputation and consumer loyalty also found that brand reputation and trust significantly contribute to customer retention, with the relationship between the consumer and the brand playing a mediating role (Kumar & Sathish, 2021).

## 2.4. Net Brand Reputation

Net Brand Reputation (NBR) is the net reputation value that enables a brand to be promoted digitally (Rahmatulloh et al., 2021). NBR also means: Collecting data from social media comments or social media listening. NBR makes the measurement of consumer loyalty simpler. The NBR value can range from -100 to 100; the higher the positive number, the more comments are positively evaluated (Vidya et al., 2015).

Today's Turkish electric car market presents a complex structure for consumers. The brands examined in this research are based on electric vehicle sales data for 2023, and the net brand reputation of the top 10 brands is analysed. In this sense, it will be a guide for consumers to buy electric cars with more confidence. In addition, it will support the brands existing in the market to determine their place in the market as social media analyses real consumer comments.

## 3. RESEARCH

### 3.1. Purpose and Importance of the Research

The aim of the research is to determine the net brand reputation by analyzing the emotions of YouTube comments regarding the sales of electric cars in the top 10 in Türkiye in 2023. In this context, the comments below the videos below were scraped through the Python program. Differences between the comments we obtained and the current number of comments may occur. Although there are many reasons for this, some of them are as follows;

Due to the fact that the data obtained was taken on a certain date. New comments are made every day and some comments are hidden or deleted by administrators, there may be differences in the numbers between the numbers that appear in our research and Youtube comments. Youtube comments were used as the data source. The reason for this is that this platform has a large user base and is very rich in terms of data. This research data was created between 01.07.2024-15.07.2024 from the YouTube links specified in Table 1.

Table 1. Youtube Links that Analyzed

| CAR BRANDS                                                                                            | YOUTUBE LINKS                                                                                         |                                                                                                       |                                                                                                       |  |  |
|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--|--|
| MERCEDES                                                                                              | SKYWELL                                                                                               | CITROEN                                                                                               | VOLVO                                                                                                 |  |  |
| <a href="https://www.youtube.com/watch?v=iwhAbXjKWOM">https://www.youtube.com/watch?v=iwhAbXjKWOM</a> | <a href="https://www.youtube.com/watch?v=XH8t2aP9Qdk">https://www.youtube.com/watch?v=XH8t2aP9Qdk</a> | <a href="https://www.youtube.com/watch?v=C1hvQG9pJvg">https://www.youtube.com/watch?v=C1hvQG9pJvg</a> | <a href="https://www.youtube.com/watch?v=idqR6vHZtN0">https://www.youtube.com/watch?v=idqR6vHZtN0</a> |  |  |
| <a href="https://www.youtube.com/watch?v=iwhAbXjKWOM">https://www.youtube.com/watch?v=iwhAbXjKWOM</a> | <a href="https://www.youtube.com/watch?v=XH8t2aP9Qdk">https://www.youtube.com/watch?v=XH8t2aP9Qdk</a> | <a href="https://www.youtube.com/watch?v=C1hvQG9pJvg">https://www.youtube.com/watch?v=C1hvQG9pJvg</a> | <a href="https://www.youtube.com/watch?v=idqR6vHZtN0">https://www.youtube.com/watch?v=idqR6vHZtN0</a> |  |  |
| <a href="https://www.youtube.com/watch?v=iwhAbXjKWOM">https://www.youtube.com/watch?v=iwhAbXjKWOM</a> | <a href="https://www.youtube.com/watch?v=XH8t2aP9Qdk">https://www.youtube.com/watch?v=XH8t2aP9Qdk</a> | <a href="https://www.youtube.com/watch?v=C1hvQG9pJvg">https://www.youtube.com/watch?v=C1hvQG9pJvg</a> | <a href="https://www.youtube.com/watch?v=idqR6vHZtN0">https://www.youtube.com/watch?v=idqR6vHZtN0</a> |  |  |
| <a href="https://www.youtube.com/watch?v=iwhAbXjKWOM">https://www.youtube.com/watch?v=iwhAbXjKWOM</a> | <a href="https://www.youtube.com/watch?v=XH8t2aP9Qdk">https://www.youtube.com/watch?v=XH8t2aP9Qdk</a> | <a href="https://www.youtube.com/watch?v=C1hvQG9pJvg">https://www.youtube.com/watch?v=C1hvQG9pJvg</a> | <a href="https://www.youtube.com/watch?v=idqR6vHZtN0">https://www.youtube.com/watch?v=idqR6vHZtN0</a> |  |  |
| <a href="https://www.youtube.com/watch?v=iwhAbXjKWOM">https://www.youtube.com/watch?v=iwhAbXjKWOM</a> | <a href="https://www.youtube.com/watch?v=XH8t2aP9Qdk">https://www.youtube.com/watch?v=XH8t2aP9Qdk</a> | <a href="https://www.youtube.com/watch?v=C1hvQG9pJvg">https://www.youtube.com/watch?v=C1hvQG9pJvg</a> | <a href="https://www.youtube.com/watch?v=idqR6vHZtN0">https://www.youtube.com/watch?v=idqR6vHZtN0</a> |  |  |
| <a href="https://www.youtube.com/watch?v=iwhAbXjKWOM">https://www.youtube.com/watch?v=iwhAbXjKWOM</a> | <a href="https://www.youtube.com/watch?v=XH8t2aP9Qdk">https://www.youtube.com/watch?v=XH8t2aP9Qdk</a> | <a href="https://www.youtube.com/watch?v=C1hvQG9pJvg">https://www.youtube.com/watch?v=C1hvQG9pJvg</a> | <a href="https://www.youtube.com/watch?v=idqR6vHZtN0">https://www.youtube.com/watch?v=idqR6vHZtN0</a> |  |  |

|                                                                                                       |                                                                                                       |                                                                                                       |
|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| MG                                                                                                    | BMW                                                                                                   | OPEL                                                                                                  |
| <a href="https://www.youtube.com/watch?v=04gw0pzkd7U">https://www.youtube.com/watch?v=04gw0pzkd7U</a> | <a href="https://www.youtube.com/watch?v=YA8ihSqZn0E">https://www.youtube.com/watch?v=YA8ihSqZn0E</a> | <a href="https://www.youtube.com/watch?v=ezcYMHdbvGU">https://www.youtube.com/watch?v=ezcYMHdbvGU</a> |
| <a href="https://www.youtube.com/watch?v=04gw0pzkd7U">https://www.youtube.com/watch?v=04gw0pzkd7U</a> | <a href="https://www.youtube.com/watch?v=YA8ihSqZn0E">https://www.youtube.com/watch?v=YA8ihSqZn0E</a> | <a href="https://www.youtube.com/watch?v=ezcYMHdbvGU">https://www.youtube.com/watch?v=ezcYMHdbvGU</a> |
| <a href="https://www.youtube.com/watch?v=04gw0pzkd7U">https://www.youtube.com/watch?v=04gw0pzkd7U</a> | <a href="https://www.youtube.com/watch?v=YA8ihSqZn0E">https://www.youtube.com/watch?v=YA8ihSqZn0E</a> | <a href="https://www.youtube.com/watch?v=ezcYMHdbvGU">https://www.youtube.com/watch?v=ezcYMHdbvGU</a> |
| <a href="https://www.youtube.com/watch?v=04gw0pzkd7U">https://www.youtube.com/watch?v=04gw0pzkd7U</a> | <a href="https://www.youtube.com/watch?v=YA8ihSqZn0E">https://www.youtube.com/watch?v=YA8ihSqZn0E</a> | <a href="https://www.youtube.com/watch?v=ezcYMHdbvGU">https://www.youtube.com/watch?v=ezcYMHdbvGU</a> |

| TOGG                                                                                                  | TESLA                                                                                                 | RENAULT                                                                                               |
|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| <a href="https://www.youtube.com/watch?v=sjnuAhUEqmU">https://www.youtube.com/watch?v=sjnuAhUEqmU</a> | <a href="https://www.youtube.com/watch?v=QgcMEb3HdY4">https://www.youtube.com/watch?v=QgcMEb3HdY4</a> | <a href="https://www.youtube.com/watch?v=u6zLBagxq8I">https://www.youtube.com/watch?v=u6zLBagxq8I</a> |
| <a href="https://www.youtube.com/watch?v=sjnuAhUEqmU">https://www.youtube.com/watch?v=sjnuAhUEqmU</a> | <a href="https://www.youtube.com/watch?v=QgcMEb3HdY4">https://www.youtube.com/watch?v=QgcMEb3HdY4</a> | <a href="https://www.youtube.com/watch?v=u6zLBagxq8I">https://www.youtube.com/watch?v=u6zLBagxq8I</a> |
| <a href="https://www.youtube.com/watch?v=sjnuAhUEqmU">https://www.youtube.com/watch?v=sjnuAhUEqmU</a> | <a href="https://www.youtube.com/watch?v=QgcMEb3HdY4">https://www.youtube.com/watch?v=QgcMEb3HdY4</a> | <a href="https://www.youtube.com/watch?v=u6zLBagxq8I">https://www.youtube.com/watch?v=u6zLBagxq8I</a> |
| <a href="https://www.youtube.com/watch?v=sjnuAhUEqmU">https://www.youtube.com/watch?v=sjnuAhUEqmU</a> | <a href="https://www.youtube.com/watch?v=QgcMEb3HdY4">https://www.youtube.com/watch?v=QgcMEb3HdY4</a> | <a href="https://www.youtube.com/watch?v=u6zLBagxq8I">https://www.youtube.com/watch?v=u6zLBagxq8I</a> |
| <a href="https://www.youtube.com/watch?v=sjnuAhUEqmU">https://www.youtube.com/watch?v=sjnuAhUEqmU</a> | <a href="https://www.youtube.com/watch?v=QgcMEb3HdY4">https://www.youtube.com/watch?v=QgcMEb3HdY4</a> | <a href="https://www.youtube.com/watch?v=u6zLBagxq8I">https://www.youtube.com/watch?v=u6zLBagxq8I</a> |
| <a href="https://www.youtube.com/watch?v=sjnuAhUEqmU">https://www.youtube.com/watch?v=sjnuAhUEqmU</a> | <a href="https://www.youtube.com/watch?v=QgcMEb3HdY4">https://www.youtube.com/watch?v=QgcMEb3HdY4</a> | <a href="https://www.youtube.com/watch?v=u6zLBagxq8I">https://www.youtube.com/watch?v=u6zLBagxq8I</a> |
| <a href="https://www.youtube.com/watch?v=sjnuAhUEqmU">https://www.youtube.com/watch?v=sjnuAhUEqmU</a> | <a href="https://www.youtube.com/watch?v=QgcMEb3HdY4">https://www.youtube.com/watch?v=QgcMEb3HdY4</a> | <a href="https://www.youtube.com/watch?v=u6zLBagxq8I">https://www.youtube.com/watch?v=u6zLBagxq8I</a> |

Source: Determined and tabulated by researchers

Based on Table 1, examples of positive and negative comments are as follows :

For Togg;

- Positive Comment: "I've been using the Togg T10X for about 6 months and I'm really pleased. The performance of the vehicle is amazing, especially the fast charging feature is very useful. It provides a comfortable drive in city traffic and on long roads."
- Negative Comment: "The battery performance of the vehicle looks great on paper, but in reality I'm a little disappointed. The range expectation is not fully met when driving long roads."

For Tesla;

- Positive Comment: "The performance and technological features of the Tesla Model Y are really impressive. The autopilot system provides great convenience in city traffic."

- Negative Comment: "Although the vehicle is generally good, the suspension system is a bit stiff on rough roads and this reduces comfort."

For Renault;

- Positive Comment: "The interior design and driving dynamics of the Renault Megane E-Tech are very successful. Despite being an electric vehicle, it is quite fast."

- Negative Comment: "The vehicle's range is sufficient for city use, but I would have expected more range on long journeys."

For MG;

- Positive Comment: "The MG ZS EV stands out with its spacious interior and practical features suitable for family use. The price-performance ratio is quite good."

- Negative Comment: "The interior material quality of the vehicle could have been a little better. Some plastic parts feel cheap."

For BMW;

- Positive Comment: "The driving dynamics and luxurious interior of the BMW iX1 are really impressive. Despite being an electric vehicle, it offers typical BMW driving pleasure."

- Negative Comment: "Although the vehicle is generally good, it falls a little behind its rivals in terms of range."

Sentiment analysis of YouTube comments examines customers' opinions of electric car brands. Compared to the traditional survey method, YouTube comments provide a more realistic measure of public sentiment by showing consumers' immediate reactions. Analyzing these comments allows marketers and manufacturers to understand the emotional aspect of brands that may influence prospective buyers. Sentiment analysis can help find consumers' thoughts (Pang & Lee, 2008). In an environment where the electric car market is rapidly growing in Türkiye, it is especially important to understand the sensitivity towards electric car brands. Positive or negative emotions can directly impact sales, brand loyalty and customer trust. According to a study by Chevalier & Mayzlin (2006), online reviews significantly influence sales: positive reviews encourage purchases, while negative reviews discourage potential buyers from purchases.

It is thought that conducting sentiment analysis for the top ten brands in electric car sales in Türkiye will help identify strong and weak brands and determine strategies to increase consumer interaction and market share. Sentiment analysis of YouTube comments provides a data-driven method for understanding changing perceptions of customer preferences. For example, if a large number of reviews highlight concerns about a particular feature of an electric vehicle, manufacturers may prioritize fixing those issues in future models or updates. According to Liu (2012), sentiment analysis provides actionable information that can influence customer service, product improvements, and overall brand strategy. Therefore, it is estimated that this research will help companies better meet consumer expectations by measuring the brand reputation of electric cars by 2023 and creating a basis for strategic improvements.

Electric vehicles stand out as the transportation technology of the future with their role in reducing environmental problems and increasing energy efficiency. Therefore, accurately analyzing consumer perception of electric vehicles will provide valuable information for both industry stakeholders and policy makers.

This research on electric vehicles and brand reputation revealed important results by analyzing consumer perception and brand reputation in the electric vehicle market in Türkiye. Sentiment analysis and net brand reputation scores provide valuable information to help brands determine strategies to increase consumer satisfaction and gain a competitive advantage in the market. The widespread use of electric vehicles and increasing consumer confidence are critical for a sustainable future. It is clear that many electric car brands have a market in Turkey (see Table 2). Accordingly, competition among electric car brands has become very important. For this reason, the actions they take for their brand reputation can give them an advantage over other automobile brands.

**Table 2. Sales of Electric Car Brands / Top 10 Brands**

| Number | Electric Car Brands - TOP 10 | 2023 Sales/Quantity |
|--------|------------------------------|---------------------|
| 1      | Togg                         | 19,583              |
| 2      | Tesla                        | 12,150              |
| 3      | Renault                      | 4,785               |

|    |          |        |
|----|----------|--------|
| 4  | MG       | 3,923  |
| 5  | BMW      | 3,746  |
| 6  | Opel     | 3,745  |
| 7  | Mercedes | 3,622  |
| 8  | Skywell  | 2,541  |
| 9  | Citroen  | 1,881  |
| 10 | Volvo    | 1,633  |
|    | Total    | 57,609 |

Source: [www.tehad.org](http://www.tehad.org) (Date of access: 20.04.2024)

### 3.2. Limitations of the Research and Sample

Purposeful sampling was used in the research. Within this sample, the top ten electric car brands operating in Türkiye according to 2023 sales figures were included in the research. This situation constitutes the limitation of the research. All of the top 10 car brands operating in Türkiye were included in the research, and the comments under YouTube video comments about these car brands were analyzed using the data mining method. 10 random video comments about each car brand were included in the research, and comments on less than 100 video comments in total were included in the research. This situation constitutes the limitation of the research. In our research, 15,619 comments on YouTube video comments were included in the sample, determined in accordance with the purposeful sampling in which we included the people we could reach within the scope of the sample. This research data was created between 01.07.2024-15.07.2024 from the YouTube links specified in Table 1.

Sales of Electric Car Brands were the priority in choosing electric car brands (Table 2). Another limitation is that the search was made with 2 keywords: "Car Brand Name" and "Electric Car". The limitation of the Youtube videos reached was that the first 4 to 8 videos with the highest comments were taken. The reason why the number of videos varies between 4 and 8 is that there are not enough comments on the videos of some brands.

### 3.3. Method

Within the scope of the research, the computational social sciences approach, which is frequently used in the field of social sciences, was preferred. The main point in this approach, which advocates the use of computational methods in social sciences, is social media and big data phenomena (Şallı & Kurnaz, 2013: p.100). Through this approach, big data can be integrated into the field of social sciences as a result of the analysis process. Computational social science is about more than large digital data repositories and the computational methods needed to create and analyze them (Hofman et al., 2021: p.181). The emergence of a computational social science shares with other emerging interdisciplinary fields the need to develop a paradigm for training new scholars (Lazer et al., 2009: p.722). CSS encompasses language, location and movement, networks, images and video through the application of statistical models that capture a wide range of dependencies in data. A connected intellectual community of social scientists, computer scientists, statistical physicists and others have come together under this umbrella expression (Lazer et al., 2020: p.1060). Studies in computational social science focus on "text as data". This places the field of communication at the center of this developing field (Shah et al., 2015: p.12). In our research, text was used as data. Especially considering how valuable user comments, sentiments, criticisms, evaluations and suggestions are for brands, the text-as-data approach is very important. In the realization of these analyzes, the BERT model was used as The Transformer-based model. As personal computers have become increasingly powerful over time, advances in open-source software for research computing, notably R and Python, have simplified the process of performing computationally intensive analyses (Tindall et al., 2022). In this context, the Python programming language was used throughout the entire process, from data scraping to sentiment analysis (see figure 1.).

Within the scope of the research, all of the top 10 car brands operating in Türkiye according to 2023 sales ([www.tehad.org](http://www.tehad.org)) were included in the research. In this context, the research process was first planned. YouTube video comments about 10 car brands were first reviewed. Afterwards, 10 YouTube video comments stories for each car brand were selected and their links were stored in the background for use in the research process.

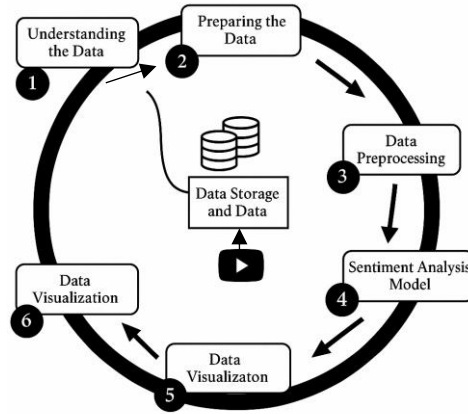


Figure 1. Research Process

Source: Created by the Researchers

In this research conducted on electric vehicles, YouTube comments were first stored with the CSV extension. These stored data were examined in detail by researchers. The data is accurately understood regarding the general structure of the data and whether YouTube comments are stored correctly. Careful examination and reporting of the "fundamental" or "surface" features of the data obtained were carried out. The data was then explored by addressing data mining questions that could be addressed using querying, reporting, and visualization. At this stage, "Are the data obtained complete?" and "Are there missing values in the data obtained?" Data quality was examined by answering some important questions, such as.

When it comes to the data preparation stage, the data goes through a preliminary preparation to be selected, cleaned, structured, and formatted in the desired way. A more in-depth data exploration task was performed at this stage to notice patterns based on business insight. In the data cleaning phase, before data analysis was carried out, cleaning was carried out to increase the success of the analysis. In this sense:

- All letters have been converted to lowercase.
- Punctuation marks have been removed.
- Numbers have been eliminated.
- Stopwords words have been removed.

Uncleaned data contains inaccuracies, improper formatting, spelling errors, punctuation, or duplications. Cleaning of data is essential for reliable data analysis (Akpınar, 2014: p.98). This process increases the quality of the quality of the data and ensures that the developed algorithm progresses quickly and accurately (Engüllü, 2018: p.6).

### 3.3.1. Data mining

Data mining can be defined as the process of extracting implicit and potentially useful information from large volumes of incomplete, random, and uncertain data (Duan & Gao, 2021: p.1). This technique enables the rapid and accurate collection and processing of big data, making it easier to extract actionable insights (Shang, 2022: p.116). Data mining uses models to reveal hidden relationships within important data sets that can predict current or future customer behavior (Aytekin, 2011: p.87). In this context, data mining was applied to the YouTube platform to analyze the sensitivity towards electric cars. The YouTube API was used to collect data, allowing the collection of comment data from selected YouTube videos within the constraints of the API. YouTube API provides access to shared comment data for specific videos, playlists, channels, topics, words, or terms. (Şahinarslan et al., 2023: p.224).

Table 3 shows the number of YouTube links analyzed and the total number of comments for the car brands included in the research.

Table 3. YouTube Video Counts and Comment Volumes About Electric Car Brands

| Order No | Brand Name | Number of Youtube Links Analyzed | Total Number of Comments |
|----------|------------|----------------------------------|--------------------------|
| 1        | Togg       | 8                                | 3,021                    |
| 2        | Tesla      | 5                                | 2,557                    |

|       |          |   |               |
|-------|----------|---|---------------|
| 3     | Renault  | 8 | 1,389         |
| 4     | MG       | 4 | 1,031         |
| 5     | BMW      | 5 | 914           |
| 6     | Opel     | 5 | 396           |
| 7     | Mercedes | 6 | 1,130         |
| 8     | Skywell  | 5 | 1,090         |
| 9     | Citroen  | 5 | 3,313         |
| 10    | Volvo    | 5 | 778           |
| Total |          |   | <b>15,619</b> |

Source: *Determined and tabulated by researchers*

### 3.3.2. Sentiment analysis method

The cleaned data is stored in a new CSV file. A sentiment analysis model was developed based on this stored data, and analyses were performed on this cleaned data. There are two steps in the BERT model: pretraining and fine-tuning. During pre-training, the model is trained on unlabeled data over different pre-training tasks. For fine-tuning, the BERT model is first initialized with pre-trained parameters and all parameters are fine-tuned using labeled data from subsequent tasks (Devlin et al., 2018). Within the scope of the research, the pre-trained model "bert-base-turkish-sentiment-cased" was used for BERTurk-based sentiment analysis (Savasy, 2024). BERT model taken from HuggingFace (Hugging Face, 2024). As a platform, HuggingFace helps users create their own interfaces where pre-trained deep learning models can be tested by other end users (Boztepe et al., 2022, s.195). In a study investigating the success rates of the models, it was concluded that the most successful model was the model prepared with the BERT architecture and representing the word size with 128k vectors. Compared to deep learning architectures, it was concluded that much higher scores were obtained with much less parameter training (Sel & Hanbay, 2021: p.683). The Turkish BERT model (BERTurk) is pre-trained on Oscar Corpus, Opus Corpora, and Wikipedia. The model consists of 12 transducer layers. BERTurk models vary in word sizes of 32K and 128K, and both are available in trained and untrained versions (Koru & Uluyol, 2024: p.14923). In the study, the Google BERT model, a bi-directional natural language processing model that effectively reveals contextual relationships between sentences and words based on artificial neural networks, was used (Sevli & Kemaloğlu, 2021). Empirical evidence presented in a comparative study shows that the BERT model should be used as a default technique in NLP problems (Garrido-Merchan et al., 2023). Research analysis was carried out after the sentiment analysis model was included in the algorithm. The model distinguished emotional states as positive and negative during the emotion analysis stage. Therefore, the model analyzed 15,619 data.

### 3.4. Data Visualization

Data visualization was made in order to provide more understandable results of the obtained data. Data visualization is the use of computer-based interactive visual representations of abstract and non-physical data by enhancing people's knowledge. Within the scope of visualization, users are helped to discover information more easily, as well as to have an idea about the data and see unexpected structures (Çelik & Akdamar, 2018: p.253). According to Kahya (2021: p.13), data visualization is the process of organizing complex and dispersed data and making it easier to understand. Data visualizations carried out within the scope of the research are included in the findings section.

### 3.5. Net Brand Reputation Score (NBR Score)

Net Brand Reputation (NBR) is a comprehensive measurement that reflects the general public perception of a brand. Unlike traditional reputation metrics, which may focus solely on brand awareness or market share, NBR combines various dimensions of consumer sentiment, such as satisfaction, loyalty and advocacy. This metric captures both positive and negative sentiment, providing a balanced view of how a brand is perceived across different platforms and across different consumer segments. The importance of NBR lies in its ability to provide actionable information to brands aiming to improve their market position and customer engagement strategies. According to Fombrun (1996), a strong brand reputation can lead to increased customer loyalty, higher profit margins, and greater resilience to market fluctuations. The higher the value of the NBR score, the better the brand reputation of the brand in question. The NBR calculation formula (Sharma et al., 2020):

$$\text{NBR} = \frac{\text{Net Brand Reputation Score (NBR Score)}}{\text{(Number of positive tweets + Number of negative tweets)}} \times 100\%$$

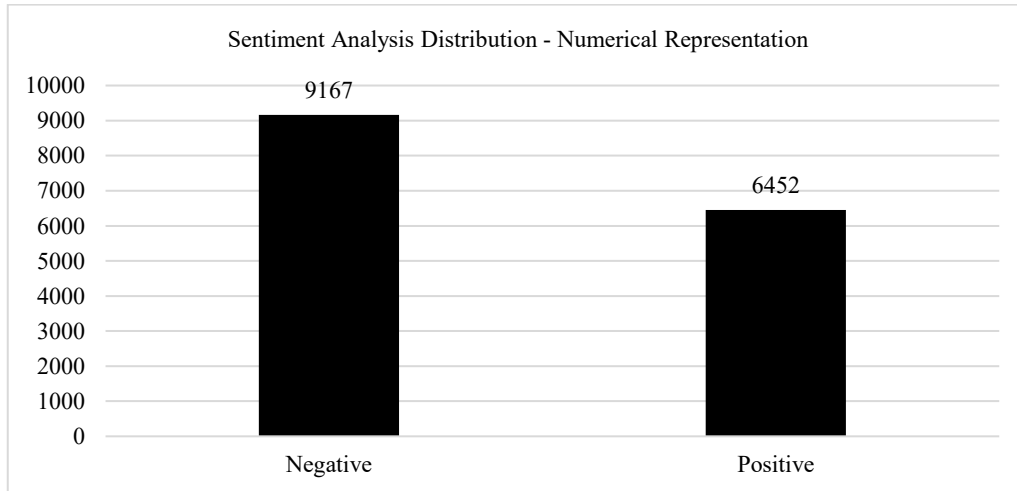
$$\text{NBR} = \frac{\text{(Number of positive tweets - Number of negative tweets)}}{\text{(Number of positive tweets + Number of negative tweets)}} \times 100\%$$

### 3.6. Findings

The research, conducted using data collected from YouTube, examined sentiments regarding electric vehicles in Türkiye. Later, the research was supported by NBR (Net Brand Reputation) in order to reveal effective results through these analyses. These brands, which have been introduced to electric cars in recent years and are rapidly becoming widespread, are in competition with each other. However, important issues arise here. First of all, what do people think about electric cars? Secondly, what are the thoughts about the companies that produce electric cars and offer them for sale in Türkiye?

While a general evaluation of all comments was made to reveal the general opinion about electric cars (Figure 2, Figure 3, Visual 1), NBR was also used to measure the reputation of electric car brands (Table 3 and Table 4). In this way, the general opinion about electric cars and the reputation of the brands were measured.

It is widely recognized that recent advancements in computer technologies have significantly contributed to scientific research methods (Çelik et al., 2025). Within the scope of the research, the “savasy/bert-base-turkish-sentiment-cased” model was used. It has been discussed in a study on this subject that deep learning (DL) models achieve an accuracy of 89.26% at best for the film category, while traditional methods reach an accuracy of 86.5%. Similarly, the study indicates that the same trend has been observed for other categories as well (Yıldırım, 2024). In another study, using BERT, the researchers demonstrated 82.6% accuracy in predicting emotion. This study shows how effective deep learning models and transducers are for Turkish natural language processing tasks (Alshammari & Akyüz, 2024). The researchers revealed that 97% accuracy rate was obtained in the “savasy/bertturkish-sentiment-cased” model, which was developed for Turkish sentiment analysis and fine-tuned with Turkish sentiment analysis datasets (Köksal, 2021). Related research shows the validity and reliability of the Transformer-based “savasy/bert-base-turkish-sentiment-cased” model. This model was preferred because of its success in predicting sentiments.



**Figure 2. Distribution of Sentiment Analysis**

First of all, the comments obtained in order to detect social emotions were subjected to sentiment analysis with the BERT model. Looking at the results obtained from this analysis, it was concluded that there were 9,167 negative thoughts and 6,452 positive thoughts. In general terms, it seems that a certain amount of time is needed to develop positive judgments about electric vehicles and to ensure trust.



predictability. Addressing these technical and experiential challenges is vital for enhancing consumer confidence and accelerating market penetration.

In Table 4, YouTube sentiment analysis results and net brand reputation scores of the electric car brands in the top 10 in sales in Türkiye in 2023 are calculated and shown. The total number of comments analyzed is 15,619. It was determined that the number of positive comments was 6452, and the number of negative comments was 9167. This situation shows that, in general terms, consumers are not satisfied with electric cars. According to Table 4, it has been determined that only the Togg brand has a positive NBR score and ranks first in both sales figures and NBR score.

**Table 4. Sentiment Analysis Results and NBR Scores by Brand**

| Sales Order No | Brand Name   | Number of Positive Comments | Number of Negative Comments | Total Number of Comments | NBR Scores    |
|----------------|--------------|-----------------------------|-----------------------------|--------------------------|---------------|
| 1              | Togg         | 1,520                       | 1,501                       | 3,021                    | 0.63          |
| 2              | Tesla        | 1,065                       | 1,492                       | 2,557                    | -18.91        |
| 3              | Renault      | 474                         | 915                         | 1,389                    | -31.74        |
| 4              | MG           | 393                         | 638                         | 1,031                    | -23.76        |
| 5              | BMW          | 394                         | 520                         | 914                      | -13.78        |
| 6              | Opel         | 143                         | 253                         | 396                      | -27.77        |
| 7              | Mercedes     | 515                         | 615                         | 1,130                    | -8.84         |
| 8              | Skywell      | 480                         | 610                         | 1,090                    | -11.92        |
| 9              | Citroen      | 1,156                       | 2,157                       | 3,313                    | -30.21        |
| 10             | Volvo        | 312                         | 466                         | 778                      | -19.79        |
|                | <b>TOTAL</b> | <b>6,452</b>                | <b>9,167</b>                | <b>15,619</b>            | <b>-17.38</b> |

Source: Determined and tabulated by researchers

Table 5 shows the NBR score rankings according to the 2023 electric vehicle sales rankings. According to the sales figures ranking results, the first 3 brands were Togg, Tesla and Renault respectively, and according to the NBR Scores results, the first 3 brands were Togg, Mercedes and Skywell. According to these results, the Togg brand ranks first according to both sales figures and NBR scores. Against this; While Tesla ranks 2nd according to sales figures, it ranks 5th according to NBR scores; While Renault ranked 3rd according to sales figures, it ranked 10th, that is, last, in the NBR score ranking.

**Table 5. NBR Scores of Comparison Among the Top 10 Electric Car Brands**

| Sales Order No | Brand Name      | NBR Scores    | NBR Score Ranking |
|----------------|-----------------|---------------|-------------------|
| 1              | <b>Togg</b>     | <b>0,63</b>   | <b>1</b>          |
| 2              | Tesla           | -18,91        | 5                 |
| 3              | Renault         | -31,74        | 10                |
| 4              | MG              | -23,76        | 7                 |
| 5              | BMW             | -13,78        | 4                 |
| 6              | Opel            | -27,77        | 8                 |
| 7              | <b>Mercedes</b> | <b>-8,84</b>  | <b>2</b>          |
| 8              | <b>Skywell</b>  | <b>-11,92</b> | <b>3</b>          |
| 9              | Citroen         | -30,21        | 9                 |
| 10             | Volvo           | -19,79        | 6                 |
|                | Total           | -17,79        |                   |

Source: Determined and tabulated by researchers

#### 4. CONCLUSION AND RECOMMENDATIONS

As a result of this study, important inferences were provided about the sensitivity analysis of YouTube's comments regarding electric vehicle sales in the top 10 in Türkiye in 2023, consumer perceptions, and brand reputations. In this article, 15,619 comments about the top 10 electric car brands were analyzed using advanced text mining techniques. In the analysis, YouTube comments were classified according to positive and negative opinions, and

remarkable results were detected. The general emotional distribution of consumers regarding electric cars on the subject shows that negative comments predominate, accounting for 59%, while positive comments constitute 41%. This shows that there is a significant amount of consumer dissatisfaction or concern about electric vehicles in Türkiye. Specifically, 9,167 negative comments and 6,452 positive comments were identified. This trend highlights a potential barrier to wider adoption of electric vehicles, as negative perceptions can significantly influence consumers' decision-making.

The study also calculated Net Brand Reputation (NBR) scores for each brand based on sentiment analysis. Domestic Turkish electric vehicle brand TOGG emerged with the highest NBR score of +0.63, reflecting the positive perception of the public. TOGG's leading position in both sales and positive perception indicates successful market entry and consumer approval.

In contrast, Tesla ranked 5th in the NBR rankings with an NBR score of -18.91, despite being second in sales, indicating a significant amount of negative feedback. This discrepancy shows that although Tesla's presence in the market is strong, consumer experiences or expectations are not being fully met. Renault and Citroen brands have also faced significant consumer perception problems; NBR scores of -31.74 and -30.21, respectively, placed Renault in last place (10th) in the NBR rankings, although it ranked third in sales scores.

The analysis revealed an environment of varying consumer sentiment across different brands, with local brands such as TOGG performing better in consumer perception compared to established international brands.

Keyword frequency analysis highlights recurring themes in consumer reviews. Positive statements often include terms such as "good" and "innovation" and reflect appreciation for technological advances and design features. In negative comments, the expressions "range", "charging" and "expensive" were frequently used. This illustrates concerns about electric vehicle range limitations, charging infrastructure, and perceived high costs.

Karaarslan et al. (2021) study, similar to our study, emphasized the importance of consumer sentiment analysis for brands in terms of marketing and brand management. In addition, our article differs from this article as a more quantitative example. Karaarslan et al. (2021) study is more in the form of content analysis. The findings of our article found that there were more negative comments (59% negative, 41% positive) against electric vehicles in general. In this sense, it differs from the findings of the mentioned sample article. Karaarslan et al. (2021) study, found that there were more positive comments about the future of electric vehicles. This difference may indicate that consumer perception in Turkey has changed from 2021 to 2024 or that the brands studied are perceived differently.

Similar to the findings in Polatgil's (2024) study, the positivity of the comments about the TOGG brand in our article is also striking. In our study, an analysis was made on 10 brands, and Polatgil's 2024 study focused only on the TOGG brand. In terms of the results that our findings share, the biggest criticisms about electric vehicles in both studies are about "charging time", "range" and "high price". The common feature of negative comments is that they usually point to range anxiety and infrastructure deficiencies. Both articles emphasize how social media (especially YouTube comments) shapes brand perception. The result that consumers' comments directly affect the reputation of brands is also a common finding.

Based on the results of this study, our recommendations from different perspectives are as follows: Manufacturers should prioritize addressing the common negative emotions identified in the analysis. Improving perceived range and charging infrastructure can significantly increase consumer satisfaction. Transparent communication about battery life and charging options can ease concerns and build trust. There is a need to improve consumer education on the benefits and practical aspects of electric vehicles. Marketing campaigns should focus on the long-term cost savings, environmental benefits, and technological advancements of electric vehicles. Highlighting government incentives and an expanding pricing network can also help alleviate concerns about cost and convenience. Brands with a positive NBR, like TOGG, can leverage their local advantage by promoting national pride and local investment in their marketing strategies. In this case, it can strengthen brand loyalty and further improve public perception. Constant monitoring of social media and online comments is crucial to responding to consumer issues in a timely manner. Brands should actively engage with consumers on platforms like YouTube, directly addressing concerns and providing updates on product improvements and company initiatives. Prioritizing features that respond to common negative feedback, such as increasing the range capabilities of vehicles and reducing costs, with information obtained from sentiment analysis can better align product offerings with consumer expectations. Companies should benchmark against brands with higher NBR scores to determine best practices. Learning from competitors' strengths can provide actionable insights to improve brand reputation and customer satisfaction.

This study underlines the importance of integrating consumer feedback into strategic planning for electric car manufacturers in Türkiye. Addressing the highlighted concerns and capitalizing on the positives can drive better consumer perception and foster a more favorable market environment for electric vehicles.

## REFERENCES

- Ablak, E., & Sağlam, M. (2022). Reklamda ünlü kullanımının tüketici davranışsal niyetlerine etkisinde marka aşkı ve marka itibarının seri aracılık etkisi. *Gümüşhane Üniversitesi Sosyal Bilimler Dergisi*, 13(3), 1143-1160.
- Açıkgöz, F. Y., Kayakuş, M., Zābavā, B. Ş., & Kabas, O. (2024). Brand reputation and trust: The impact on customer satisfaction and loyalty for the hewlett-packard brand. *Sustainability*, 16(22), 9681. <https://doi.org/10.3390/su16229681>.
- Aguwa, C., Olya, M. H., & Monplaisir, L. (2017). Modeling of fuzzy-based voice of customer for business decision analytics. *Knowledge-Based Systems*, 125, 136-145. <https://doi.org/10.1016/j.knosys.2017.03.019>.
- Akpınar, H. (2014). *Data Veri Madenciliği Veri Analizi* (1. Baskı). Papatya Yayıncılık.
- Alshammari, Q., & Akyüz, S. (2024). Mental health on twitter in Turkey: Sentiment analysis with transformers. In: Allahviranloo, T., Hosseinzadeh Lotfi, F., Moghaddas, Z., Vaez-Ghasemi, M. (eds) *Decision Making in Healthcare Systems. Studies in Systems, Decision and Control*, 513. Springer, Cham. [https://doi.org/10.1007/978-3-031-46735-6\\_17](https://doi.org/10.1007/978-3-031-46735-6_17).
- Aydoğdu, H., & Sağtaş, S. (2023). Mobil yemek servis uygulamalarında kurumsal sosyal sorumluluk faaliyetlerinin tüketici satın alma niyetine etkisi: Marka itibarının aracılık rolü. *İşletme Araştırmaları Dergisi*, 15(3), 2195-2212. <https://doi.org/10.20491/isarder.2023.1706>.
- Aytekin, Ç. (2011), *Müşteri ilişkileri yönetimi için bloglar üzerinde fikir madenciliği*. Doktora Tezi, İstanbul, Marmara Üniversitesi Sosyal Bilimler Enstitüsü.
- Baker, M., & Wurgler, J. (2007). Investor sentiment in the stock market. *Journal of Economic Perspectives*, 21(2), 129-151.
- Bakır, N. O., & Safarzade, G. (2020). Marka itibarının daha fazla ödeme niyetine etkisi: Marka aşkının aracılık rolü ve Nike markası üzerine bir araştırma. *Sosyal Bilimler Dergisi*, 5(2), 149-172.
- Bloem, C. (2024, May 13). *Percent of people trust online reviews as much as friends*. Inc. <https://www.inc.com/craig-bloem/84-percent-of-people-trust-online-reviews-as-much-.html>
- Boztepe, E. B., Karakaya, B., Karasulu, B., & Ünlü, İ. (2022). An approach for audio-visual content understanding of video using multimodal deep learning methodology. *Sakarya University Journal of Computer and Information Sciences*, 5(2), 181-207. DOI: 10.35377/saucis.05.02.1139765.
- Ceron, A., Curini, L., Iacus, S. M., & Porro, G. (2014). Every tweet counts? How sentiment analysis of social media can improve our knowledge of citizens' political preferences with an application to Italy and France. *New Media & Society*, 16(2), 340-358. <https://doi.org/10.1177/1461444813480466>.
- Chevalier, J. A., & Mayzlin, D. (2006). The effect of word of mouth on sales: Online book reviews. *Journal of Marketing Research*, 43(3), 345-354. <https://doi.org/10.1509/jmkr.43.3.345>.
- Çalı, S., & Balaman, Ş. Y. (2019). Improved decisions for marketing, supply and purchasing: Mining big data through an integration of sentiment analysis and intuitionistic fuzzy multi criteria assessment. *Computers & Industrial Engineering*, 129, 315-332. <https://doi.org/10.1016/j.cie.2019.01.051>.
- Çelik, A., Göktaş, N., & Yıldız, E. (2025). A new perspective on social sustainability: examining Amazon workers' working conditions and protests applying computational methods in social sciences. *Discov Sustain*, 6(58), <https://doi.org/10.1007/s43621-024-00737-x>.
- Çelik, S., & Akdamar, E. (2018). Büyük veri ve veri görselleştirme. *Akademik Bakış Uluslararası Hakemli Sosyal Bilimler Dergisi*, (65), 253-264.
- Danielis, R., Rotaris, L., Giansoldati, M., & Scorrano, M. (2020). Drivers' preferences for electric cars in Italy. Evidence from a country with limited but growing electric car uptake. *Transportation Research Part A: Policy and Practice*, 137, 79-94. <https://doi.org/10.1016/j.tra.2020.04.004>
- De Chernatony, L. (1999). Brand management through narrowing the gap between brand identity and brand reputation. *Journal of Marketing Management*, 15(1-3), 157-179. <https://doi.org/10.1362/026725799784870432>
- Devlin, J., Chang, M. W., Lee, K., & Toutanova, K. (2018). Bert: Pre-training of deep bidirectional transformers for language understanding. *arXiv*, <https://doi.org/10.18653/v1/N19-1423>.

- Diker, E., & Koçyiğit, M. (2017). Halkla ilişkiler algısı ve marka itibarı arasındaki ilişkinin yapısal eşitlik modeli ile incelenmesi. *Gümüşhane Üniversitesi İletişim Fakültesi Elektronik Dergisi*, 5(2), 574-590.
- Ding, N., Prasad, K., & Lie, T. T. (2017). The electric vehicle: a review. *International Journal of Electric and Hybrid Vehicles*, 9(1), 49-66.
- Duan, J., & Gao, R. (2021). Research on college english teaching based on data mining technology. *EURASIP Journal on Wireless Communications and Networking*, 1-12. <https://doi.org/10.1186/s13638-021-02071-6>
- Durmaz, Y., & Ertürk, S. (2016). Marka uygulamaları ve önemi. *International Journal of Academic Value Studies*, 2(2), 82-93.
- Ehsani, M., Gao, Y., & Emadi, A. (2018). *Modern electric, hybrid electric, and fuel cell vehicles: Fundamentals, theory, and design*. CRC Press, Boca Raton, Third Edition, (E-Book).
- Engüllü B. (2018), Twitter sentiment analysis, Yüksek Lisans Tezi, İstanbul, Bahçeşehir Üniversitesi Fen Bilimleri Enstitüsü.
- Fan, Z. P., Che, Y. J., & Chen, Z. Y. (2017). Product sales forecasting using online reviews and historical sales data: A method combining the Bass model and sentiment analysis. *Journal of Business Research*, 74, 90-100. <https://doi.org/10.1016/j.jbusres.2017.01.010>.
- Fombrun, C. J. (1996). *Reputation: Realizing value from the corporate image*. Harvard Business School Press.
- Foroudi, P. (2019). Influence of brand signature, brand awereness, brand attitude, brand reputation on hotel industry's brand performance. *International Journal of Hospitality Management*, 76, 271-285. <https://doi.org/10.1016/j.ijhm.2018.05.016>.
- Garrido-Merchan, E. C., Gozalo-Brizuela, R., & Gonzalez-Carvajal, S. (2023). Comparing BERT against traditional machine learning models in text classification. *Journal of Computational and Cognitive Engineering*, 2(4), 352–356. <https://doi.org/10.47852/bonviewJCCE3202838>.
- Günther, H. O., Kannegiesser, M., & Autenrieb, N. (2015). The role of electric vehicles for supply chain sustainability in the automotive industry. *Journal of Cleaner Production*, 90, 220-233. <https://doi.org/10.1016/j.jclepro.2014.11.058>.
- Hajimiragha, A., Canzares, C.A., Fowler, M.W., & Elkamel, A. (2010). Optimal transition to plug-in hybrid electric vehicles in Ontario, Canada, considering the electricity-grid limitations, *IEEE Transactions on Industrial Electronics*, 57(2), 690-701. DOI: 10.1109/TIE.2009.2025711.
- Hofman, J. M., Watts, D. J., Athey, S., Garip, F., Griffiths, T. L., Kleinberg, J., ... & Yarkoni, T. (2021). Integrating explanation and prediction in computational social science. *Nature*, 595(7866), 181-188. <https://doi.org/10.1038/s41586-021-03659-0>.
- Hugging Face Services Documentation, (2024, May 23). *Hugging face*. <https://huggingface.co/docs>
- Juriscic, B., & Azevedo, A. (2011). Building customer-brand relationships in the mobile communications market: The role of brand tribalism and brand reputation. *Journal of Brand Management*, 18(4-5), 349-366. <https://doi.org/10.1057/bm.2010.37>.
- Kahya, A. N. (2021). Wikipedia'daki verilere metin madenciliği yöntemlerinin uygulanması. *Eskişehir Türk Dünyası Uygulama ve Araştırma Merkezi Bilişim Dergisi*, 2(1), 11-14.
- Karaarslan, M. H., Barın, A., & Bingöl, M. (2021). Türkiye'deki elektrikli otomobil markalarının pazarlama iletişimi kanalı olarak youtube gönderilerinin incelenmesi. *Uluslararası Bankacılık, Ekonomi ve Yönetim Araştırmaları Dergisi*, 4(2), 78-107. Doi: 10.52736/ubeyad.970255.
- Karapınar, D. Ç. (2018). Marka imajı ve itibarı oluşturmada halkla ilişkilerin rolü. *İnönü Üniversitesi İletişim Fakültesi Elektronik Dergisi (İNİF E-Dergi)*, 3(1), 127-141.
- Kaynar, O., Görmez, Y., Yıldız, M., & Albayrak, A. (2016). Makine öğrenmesi yöntemleri ile Duygu Analizi. *International Artificial Intelligence and Data Processing Symposium*, 17(18), 234-241.
- Knobloch, F., Hanssen, S. V., Lam, A., Pollitt, H., Salas, P., Chewpreecha, U., ... & Mercure, J. F. (2020). Net emission reductions from electric cars and heat pumps in 59 world regions over time. *Nature Sustainability*, 3(6), 437-447. <https://doi.org/10.1038/s41893-020-0488-7>.
- Koru, G. K., & Uluyol, Ç. (2024). *Detection of turkish fake news from tweets with BERT models*. IEEE Access.

- Köksal, Ö. (2021). Enhancing Turkish sentiment analysis using pre-trained language models. In *2021 29th Signal Processing and Communications Applications Conference (SIU)* (pp. 1-4). IEEE.
- Kumar, N., & Sathish, A. S. (2021). Understanding the influence of brand reputation and trust on loyalty: A mediated role of relationship. *PalArch's Journal of Archaeology of Egypt/Egyptology*, 17, 8441-8457.
- Lazer, D. M., Pentland, A., Watts, D. J., Aral, S., Athey, S., Contractor, N., ... & Wagner, C. (2020). Computational social science: Obstacles and opportunities. *Science*, 369(6507), 1060-1062. DOI: 10.1126/science.aaz8170.
- Lazer, D., Pentland, A., Adamic, L., Aral, S., Barabasi, A. L., Brewer, D., ... & Van Alstyne, M. (2009). Social science. Computational social science. *Science (New York, NY)*, 323(5915), 721-723. <https://doi.org/10.1126/science.1167742>.
- Liu, B. (2012). Sentiment analysis and opinion mining. *Synthesis Lectures on Human Language Technologies*, 5(1), 1-167. <https://doi.org/10.2200/S00416ED1V01Y201204HLT016>.
- Nandwani, P., & Verma, R. (2021). A review on sentiment analysis and emotion detection from text. *Social Network Analysis and Mining*, 11(1), 81. <https://doi.org/10.1007/s13278-021-00776-6>.
- O'Connor, B., Balasubramanyan, R., Routledge, B., & Smith, N. (2010). From tweets to polls: Linking text sentiment to public opinion time series. *Proceedings of the International AAAI Conference on Web and Social Media*, 4(1), 122-129. <https://doi.org/10.1609/icwsm.v4i1.14031>.
- Özbay, H., Közkurt, C., Dalcalı, A., & Tektaş, M. (2020). Geleceğin ulaşım tercihi: Elektrikli araçlar. *Akıllı Ulaşım Sistemleri ve Uygulamaları Dergisi*, 3(1), 34-50.
- Pandian, A. P. (2021). Performance evaluation and comparison using deep learning techniques in sentiment analysis. *Journal of Soft Computing Paradigm (JSCP)*, 3(2), 123-134. <https://doi.org/10.36548/jscp.2021.2.006>.
- Pang, B., & Lee, L. (2008). Opinion mining and sentiment analysis. *Foundations and Trends in Information Retrieval*, 2(1-2), 1-135. <https://doi.org/10.1561/15000000011>.
- Polatgil, M. (2024). TOGG otomobilleri youtube video yorumlarının duygu analizi ve makine öğrenme modeli ile incelenmesi. *Uluslararası Anadolu Sosyal Bilimler Dergisi*, 8(1), 15-35. <https://doi.org/10.47525/ulasbid.1398206>.
- Rahman, M. W. U., Shao, S., Satam, P., Hariri, S., Padilla, C., Taylor, Z., & Nevarez, C. (2022). A bert-based deep learning approach for reputation analysis in social media. In *2022 IEEE/ACS 19th International Conference on Computer Systems and Applications (AICCSA)* (pp. 1-8). IEEE.
- Rahmatulloh, A., Shofa, R. N., & Darmawan, I. (2021). Sentiment analysis of ojek online user satisfaction based on the naïve bayes and net brand reputation method. In *2021 9th International Conference on Information and Communication Technology (ICOICT)* (pp. 337-341). IEEE.
- Román, S. & Sanchez-Siles, L.M. (2018). Parents' choice criteria for infant food brands: A scale development and validation. *Food Quality and Preference*, 64(1), 1-10. <https://doi.org/10.1016/j.foodqual.2017.10.008>.
- Rust, R. T., Rand, W., Huang, M. H., Stephen, A. T., Brooks, G., & Chabuk, T. (2021). Real-time brand reputation tracking using social media. *Journal of Marketing*, 85(4), 21-43. <https://doi.org/10.1177/0022242921995173>.
- Seker, S. E. (2016). Duygu analizi (sentimental analysis). *YBS Ansiklopedi*, 3(3), 21-36.
- Sel, İ., & Hanbay, D. (2021). Ön eğitilmiş dil modelleri kullanarak türkçe tweetlerden cinsiyet tespiti, *Fırat Üniversitesi Mühendislik Bilimleri Dergisi*, 33(2), 675-684. <https://doi.org/10.35234/fumbd.929133>.
- Sevli, O., & Kemaloğlu, N. (2021). Olağandışı olaylar hakkındaki tweet'lerin gerçek ve gerçek dışı olarak google BERT modeli ile sınıflandırılması. *Veri Bilimi*, 4(1), 31-37.
- Shah, D. V., Cappella, J. N., & Neuman, W. R. (2015). Big data, digital media, and computational social science: Possibilities and perils. *The ANNALS of the American Academy of Political and Social Science*, 659(1), 6-13. <https://doi.org/10.1177/0002716215572084>.
- Shang, Y. (2022). Development of college english personalized learning support system based on data mining technology. In *2022 International Conference on Computation, Big-Data and Engineering (ICCBE)* (pp. 114-117). IEEE.

- Shapiro C. (1983). Premiums for high quality products as returns to reputations. *The Quarterly Journal of Economics*, 98(4), 659-679. <https://doi.org/10.2307/1881782>.
- Sharma, S. K., Daga, M., & Gemini, B. (2020). *Twitter sentiment analysis for brand reputation of smart phone companies in India*. In Proceedings of ICETIT 2019: Emerging Trends in Information Technology (pp. 841-852). Springer International Publishing.
- Singh, N. K., Tomar, D. S., & Sangaiah, A. K. (2020). Sentiment analysis: a review and comparative analysis over social media. *Journal of Ambient Intelligence and Humanized Computing*, 11(1), 97-117. <https://doi.org/10.1007/s12652-018-0862-8>.
- Şahinaslan, Ö., Dalyan, H., & Şahinaslan, E. (2022). Naive bayes sınıflandırıcısı kullanılarak youtube verileri üzerinden çok dilli duygu analizi. *Bilişim Teknolojileri Dergisi*, 15(2), 221-229. <https://doi.org/10.17671/gazibtd.999960>.
- Şallı, Ş. & Kurnaz, Z. (2023). Sosyal bilimlerde paradigma değişimleri ve bilişimsel/hesaplamalı sosyal bilimler yöntemleri. *Journal of Business and Communication Studies*, 2(1), 97-125. <http://dx.doi.org/10.29228/jobacs.70033>.
- Tindall, D., McLevey, J., Koop-Monteiro, Y., & Graham, A. (2022). Big data, computational social science, and other recent innovations in social network analysis. *Canadian Review of Sociology/Revue canadienne de sociologie*, 59(2), 271-288. <https://doi.org/10.1111/cars.12377>.
- Tokcaer, S. (2021). Türkçe metinlerde duygu analizi. *Yaşar Üniversitesi E-Dergisi*, 16(63), 1514-1534. <https://doi.org/10.19168/jyasar.928843>.
- Tuzcu, S. (2020). Çevrimiçi kullanıcı yorumlarının duygu analizi ile sınıflandırılması. *Eskişehir Türk Dünyası Uygulama ve Araştırma Merkezi Bilişim Dergisi*, 1(2), 1-5.
- Veloutsou, C., & Moutinho, L. (2009). Brand relationships through brand reputation and brand tribalism. *Journal of Business Research*, 62(3), 314-322. <https://doi.org/10.1016/j.jbusres.2008.05.010>.
- Vidya, N. A., Fanany, M. I., & Budi, I. (2015). Twitter sentiment to analyze net brand reputation of mobile phone providers. *Procedia Computer Science*, 72, 519-526. <https://doi.org/10.1016/j.procs.2015.12.159>.
- Vuong, T. K., & Bui, H. M. (2023). The role of corporate social responsibility activities in employees' perception of brand reputation and brand equity. *Case Studies in Chemical and Environmental Engineering*, 7, <https://doi.org/10.1016/j.cscee.2023.100313>.
- Wang, H., Can, D., Kazemzadeh, A., Bar, F., & Narayanan, S. (2012). A system for real-time twitter sentiment analysis of 2012 us presidential election cycle. *Proceedings of the ACL 2012 System Demonstrations*, 115-120.
- Wang, X., Li, B., Gerada, D., Huang, K., Stone, I., Worrall, S., & Yan, Y. (2022). A critical review on thermal management technologies for motors in electric cars. *Applied Thermal Engineering*, 201, <https://doi.org/10.1016/j.applthermaleng.2021.117758>.
- Yazdi, A., Ramachandran, S., Mohsenifard, H., Nawaser, K., Sasani, F., & Gharleghi, B. (2024). The Ebb and Flow of Brand Loyalty: A 28-Year Bibliometric and Content Analysis. *arXiv*, <https://doi.org/10.48550/arXiv.2402.13177>.
- Yıldırım, S. (2024, May 23). *savasy/bert-base-turkish-sentiment-cased*. Hugging face. <https://huggingface.co/savasy/bert-base-turkish-sentiment-cased>
- Yıldız, E., & Uzunçarşılı Soydaş, A. (2023). Kriz yönetiminde bir erken uyarı ve müdahale sistemi olarak yapay zekânın kullanımı. In N. E. Dilmen & Ç. Aytekin (Eds.), *Yapay zekâ ve iletişim* (pp. 63-88). Kriter Yayınları.