

# APPLICATION OF DATA ENVELOPMENT ANALYSIS IN MARKETING <sup>1</sup>

## PAZARLAMADA VERİ ZARFLAMA ANALİZİNİN UYGULANMASI

Ali TEHCİ <sup>2</sup>, Yusuf ERSOY <sup>3</sup>, Fuad SELAMZADE <sup>4</sup>

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<sup>2</sup>Doç. Dr., Ordu Üniversitesi, Fatsa Deniz Bilimleri Fakültesi, Denizcilik İşletmeleri Yönetimi Bölümü, a.tehci@odu.edu.tr, Orcid: 0000-0001-9949-2794

<sup>3</sup>Doç. Dr. Muş Alparslan Üniversitesi, Malazgirt Meslek Yüksekokulu, Finans Bankacılık ve Sigortacılık Bölümü, y.ersoy@alparslan.edu.tr, Orcid: 0000-0002-0106-1695

<sup>4</sup>Doç. Dr. Muş Alparslan Üniversitesi, Sağlık Bilimleri Fakültesi, Sağlık Yönetimi Bölümü, f.salamov[at]alparslan.edu.tr, Orcid:0000-0002-2436-8948

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### ÖZET

Müşteri odaklı yaklaşımın hakim olduğu rekabetçi bir ortamda, kuruluşların pazarlama departmanlarına kaynak ayırmaları gerekmektedir. Bu nedenle, pazarlama departmanlarının performans değerlendirmeleri yaparak kaynaklarını etkili ve verimli bir şekilde kullanmaları önemlidir. Performans değerlendirmesinde Veri Zarflama Analizi (VZA) yöntemi yaygın olarak kullanılmaktadır. Bu nedenle, mevcut çalışma Web of Science veri tabanında pazarlama sektöründe VZA yöntemi kullanılarak yapılan çalışmaları inceleyerek bütünsel bir bakış açısı sunmayı amaçlamaktadır. Öneriler, ilgili alandaki çalışmaların sürdürülebilirlik hedefleriyle uyumludur. Ortak varlık anahtar kelime analizi sonucunda sosyal medya, sosyal paylaşım platformları, reklamcılık ve sürdürülebilir eğitim konuları dikkat çekmektedir. Çalışmaların en temel sürdürülebilirlik hedefi, sektör inovasyonu ve altyapı olarak belirlenmiştir. İlgili alandaki mevcut çalışmaların inovasyon ve sosyal medya ile ilgili olduğu söylenebilir.

### ABSTRACT

In a competitive environment where a customer-focused approach prevails, organizations must allocate resources to their marketing departments. Therefore, it is essential for organizations to use their resources effectively and efficiently by conducting performance evaluations of their marketing departments. The Data Envelopment Analysis (DEA) method is widely recognized for its effectiveness in performance evaluation. This study aims to provide a holistic perspective by examining research conducted using the DEA method within the marketing industry, as indexed in the Web of Science database. The findings align with the sustainability objectives of studies in this field. Through a common entity keyword analysis, topics such as social media, social sharing platforms, advertising, and sustainable education emerge as significant areas of interest. The primary sustainability goal identified in the studies is Industry Innovation and Infrastructure. It can be concluded that current research in this area is closely related to innovation and social media.

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**M**arketing is an essential business function that addresses the needs and desires of customers while ensuring their satisfaction. While goods and services provide the desired benefits for consumers, marketers interpret these benefits as product designs that align with consumer expectations and characteristics (Altunışık et al., 2012). Within the framework of modern marketing, this function also includes the marketing of goods, services, and ideas. The contemporary concept of customer-oriented marketing focuses on fulfilling human demands and needs, representing a business activity that must profitably meet customer requirements by offering compelling value propositions (Tek, 2013). Businesses facing numerous challenges must use their resources effectively and efficiently to sustain their operations. Optimal resource allocation for companies operating in both national and global markets will enable them to maintain their market shares and explore new market opportunities (Cenger and Poyraz, 2019). Marketing activities aim to generate income indirectly by creating value for consumers. Therefore, organizations must conduct performance evaluations and utilize their limited resources effectively and efficiently.

Performance, a fundamental concept in contemporary understanding (Erciş, 2009), can be defined as an indicator of an organization's success over a certain period. A quality-oriented approach necessitates the effective use of resources. Methods for measuring marketing effectiveness indicate that its function is closely linked to the overall performance of the business (Rust et al., 2004). Given that a customer-oriented approach often requires increased marketing expenditures, the marketing department is a unit that necessitates adequate resource allocation (Halim, 2010). It is crucial to assess how effectively marketing expenditures produce results, specifically to what extent marketing objectives are achieved based on selected marketing investments. Marketing effectiveness, defined as the optimal execution of marketing activities with the best input-output ratio, is intricately connected to the financial performance of the company (Çitak, 2015). In this context, effectiveness measurement serves as a guiding tool for organizations, providing a framework that accurately represents the roles of resources in the input-output process (Sehil and Tepeli, 2024).

In the literature, the Data Envelopment Analysis (DEA) method is used for measuring efficiency. Numerous studies have applied the DEA method across various fields (Emrouznejad and Yang, 2018; Ersoy, 2021; Selamzade et al., 2023; Ersoy and Tehci, 2024). Consequently, the current study aims to contribute to the literature by providing a comprehensive review of articles in the field of marketing that employ the DEA method, as indexed in the Web of Science (WoS) database. There are several studies in the literature that utilize bibliometric analysis of research conducted using the DEA method (Yu and He, 2020; Peykani et al., 2021; Cikovic et al., 2022; Sıcaköz, 2023; Ahmad and Nana Khurizan, 2024; Maral, 2024; Tripathy et al., 2024). This study distinguishes itself from others by focusing specifically on the field of marketing. Research in marketing is typically conducted using quantitative methods, particularly surveys, to analyze internal and external customer behavior. Consequently, studies conducted with the DEA method are relatively scarce. However, understanding the effectiveness of organizations is crucial for assessing marketing performance. Therefore, it is believed that addressing the research questions posed in this study will make a valuable contribution to the existing literature. The primary research question of the current study is as follows: What are the fundamental bibliometric characteristics of studies conducted using the DEA method in the marketing sector, as indexed in the WoS database, and what foundational insights have emerged in the literature?

The remainder of the study is organized as follows: The second section presents the study includes the DEA method. The third section outlines the materials and methods employed in the research. The fourth section details the research findings. Finally, the fifth section offers a comprehensive evaluation of the study.

## 1. DATA ENVELOPMENT ANALYSIS

DEA is a non-parametric analysis method that provides the opportunity to measure the relative efficiency of decision-making units. It is used to calculate the relative effectiveness of decision-making units with common features and similar purposes (Gedik, et al., 2017). In this method, since input and output are the factors that will determine the efficiency score, great care is taken when selecting the variables. The method is frequently used in different sectors with different input/output variables (Chandra et al., 1998; Ersoy and Tehci, 2020; Rella et al., 2024). The basis of DEA is Farrell's (Farrell, 1957), theoretical approach to determining performance efficiency. While the CCR model, which is based on constant variable returns to scale, consists of the initials of authors named Charnes, Cooper, and Rhodes, the BCC model, which is based on variable returns to scale, consists of the initials of authors named Banker, Charnes, and Rhodes (Cook and Seiford, 2009; Doğan and Ersoy, 2018; Ersoy and Tehci, 2024).

In the DEA method, the efficiency scores obtained by decision-making units as a result of producing more than one input and more than one output are evaluated (Selamzade et al., 2023). The DEA method, which was previously used to measure the effectiveness of non-profit organizations, continues to be widely used to measure the effectiveness of for-profit organizations (Okursoy and Özdemir, 2015; Doğan and Ersoy, 2018). The DEA method has many different application areas such as construction, energy, banking, agriculture, healthcare and logistics (Emrouznejad and Yang, 2018; Selamzade and Baghirov, 2022a; Selamzade and Baghirov, 2022b; Ersoy and Küsbeci, 2023; İmren Karaosmanoğlu et al., 2023; Ersoy and Tehci, 2023; Kolahdoozi et al., 2024; Zubir et al., 2024; Ersoy and Tehci, 2024; Hassan Shah et al., 2024; Boakye et al., 2024; Yu and Rakshit, 2025).

## 2. MATERIALS AND METHOD

The bibliometric analysis method, which involves quantitative research on a specific theme, enhances our understanding of the information. Consequently, this study conducted a quantitative analysis of the literature using the bibliometric analysis method. Specifically, articles in the WoS database that employed the DEA method in the field of marketing were examined. Keyword analysis was performed using VOSviewer, a software program that reveals the strength of relationships and distances between items (Van and Waltman, 2010). Relevant data were obtained from WoS, the largest database of scientific literature. To access the information in the database, the Boolean operator "and" search method, which combines the keywords "Marketing" and "Data Envelopment Analysis (author keywords = "Marketing" and abstract = "Data Envelopment Analysis"). The search criteria were not limited to any specific time period. WoS is a globally recognized multidisciplinary database and was selected for the data in this study; therefore, other databases were excluded from consideration. While this limitation may affect the study, it provides valuable insights for future research. As a result, a total of 36 studies were identified, comprising 26 articles and 10 conference proceedings, to be included in the review.

## 3. RESULTS AND DISCUSSION

Within the scope of this research, a descriptive statistical analysis of the number of publications by country was conducted. It was determined that there are publications from 20 countries. The country with the highest number of publications in the relevant field is China, with 21 publications, followed by Taiwan with 7 and the United States with 6. An examination of the WoS categories reveals that the fields with the most publications are Management (15), Operations Research and Management Science (14), and Business (9). Of these publications, 35 were written in English and 1 in Chinese. In terms of WoS indexes, the majority fall under the Social Sciences Citation Index (16) and the Science Citation Index Expanded (14). The annual distribution of the studies is illustrated in Figure 1.

**Figure 1.** Annual Distribution



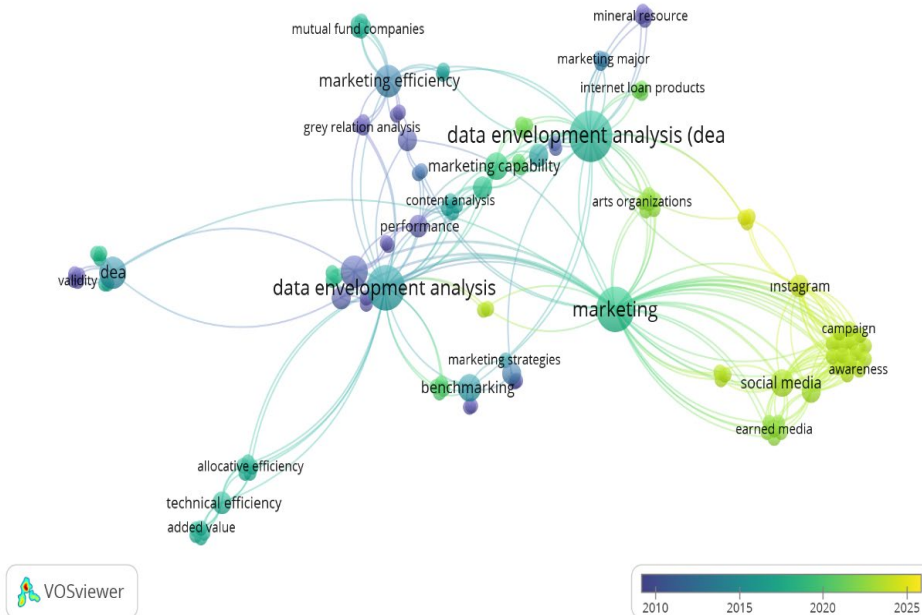
Figure 1 illustrates that studies utilizing the DEA method in the field of marketing began in 2004. Although there appears to be an increasing trend in recent years, drawing definitive conclusions on this topic is challenging due to the limited number of studies in the relevant area. It can be observed that research output in this field fluctuates over time. In bibliometric analyses, the WoS database also provides subject headings related to the sustainability objectives of the studies. Consequently, the primary sustainability objective for the current research was identified as "Industrial Innovation and Infrastructure. word clouds visually represent the most frequently used terms in related research. In this context, word clouds are crucial for effectively presenting the themes of related studies. The frequency of a word's appearance in research texts determines its size in the visual representation; the more frequently a word appears, the larger it appears in the design. The word cloud corresponding to the sustainable development goal is shown in Figure 3.

Figure 2. Sustainable Development Goal Word Cloud



Within the scope of this research, a data visualization technique was employed for keyword analysis, enabling the evaluation of studies that contribute to the field of marketing through the DEA method. In this context, VOSviewer was utilized to create a network structure that illustrates the relationships between keywords, highlighting their strengths and research trends. This network map, which combines similar colors to represent related keywords, is presented in Figure 3.

Figure 3. Keywords Network Visualization



The minimum number of occurrences for keywords in the relevant field was determined as 1, and a total of 158 keywords. Irrelevant keywords, such as country names, were excluded from the analysis. Consequently, 128 keywords were retained for further examination. In Figure 3, the size of the circles represents the most discussed topics. Notably, a cluster has emerged in the yellow areas following 2020, indicating that recent studies on DEA and marketing have increasingly focused on social networking sites. Based on the size of the environment and the number of connections, the keywords sharing platforms, and were analyzed alongside other relevant clusters within the domains of marketing and DEA.

#### 4. CONCLUSION

Organizations must align their actions with the demands and needs of customers in the market while developing their products and services accordingly. To achieve this, marketing activities that continuously adapt to contemporary developments play a crucial role. The modern marketing approach necessitates that organizations allocate resources to relevant departments to satisfy both internal and external customers. In order for organizations to sustain their activities, they must utilize resources effectively and efficiently. Therefore, businesses need to conduct thorough performance evaluations that assist them in making and implementing informed decisions. The DEA method, which enables the assessment of units that use their processes effectively versus those that do not, is one of the most widely employed techniques for measuring productivity in the literature. However, there is a limited number of studies examining marketing through the lens of DEA. This research distinguishes itself from other studies in this regard. Future research could explore the integration of the DEA method with multi-criteria decision-making approaches as a potential area of investigation. Additionally, specific subfields of marketing, such as e-commerce, may serve as valuable topics for focused studies. Furthermore, conducting research by exploring other databases could yield significant insights. Analyzing publications indexed by Scopus, a prominent international database, alongside ULAKBİM, a national database, is anticipated to provide a more comprehensive framework for the relevant field.

#### AUTHOR DECLARATIONS

**Declarations of Research and Publication Ethics:** This study has been prepared in accordance with the rules of scientific research and publication ethics.

**Ethics Committee Approval:** This research does not require ethics committee approval as it does not include analyzes that require ethics committee permission.

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