Scientific
Research
Publishing

Utilization of DSS to the Promotion and Conclusion of Charters in the Shipping and Supply Chain Context

Foteini Kontogiorgou[1], Damianos P. Sakas[2], Nikolaos T. Giannakopoulos[2], Nikos Kanellos[2], Christos Christopoulos[3]

[1]Department of Supply Chain Systems Management, Agricultural University of Athens, Athens, Greece
[2]BICTEVAC LABORATORY—Business Information and Communication Technologies in Value Chains Laboratory, Department of Agribusiness and Supply Chain Management, School of Applied Economics and Social Sciences, Agricultural University of Athens, Athens, Greece
[3]Global Operations Transformation & Excellence, Swissport International Ltd., Zurich, Switzerland
Email: n.giannakopoulos@aua.gr

Abstract

In recent times, the importance of shipping services has been rapidly increasing. As a consequence, shipping companies seek to capitalize on every available strategy and opportunity to promote their services and manage to promote and conclude charters. This highlights the role of digital marketing and the utilization of customer data originating from corporate websites. Moreover, to this aim, shipping companies can utilize various Decision Support Systems (DSSs) available, based on their corporate goals. This research focused on gathering big data from the web pages of the 5 largest shipping companies in the worldwide economic context, which were analyzed by utilizing various DSSs to evaluate their effect on the performance of the shipping firms. The collected data were elaborated through statistical analyses (correlation and linear regression), and their coefficients were used as inputs for the deployed Fuzzy Cognitive Mapping (FCM) DSS model. As a result, from the utilization of the DSS with the website analytical data from the shipping companies, the authors found that it is essential for these firms to reduce the bounce rate of their website customers and visitors in order to enhance their ranking in search engines. Thus, by ranking higher in their customers' search engine results, shipping companies would be able to promote and conclude more charters. The role of DSSs in this goal of shipping companies is highlighted by this study as a determinant.

Keywords

Supply Chain, Shipping Companies, Digital Marketing, Charters, Fuzzy

Cognitive Maps (FCM), Decision Support Systems (DSS)

1. Introduction

1.1. Management Information Systems (MIS)

Information systems are extensively used for decision-making, facilitating communication, maintaining records, and achieving higher productivity than the system they are used in. Transactions are now conducted without paper, while checks and cash are converted into electronic checks and digital currency. Simultaneously, new functions are implemented in businesses, such as online business processes, secure payment procedures, and remote business management from anywhere outside the office or organization (remote work, telecommuting). All these radical and scalable changes have influenced the way and modern conditions of work. Management processes are now distinguished by speed, accuracy, and business operations are supported through information technology (Goes, 2014).

An information system requires at least one person capable of addressing a proven problem within an organizational framework, aiming to solve the supporting evidence made available through some presentation methods. The aforementioned process defines the basic variables that constitute a Management Information System (MIS) (Peffers et al., 2007). The approach to management information systems, in combination with the ability to effectively participate in the analysis, design, implementation, and use of computer-based information systems, is necessary. Successful managers must manage efficiently, making correct decisions based on valid, relevant, up-to-date, and organized information. Whether it is an issue that is highly significant and complex or something simple and routine, all decisions must be based on information that should be available to decision-makers (O'Brien & Marakas, 2007).

The basic characteristics of information systems are described as follows: 1) they contribute to decision-making through "intelligent" information support; 2) their implementation supports coordination efforts without unnecessary delays; 3) they improve information processing and the assessment of complex situations; 4) they contribute to result extraction through various methods (DeLone & McLean, 2003). Information systems include customer relationship management, operational planning systems, and decision support systems (DeLone & McLean, 2003).

The Management Information System (MIS) begins and ends with the marketing manager. The system starts by assessing the merchant's information needs and then uses a combination of sources to create the required information. These sources include internal databases, marketing intelligence, marketing analysis, and marketing research. All generated information is analyzed to be effectively distributed to the marketing manager in the correct format and at the

appropriate time to assist in planning, implementation, and control. Additionally, information originates from the marketing environment, and after analysis, the marketing environment is influenced once again by marketing decisions (DeLone & McLean, 2003).

The Decision Support System (DSS) is a software system that aids the decision-making process by helping decision-makers understand the implications of their decisions. It is a comprehensive system of computational tools with an interactive, rule-based operating environment. It also provides capabilities for organizing and processing data and information through databases and geographic information systems. Additionally, it offers computational tools for system analysis. Ultimately, it is designed to assist decision-makers in relatively complex and unstructured problems by formulating and thoroughly examining a series of alternative options (Klaus et al., 2000).

1.2. MIS in Shipping Context

Due to the international nature of the shipping industry and intense competition to enter new markets and countries, the use of management information systems is inevitable. The presence of new countries entails more complexity with uncontrollable factors, as well as the needs and desires of new customers. To anticipate the response of shipments to market demands and marketing mix, traders must turn to management information systems. Additionally, shipping companies need to differentiate their services from competitors and focus on branding and sales promotion. Therefore, feedback in the form of management information systems is required to assess the effectiveness of marketing tools. Traders require information that allows them to segment the market and target those segments most suitable for achieving marketing goals (Jacob et al., 2003).

Therefore, shipping lines must organize and distribute a continuous flow of information to their marketing managers. To achieve this, a marketing information system is designed, consisting of appropriate personnel, equipment, and suitable information dissemination processes, such as data gathering, classification, analysis, evaluation, and timely distribution of necessary, valid, and reliable information to decision-makers in marketing (Elbert et al., 2017).

1.3. Importance of MIS for Supply Chain Firms

Information systems are one of the fundamental tools available to businesses to achieve operational excellence, develop new products and services, improve decision-making, and gain competitive advantage, which is considered one of the most essential achievements for a business (Dröge & Germain, 1991). Supply chain management information systems are necessary for the following reasons:

- They are distinguished by providing highly reliable information. Information resources are essential for the functioning of a business. Since there is often uncertainty regarding the ownership of products in supply chain management, it relies on the personal understanding of management personnel re-

garding relevant information to decide how to handle specific reverse supply chain products. In short, the fundamental element of reverse supply chain management is the information system.

- They have a high data maintenance complexity. Data deletion is not time-based. Instead, data can vary as products change, contributing to an increase in data maintenance complexity.
- They have a broad period of monitoring. In supply chain management information systems, the period of information covers the entire product lifecycle, which is also the basis of a circular economy. Within the product lifecycle, many products have lifespans of over ten years or even several decades.
- Differentiation of recording properties. In supply chain management information systems, the properties of recorded products differ and are closely linked to the types of products. The ultimate goals are resource recycling and product reuse (backflow).
- The issues concerning product information vary significantly in supply chain management information systems, as apart from factory information, product information mainly encompasses transportation, distribution, retail trade, and consumers, which constitute the lowest level of the supply chain. Therefore, many details about products, especially concerning customers, differ in their respective positions and are not collected at all (Dröge & Germain, 1991).

The results of implementing Logistics Management Information Systems (LMIS) are that it enhances the impact of the program at all levels of the supply chain, thereby maintaining the availability of goods. It also improves the accessibility of community services, enhances the quality of care, increases professional satisfaction, and boosts morale. Furthermore, the motivation of the staff is more likely to lead to higher service quality, better performance, and increased efficiency.

1.4. Web Analytics

Web Analytics is the methodological study of patterns and trends on the internet. It is a technique that can be used for collecting, measuring, reporting, and analyzing website data. Typically, it is carried out to analyze the performance of a website and optimize internet usage. Analytical web data is used to monitor key metrics and analyze visitor activity and traffic flow. It is a systematic approach to data collection and reporting (Saura et al., 2017). There are at least two basic categories of web analytics: "off-site web analytics" and "on-site web analytics."

- Off-Site Web Analytics: It refers to the measurement and analysis of web data, regardless of whether a person owns or maintains a website. It includes measuring the potential audience of a website (opportunity), its share of voice (visibility), and the discussions happening about it across the internet as a whole.
- On-Site Web Analytics: The more common of the two, on-site web analytics

measure the behavior of visitors once they are on a specific website. This includes tracking drivers and conversions. For example, it examines how different destination pages are associated with online purchases. On-site web analytics assess the performance of a specific website in a commercial context. This data is often compared to key performance indicators and used to improve the website's audience response or marketing campaigns.

The most widely used on-site web analytics service is Google Analytics, although new tools with additional information layers are emerging, including heatmaps and session replays (Arashpour et al., 2016).

1.5. Digital Marketing

Over 3 billion people worldwide regularly use the Internet to find products, entertainment, and even friends (Ortiz-Ospina, 2019). Consumer behavior and the way companies engage both consumers and businesses have changed dramatically. To achieve these goals, organizations need marketers, specialized strategies, and agencies with up-to-date knowledge on how to implement digital media such as the Internet, email, mobile, and interactive television (Chaffey & Ellis-Chadwick, 2019).

The Digital Marketing Institute defines digital marketing as "the use of digital technologies to create an integrated, targeted, and measurable communication that helps acquire and retain customers while building deeper relationships with them". It is widely used for promoting products or services and approaching consumers through digital channels. Additionally, digital marketing involves the use of technologies to support marketing activities and enhance customer knowledge by catering to their needs. For businesses to be successful, they must merge online and traditional methods to better meet customer needs. This indicates the need for a stronger implementation of digital marketing in markets where it is not yet heavily developed. In recent years, in the realm of digital marketing, Search Engine Optimization (SEO), Search Engine Marketing (SEM), and website promotion, in general, have become integral parts of their strategies. They represent some of the most crucial tools for showcasing a company's products and services on the web as a whole (Cho & Lee, 2018).

1.5.1. What Is Search Engine Optimization (SEO)?

SEO is an acronym for Search Engine Optimization, which is the process of optimizing a website to rank it as high as possible in the organic (non-paid) search engine results (SERPs). Long-term, continuous improvement of content and digital elements is carried out to achieve a higher ranking on search engine pages. The easiest way to find a website is through search engines, using specific words or phrases known as keywords. These keywords can be the name of a company, a category of services, a specific product, etc. The results provided by search engines can vary from a few thousand to many million web pages related to the searched keyword or phrase. At the top of the results, the websites with the greatest relevance to the specific keyword or phrase are displayed (Cui & Hu,

2011).

SEO is essential for the sustainability and prosperity of a business. Especially today, where 70% of global transactions take place over the Internet. Every day, millions of searches are conducted to purchase goods. Companies that manage to appear within the top ten (10) results of search engines have a much higher likelihood of turning some of these searchers into their customers (Setiawan et al., 2020).

First of all, SEO significantly increases the website's visibility. By targeting relevant users who are genuinely interested in the website's content through the use of appropriate keywords, titles, meta tags, and meta descriptions, the goal is to achieve a high click-through rate (CTR) or the ratio of clicks to impressions. This means attracting users who are more likely to visit the website and engage with its content.

Moreover, SEO is beneficial in terms of return on investment (ROI). While the cost of optimizing a website may not be negligible, it is much smaller compared to the financial benefits it can bring to a business. This includes the potential increase in customer base and sales, making it a worthwhile investment for the overall performance of the business.

Furthermore, SEO enhances the usability of the website. During the process of optimizing a website for search engines, numerous corrections and improvements are made. This not only benefits search engines but also benefits the users. By improving the website's structure and content, it becomes more user-friendly, providing a better experience for visitors.

Additionally, SEO creates a stronger brand name by achieving higher rankings in organic search results, resulting in a much higher volume of visits. This leads to greater exposure and visibility of the brand and its services. As more pages rank higher on search engines, there is an increased likelihood of users seeing the website's content and engaging with the brand.

In conclusion, the more pages that rank high in search engines, the greater the chances for users to view the website's content and collaborate with the brand. This, in turn, results in higher exposure and a better representation of the brand and its services, making SEO a crucial aspect of a business's success and growth (Ferraz, 2017).

1.5.2. Search Engine Marketing (SEO)

Search Engine Marketing (SEM) is the practice of marketing a business using paid advertisements that appear on Search Engine Results Pages (SERPs). Advertisers bid on keywords that users might enter when searching for specific products or services, which allows the advertiser to have their ads displayed alongside the results of those search queries (Boughton, 2005).

Keywords are the foundation of Search Engine Marketing. As users input keywords as part of their search queries into search engines to find what they are looking for, it is no surprise that keywords form the basis of search engine marketing as an advertising strategy. These advertisements are often known as

"pay-per-click" ads and come in various formats. Some are small text-based ads, while others, such as Product Listing Ads (PLAs), also known as Shopping ads, are more visual product-based ads that allow consumers to see essential information at a glance, such as price and reviews.

One of the most significant benefits of Search Engine Marketing (SEM) is that it offers advertisers the opportunity to reach motivated customers who are ready to purchase at the precise moment they are searching. No other advertising medium can achieve this, which is why SEM is such an effective and powerful way to grow a business. SEM is one of the most effective methods of business growth in an increasingly competitive market. With millions of businesses competing for the same audience, it is crucial for a business to advertise online, and SEM is the most efficient way to promote products and grow the business. Paid search helps the business appear on search engine results for queries related to the business, enabling it to drive visitors to the company's website, generate potential customers, and increase brand recognition (Terrance et al., 2017).

1.6. Research Gap

Tracking customer preferences and searches is becoming increasingly difficult, which is why companies are constantly struggling and competing to achieve optimal multichannel marketing activities. Shipping industry customers are constantly seeking personalized advertising, which they see as the basis for a huge change in consumer behavior. The most important thing for a consumer is to feel loyal to the brand they have chosen and not just to buy a product or service (Lipsman et al., 2012). In conclusion, it is necessary to develop a strong enough and strategic approach that is more personalized than ever and contributes to the most effective digital transformation (Lipsman et al., 2012).

With the development of technology, consumer behavior has accelerated to more digital services, resulting in a considerable increase in their expectations for personalized experiences (Barrutia & Gilsanz, 2013). Indeed, a number of variables, including applied innovation to the customer, the Internet experience, and the advertising channel experience, contribute significantly to the progress of customer experience management, taking the customer experience to the next level. Many innovative processes such as mobile applications and the use of virtual reality help to make access to shipping websites more accessible and friendly for the user, thus promoting customer experience levels and creating a "bridge" with branding (Lavrentieva, 2020). The revolution in digital marketing lies in the personalization of advertising as the basis for customer loyalty to brands (Bala & Verma, 2018). The increase in customer conversions has now eclipsed the old and traditional approaches to advertising by companies, as customized advertising has become more powerful and more responsive to customer expectations (Abdel, 2021).

A very important tool for the efforts of advertising professionals is the Ad-Net-Zero report which is designed to support branding campaigns (Hartmann et al., 2022). A very interesting work was recently published by Polman & Wins-

ton (2021). The results of the research conducted in this thesis will contribute to the aims of this research, where the authors argue that what drives companies to grow is the use of a holistic, sustainable approach, from maximizing benefits for products, services and influence employees, consumers, suppliers, communities and more. It is a tactic that affects both consumers and owners of shipping websites (Ahmed et al., 2019).

A very important question is how shipping companies can not only collect but also analyze data properly in favor of personalization in order to achieve an effective multi-channel marketing strategy. So, it is not enough for personalized advertising to simply shape e-commerce in the future, companies themselves need to act in a more targeted way. According to several studies, which have been dedicated to the effectiveness of digital marketing on the topic of advertising activities, the personalization of e-commerce requires the collection of a large amount of data (Tran et al., 2020). Multi-channel commerce depends on the market environment; however, it is not yet expanded how multi-channel shoppers react to different online platforms and how digital advertising messages could be better processed for potential customers (Lee & Cho, 2019).

2. Materials and Methods

In this study, an innovative methodology is applied to evaluate the impacts of multi-channel digital marketing on the digital reputation of maritime businesses and the increase in user engagement. This approach has been developed because raw, unprocessed large-scale data, unlike other research methodologies such as quantitative surveys, is not influenced by any possible cognitive bias (Rao et al., 2018).

The methodology consists of four stages. In the first stage, contemporary international literature focusing on relevant issues in related industries was studied. Using this method, research gaps were identified, which will be addressed in this study by collecting research data from the global maritime market.

In the second stage, after identifying the research gaps, we identified the metrics that will act as independent variables in investigating the issues that were raised. Using this method, we formulated three hypotheses that will contribute to solving the central problem.

In the third stage, we identified the large datasets extracted from a website analytics study, analyzing five maritime businesses. These data were statistically analyzed, providing descriptive statistics and exploring their correlations.

In the fourth stage, an ambiguous cognitive map was developed to depict cause-and-effect relationships and present the approaches to business risk analysis, achieving resource allocation optimization (Giabbanelli et al., 2017).

2.1. Research Methodology

This research was conducted using reliable software, SEMrush, which provides comprehensive data research for the analysis and utilization of information sys-

tems in the promotion and contracting of charters. It is well-known that trends in social media and consequently corporate websites are constantly changing, as they are influenced by user behavior and the satisfaction of customer preferences, leading to the necessity of continuous adjustments in the new digital landscape (Anna Rickman & Cosenza, 2007). The shipping companies that are included in our research are Maersk, MSC, COSCO, CMA CGM, and Evergreen, and were selected based on their shipping tonnage, total market share, and number of ships owned (Companies Market Cap, 2023; Marine Digital, 2020), as seen in Table 1.

Companies seeking to target their audience and achieve positive results are constantly searching for suitable methods, and one of them is leveraging the reputation of social media (Yan, 2011). A fundamental step in developing and succeeding in an omnichannel marketing strategy is creating detailed user preferences, which is one of the greatest corporate challenges. The way a business climbs is determined by its visitation determined by the channels it uses. Social media platforms and websites play a significant role as they enhance sales opportunities and brand communication, becoming essential business tools. Consequently, they lead to acquiring new followers and influencing them (Hallikainen, 2015).

Brand communication occurs every time a potential customer or client interacts with a specific brand name. It contributes to recognizing a corporate logo on the internet or signing up for a newsletter. Developing a consistent brand name will make all communication methods more effective. The reason they participate in our research methodology is that, despite the numerous points of search and contact available today, consumers choose to use and spend more time on the internet. Many pieces of information they seek are scattered across various platforms. With this in mind, businesses are increasingly struggling to find solutions and approach all marketing activities. The research conducted aims to understand whether consumers are now able to distinguish and select companies that have invested in optimizing their brand name and are not just user-friendly.

Table 1. Analysis of 5 largest shipping companies in 2022.

Shipping Companies	TEU capacity	Total market share	Number of ships owned
Maersk	4.10 m	16.90%	705
MSC	3.80 m	16.00%	579
COSCO	3.10 m	12.50%	503
CMA CGM	2.70 m	12.50%	570
Evergreen	1.67 m	6.21%	195

Sources:
https://companiesmarketcap.com/container-shipping/largest-companies-by-market-cap/
and https://marine-digital.com/article_15biggest_shipping_companies.

Web Analytics is used to evaluate the success rate of a website and its related business. The analytical data of the web was collected from the websites under examination and analyzed quantitatively, forming the key performance indicators (KPIs). The KPIs of web analytics are used to analyze user activity on maritime websites and the behavior of users on social media platforms, and they have been gathered from Semrush (2023), as seen in Table 2.

2.2. Research Hypotheses

For the deployment of the present research, the authors settled the following research hypotheses, based on the referred literature review, aims of the study, and research methodology:

H1: The ranking of maritime companies on the internet (global rank) is influenced by the bounce rate of their website visitors. Advertising campaigns, especially off-site campaigns, aim to redirect visitors, for example, from social media to the dominant digital tool, which is the website. Creating attractive advertisements may captivate visitors with the advertisement but not necessarily encourage them to

Table 2. Web Analytics KPIs.

WA KPIs	Description of the WA KPIs
Social media traffic	Social media platforms that users use after seeing an advertisement or links end up on the company's website.
Organic traffic visitors	Visitors who land on the company's website using a search engine.
New visitors	New visitors are those who navigate to the website for the first time on a specific device.
Global rank	The combination of total platform traffic (organic, social, and paid visits) and user engagement metrics (pages/visits, average time on site).
Websites' Average Time on Site	Average time spent by users on a website per visit.
Times spent	Calculates the total number of pages displayed to each user when they enter a shipping website.
Websites' Total Visits	Counts how many users visit a website each day.
Repeat users	The total number of returning visitors who visit the website.
Websites' Bounce Rate	The percentage of website users who visit a page and ultimately leave the website without reading a second page.
Websites' Paid Traffic	Created through pay-per-click methods, such as paid advertising, a user in a Google search clicks on the shipping website after an advertisement.
Google ranking	Google ranking is an algorithm for measuring the relative relevance, quality, and significance of results on a shipping website.

Source: https://www.semrush.com/.

purchase the product or service offered by the website. This results in a high bounce rate, meaning visitors leave the website without taking further action. As a consequence, the company's ranking on search engines may decrease.

H2: The ranking of maritime companies on the internet (global rank) is influenced by the average number of pages viewed by visitors on their website. It is expected that website visitors, seeking complete information, will navigate through multiple pages. This extensive exploration of the website is recorded by search engine crawlers, which subsequently boosts the website's ranking.

H3: The ranking of maritime companies on the internet (global rank) is influenced by the average time visitors spend on their websites. The time visitors spend on the company's website has an ambiguous value if the visitation is static, it is presumed that the impact on the website's ranking on search engines is not positive.

H4: The ranking of maritime companies on the internet (global rank) is influenced by the number of new visitors their website receives. Acquiring new visitors is considerably more expensive than retaining returning visitors who frequently visit a company's website. Therefore, it is expected that an increase in new visitors will have a positive impact on the website's climb in search engine rankings.

3. Results

3.1. Statistical Analysis

In the present section of the study, the subject study focuses on the analysis of data derived from the selected sample of shipping companies. Descriptive statistics refers to the observation and analysis of appropriate measures and variables capable of providing accurate information about the nature and representation of the selected variables in an analysis. Consequently, the following descriptive statistics measures were selected for this study: 1) mean, 2) minimum value, 3) maximum value, and 4) standard deviation. The entire set of independent and dependent variables of the research was examined based on these descriptive statistics measures, and the results are presented in Table 3. The chosen descriptive

Table 3. Descriptive statistics.

Variables	Observations	Mean	Minimum	Maximum	Std Deviation
Internet Ranking	180	350,962.71	346,736.00	356,378.00	3301.43
Bounce rate	180	0.30	0.21	0.37	0,05
Pageviews per user	180	2.58	2.00	3.26	0.43
Average time on a website	180	257.94	166.40	349.00	63.23
New visitors %	180	1.54%	1.00%	2.00%	0.36%

N = 180 days of data collection for the 5 shipping companies. Source: https://www.semrush.com/.

statistics measures provide us with a magnitude order for the values of this specific sample, allowing for the comparison of the same magnitudes in other periods. The mean, minimum, and maximum values of our variables inform us about their positions (measures of central tendency), while the standard deviation indicates the dispersion of the variables (measures of dispersion). These results will aid in concluding a combination with those obtained from linear regression.

In the following table (Table 4), the results of correlation analysis on the sample variables are presented. The extraction of the correlation analysis results was based on Pearson's coefficient (Pearson's correlation coefficient) (Pearson, 1895). In the table, correlations of 56 variables are displayed with an asterisk, indicating statistically significant associations at a significance level of a = 0.05. This means that depending on the sign of the correlations, two variables can be positively or negatively related, and, based on the significance level a (0.05), they may have a statistically significant correlation or not. Therefore, understanding the relationship between variables helps in verifying research questions as well as shaping linear regressions.

It is understood that the online ranking, which also serves as the dependent variable of the analysis and upon which research hypotheses were formulated, exhibits a unique statistically significant negative correlation with the bounce rate of the websites of shipping companies. This implies that it is not significantly influenced by any other independent variable in the table, except for the bounce rate.

Having completed the stage of descriptive statistics for the selected variables in this study, we proceed with conducting appropriate linear regressions (Glantz & Slinker, 1990). For these regressions, the online ranking of the shipping companies in the sample was chosen as the dependent variable. The individual independent variables (bounce rate, pages per user, time spent on the website, and new website users) will be examined for their significance in influencing the online ranking, to obtain relevant data on the factors that statistically affect it.

Furthermore, as we move on to the analyzed linear regressions of the online ranking of the shipping companies, we begin with the one involving the bounce

Table 4. Correlation analysis.

Variables	Internet Ranking	Bounce rate	Pageviews per user	Average time on a website	New visitors
Internet Ranking	1	0.822*	0.145	0.564	0.556
Bounce rate	0.822*	1	0.197	−0.129	−0.335
Pageviews per user	0.145	0.197	1	0.183	0.850*
Average time on a website	0.564	−0.129	0.183	1	0.211
New visitors	0.556	−0.335	0.850*	0.211	1

*Indicates statistical significance at the 95% level. Source: created by the authors.

rate of their websites. Starting with the first linear regression of the online ranking with the bounce rate, we analyze the results presented in Table 5. From this table, we observe that the regression of the online ranking with the bounce rate of the websites of shipping companies is statistically significant, as indicated by the *p*-value of 0.023 < a = 0.05, and the coefficient of determination $R^2 = 0.676$, meaning that the bounce rate explains a significant portion of the variability in the online ranking (67.6%). Additionally, it is evident that for every 1% decrease in the bounce rate of the websites of shipping companies, their online ranking decreases by 82.2%.

In the second linear regression model of the online ranking with pages per user, we obtain the results presented in Table 6. It is evident that, given the *p*-value of the regression is greater than the significance level a = 0.05 (0.756), and the coefficient of determination R^2 is quite small (0.021), the linear regression model is not statistically significant overall. Therefore, the independent variable of pages per user does not significantly influence the online ranking.

Regarding the next linear regression model of the online ranking with the time spent by visitors on the websites of shipping companies, we will observe Table 7. Similar to the previous linear regression, we find that the *p*-value of the regression is greater than the significance level a = 0.05 (0.187), and the coefficient of determination R^2 is relatively small (0.318). As a result, the linear regression model is not statistically significant overall. Therefore, the independent variable of time spent by visitors on the websites of shipping companies does not significantly influence their online ranking.

Lastly, in the final linear regression of the Data Analysis, the effect of new website users on the online ranking of shipping companies is examined (Table 8). Similar to the two previous linear regressions of the online ranking, the

Table 5. Linear regression of bounce rate.

Variables	Standardized coefficient	R^2	F	*p*-Value
Bounce Rate	0.822* (1456.679)	0.676	10.444	0.023*

*Indicate statistical significance at the 95% confidence level. Source: created by the authors.

Table 6. Linear regression of pages per visitor.

Variables	Standardized coefficient	R^2	F	*p*-Value
Pages per Visitor	0.145 (3381.477)	0.021	0.108	0.756

Source: created by the authors.

Table 7. Linear regression of time spent on website.

Variables	Standardized coefficient	R^2	F	*p*-Value
Time Spent on Website	0.564 (19.289)	0.318	2.329	0.187

Source: created by the authors.

Table 8. Linear regression of new users.

Variables	Standardized coefficient	R²	F	p-Value
New users	0.556 (34054.365)	0.309	2.232	0.195

Source: created by the authors.

p-value of new website users is greater than a = 0.05 (0.195), and the coefficient of determination R^2 is low (0.309). Consequently, this linear regression model is not statistically significant overall, indicating that new website users of shipping companies cannot cause a statistically significant influence on their online ranking.

3.2. Fuzzy Cognitive Model

The number of correlations between the examined variables found and used in the development of the Fuzzy Cognitive Map (FCM). The primary objective of the FCM is to provide a graphical representation of the positive and negative cause-effect relationships between the measured variables (Felix et al., 2019). Consequently, these relationships were used to create three multi-channel optimization scenarios for marketing and, by extension, increasing the likelihood of charter party attachments. These macro-level scenarios can be valuable for traders and decision-makers in understanding and effectively implementing capital allocation in marketing strategy (Migkos et al., 2022).

However, the dominant reason for following this methodology is that prediction models are valuable for traders as they can simulate user behavior, reactions, and engagement free of cost without investing valuable capital in other traditional marketing techniques (Negahban & Yilmaz, 2014).

For the construction of the modeling, an online tool called Mental Modeler was chosen (MentalModeler, 2023). Based on Fuzzy Cognitive Mapping (FCM), users can easily develop semi-quantitative models of environmental issues, social concerns, or socio-ecological systems in the Mental Modeler by:

- Defining the significant elements of a system.
- Establishing the relationships between these elements.
- Executing "what if" scenarios to determine how the system may react under various possible changes.

The Mental Modeler was developed to support group decision-making, allowing users to collaboratively represent and test their hypotheses regarding a system in real time. Additionally, it has been applied as a research tool in social sciences to measure individual or collective "mental models" that often form the basis of human decision-making.

In the present study, the knowledge model and the correlations of the factors investigated are depicted in Figure 1.

Scenario 1: In the first scenario, the weak promotional strategy of the product results in a small number of new visitors to the company website, new visitors = 0.1.

Scenario 1 (Figure 2): The few new visitors in the passenger shipping industry result in negative impacts on SEO = −0.07. Additionally, based on the research,
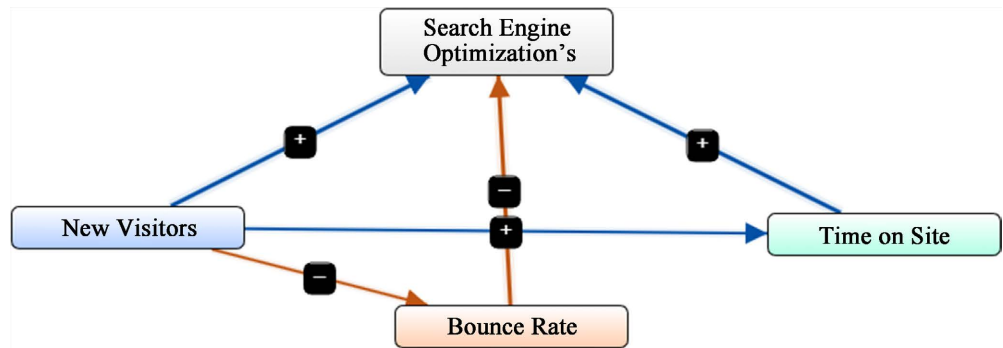
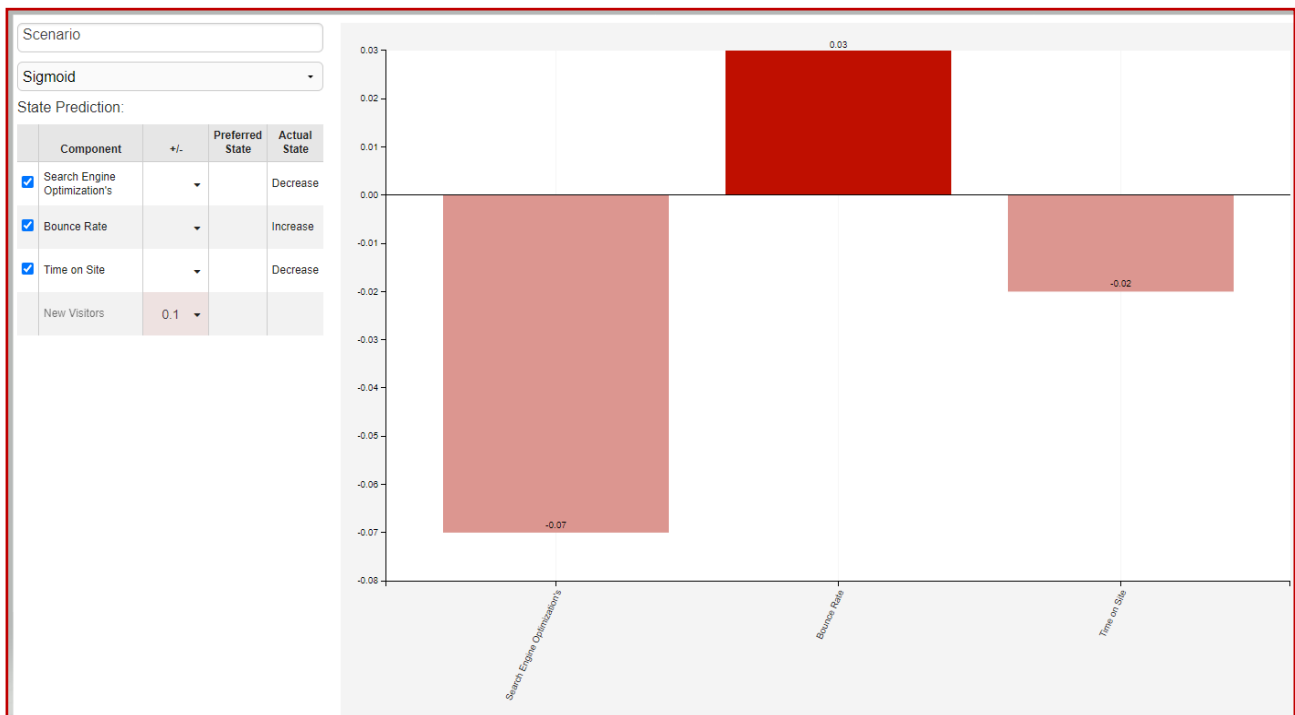**Figure 1.** Fuzzy cognitive mapping model of shipping companies websites.

Figure 2. FCM scenario 1.

the new visitors do not spend much time exploring the company website (time on site = −0.02), which also contributes negatively to the global ranking.

Scenario 2 (**Figure 3**): With more extensive promotional efforts, it becomes feasible to reach new visitors = 0.43 of the total website traffic. As a result, we no longer experience negative performance in time on site = 0, and the website's global rank is marginally negative.

Scenario 3 (**Figure 4**): With enhanced promotional efforts, it is possible to reach high percentages of new visitors compared to returning ones, new visitors = 0.68. This allows us to have an improved factor of time on site = 0.01 and consequently achieve the desired positive state of global rank = 0.03.

4. Discussion

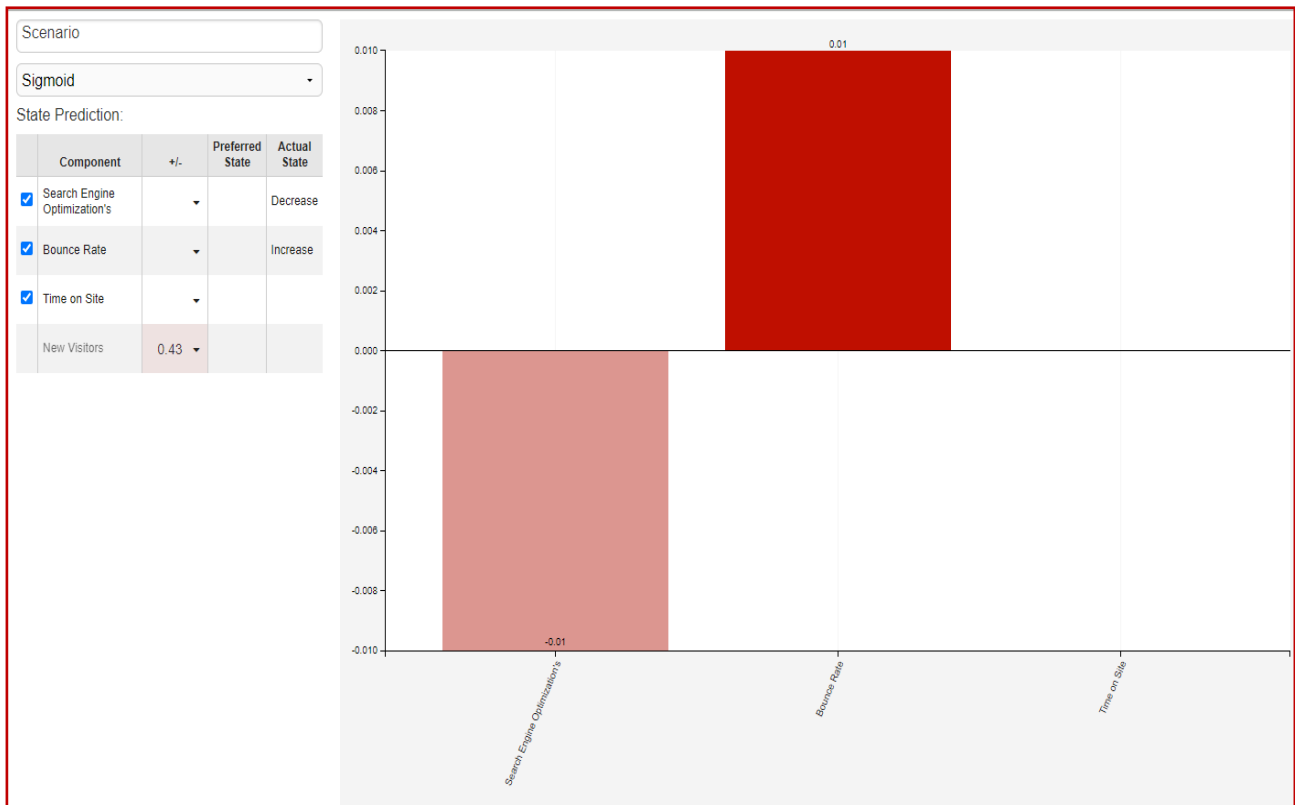After analyzing the statistical measures and results from the previous section of

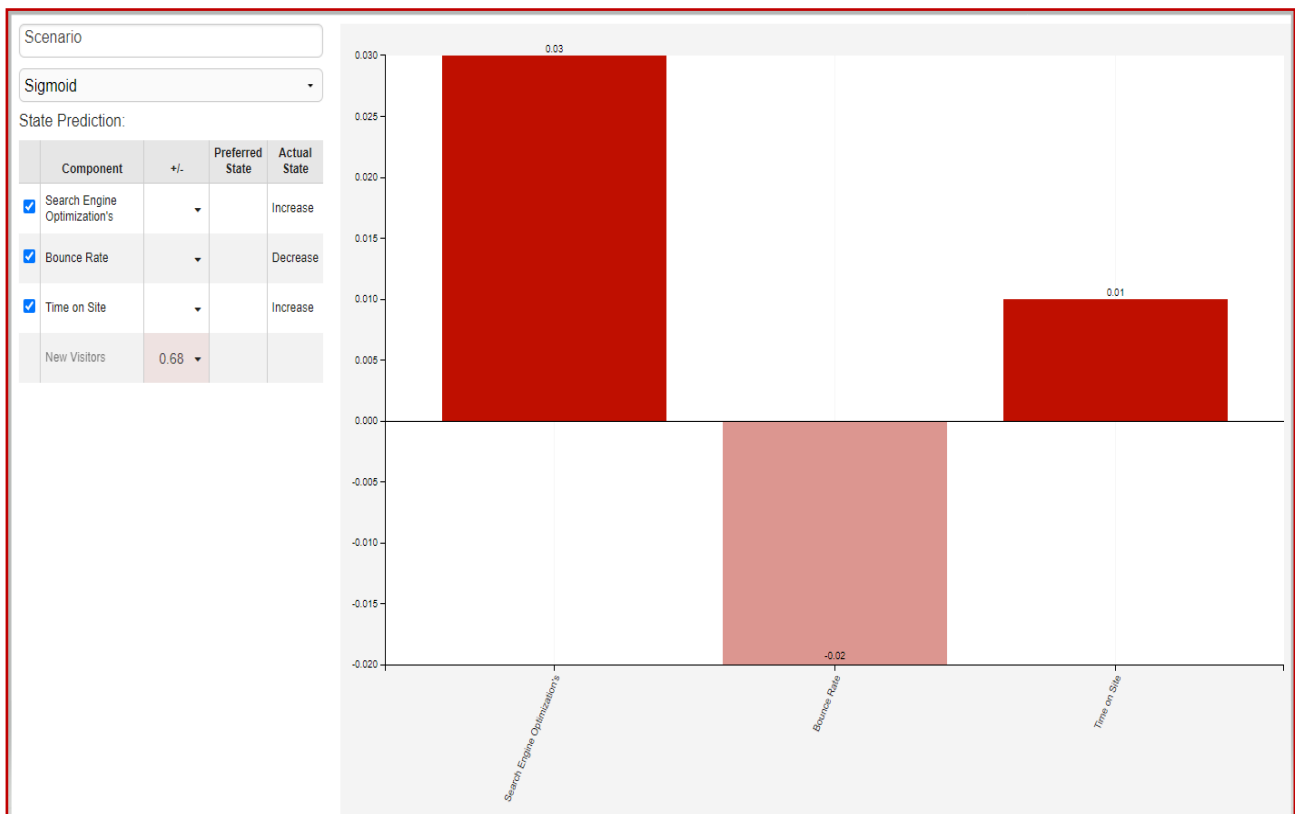**Figure 3.** FCM scenario 2.

Figure 4. FCM scenario 3.

the data analysis, the next step is to provide a clear interpretation of the above findings. This process will lead to the confirmation or rejection of the research hypotheses that were proposed earlier, from which we can gain further insights into the usefulness and interpretation of the selected metrics of the study about maritime companies.

To verify or reject the four research hypotheses of the study, we employed linear regression analysis (Glantz & Slinker, 1990) for each hypothesis separately. The research hypotheses, which were set in a previous section of this study, aim to examine the factors of digital marketing and the websites of maritime companies on their online ranking index. This index tends to lead to optimal results when it receives low values, meaning that the company's webpage climbs and appears high in the internet users' search (Sakas et al., 2023a).

To evaluate the impact of digital marketing variables on maritime companies, various metrics from the websites of these companies were utilized, such as bounce rate, new visitors, time on site, and pages per user.

Initially, the results of the generated linear regressions demonstrate the significant influence of specific digital marketing metrics and website factors on their effective climb in the global web ranking. More specifically, the most crucial variable from the websites of maritime companies appears to be the bounce rate of their visitors. A lower bounce rate leads to a better ranking of maritime companies in internet user searches. Similar findings have been observed for other companies and industries by Sakas et al. (2023b, 2023c).

Regarding the other digital marketing variables and website factors of maritime companies, none of them showed a significant impact on their online ranking. This means that time on site, pages per user, and new visitors do not affect the order in which maritime companies appear in internet search engines.

Therefore, the sole determinant factor of the online ranking of maritime companies during the period covered by the collected sample is the bounce rate of their website visitors. Specifically, the smaller the bounce rate, the lower the values of the online ranking variable for maritime companies, which means they climb higher in the rankings (e.g., the most frequently visited website is ranked 1, and so on).

This implies that the bounce rate and online ranking are positively correlated, as evidenced by their statistically significant positive correlation (Table 2) and the positive sign of the standardized coefficient (β) in the corresponding linear regression of the online ranking (Table 3). To achieve their goal of improving their presence in search engines and climbing higher in the rankings, maritime companies should focus on improving (reducing) the bounce rate of their website visitors as a crucial parameter.

Regarding the research hypotheses of the study, as previously stated, only hypothesis H1 is confirmed. This is because the online ranking metric of maritime companies is significantly influenced by the bounce rate of their website visitors. In other words, this significant effect is demonstrated through the statistically

significant results of the linear regression of online ranking with the bounce rate. On the other hand, the remaining research hypotheses (H2, H3, and H4) are not confirmed, as the corresponding linear regressions of online ranking with the individual independent variables of these hypotheses did not produce statistically significant results. Therefore, hypotheses H2, H3, and H4 are rejected.

Based on the overall results, the following conclusions can be drawn from the verification and rejection of the research hypotheses:

H1: The online ranking (global rank) of maritime companies is influenced by the bounce rate of their website visitors.

H2: The online ranking (global rank) of maritime companies is not affected by the average number of pages viewed by the visitors of their website.

H3: The online ranking (global rank) of maritime companies is not affected by the average time spent by visitors on their websites.

H4: The online ranking (global rank) of maritime companies is not affected by the number of new visitors to their websites.

Based on the analysis, H1 is the only one that is confirmed. The bounce rate of website visitors significantly influences the online ranking of maritime companies. However, H2, H3, and H4 are not confirmed, as the average number of pages viewed, the average time spent on the website, and the number of new visitors do not significantly impact the online ranking of maritime companies.

5. Conclusion

The results of this paper have a general character, meaning that they provide clear insights into the shipping companies' operations and promotion strategies. This is mostly based on the evidence that the research selected the top 5 shipping companies in the market at the moment, something that indicates the current state of the shipping context. Moreover, the gathered sample refers to 180 days of observation, highlighting an extended period for analysis, covering multiple variations in the supply and demand of concluding charters.

As for the implications that arise from this study, it is stated that the metric of shipping firms' website bounce rate is a crucial factor for determining the scale of their potential customers' search engine results. More specifically, the higher the abandoning rate of the shipping companies' websites, the higher the number of their appearances in their customers' search engine results (higher values of global/google ranking metrics), meaning that the firms' charter services have fewer chances of being in the first choices of their customers. By not appearing in the top results of their customers' search engines, shipping companies cannot promote efficiently their services, thus financial repercussions will emerge. Hence, it is suggested that shipping companies, in their aim to promote and enhance the conclusion of their charters, should focus on developing more friendly webpages to lower their customers' bounce rate. In this way, they will have an improved website visibility by attracting more potential customers from placing their website higher in their search engine results (lower value of global/google

ranking metric), and thus, improve their charter services' promotion and conclusion.

Acknowledgments

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Abdel, H. M. (2021). The Effectiveness of Advertising Personalization. *Journal of Design Sciences and Applied Arts, 2,* 114-121. https://doi.org/10.21608/jdsaa.2021.31121.1061

Ahmed, R. R., Streimikiene, D., Berchtold, G., Vveinhardt, J., Channar, Z. A., & Soomro, R. H. (2019). Effectiveness of Online Digital Media Advertising as a Strategic Tool for Building Brand Sustainability: Evidence from FMCGs and Services Sectors of Pakistan. *Sustainability, 11,* Article No. 3436. https://doi.org/10.3390/su11123436

Anna Rickman, T., & Cosenza, R. M. (2007). The Changing Digital Dynamics of Multi-channel Marketing: The Feasibility of the Weblog: Text Mining Approach for Fast Fashion Trending. *Journal of Fashion Marketing and Management, 11,* 604-621. https://doi.org/10.1108/13612020710824634

Arashpour, M., Wakefield, R., Lee, E. W. M., Chan, R., & Hosseini, M. R. (2016). Analysis of Interacting Uncertainties in On-Site and Off-Site Activities: Implications for Hybrid Construction. *International Journal of Project Management, 34,* 1393-1402. https://doi.org/10.1016/j.ijproman.2016.02.004

Bala, M., & Verma, D. (2018). A Critical Review of Digital Marketing. *International Journal of Management, IT & Engineering, 8,* 321-339.

Barrutia, J. M., & Gilsanz, A. (2013). Electronic Service Quality and Value Do Consumer Knowledge-Related Resources Matter? *Journal of Service Research, 16,* 231-246. https://doi.org/10.1177/1094670512468294

Boughton, S. B. (2005). Search Engine Marketing. *Perspectives in Business, 2,* 29-33.

Chaffey, D., & Ellis-Chadwick, F. (2019). *Digital Marketing Strategy-Implementation and Practice.* Pearson.

Cho, C.-H., & Lee, H. (2018). *Digital Marketing 4.0.* Green Pine Media.

Companies Market Cap (2023). *Largest Container Shipping Companies by Market Cap.* https://companiesmarketcap.com/container-shipping/largest-companies-by-market-cap/

Cui, M., & Hu, S. (2011). Search Engine Optimization Research for Website Promotion. In *2011 International Conference of Information Technology, Computer Engineering and Management Sciences* (pp. 100-103). The Institute of Electrical and Electronics Engineers. https://doi.org/10.1109/ICM.2011.308

Delone, W. H., & Mclean, E. R. (2003). The Delone and Mclean Model of Information System Success: A Ten-Year Update. *Journal of Management Information Systems, 19,* 9-30. https://doi.org/10.1080/07421222.2003.11045748

Dröge, C., & Germain, R. (1991). Evaluating Logistics Management Information Systems. *International Journal of Physical Distribution & Logistics Management, 21,* 22-27. https://doi.org/10.1108/EUM0000000000395

Elbert, R., Pontow, H., & Benlian, A. (2017). The Role of Inter-Organizational Information Systems in Maritime Transport Chains. *Electron Markets, 27,* 157-173. https://doi.org/10.1007/s12525-016-0216-3

Felix, G., Nápoles, G., Falcon, R., Froelich, W., Vanhoof, K., & Bello, R. (2019). A Review on Methods and Software for Fuzzy Cognitive Maps. *Artificial Intelligence Review, 52,* 1707-1737. https://doi.org/10.1007/s10462-017-9575-1

Ferraz, R. (2017). Accessibility and Search Engine Optimization on Scalable Vector Graphics. In *2017 IEEE 4th International Conference on Soft Computing & Machine Intelligence (ISCMI)* (pp. 94-98). The Institute of Electrical and Electronics Engineers. https://doi.org/10.1109/ISCMI.2017.8279605

Giabbanelli, P. J., Gray, S. A., & Aminpour, P. (2017). Combining Fuzzy Cognitive Maps with Agent-Based Modeling: Frameworks and Pitfalls of a Powerful Hybrid Modeling Approach to Understand Human-Environment Interactions. *Environmental Modelling & Software, 95,* 320-325. https://doi.org/10.1016/j.envsoft.2017.06.040

Glantz, S. A., & Slinker, B. K. (1990). *Primer of Applied Regression and Analysis of Variance.* Health Professions Division, McGraw-Hill, New York.

Goes, P. B. (2014). Design Science Research in Top Information Systems Journals. *MIS Quarterly: Management Information Systems, 38,* 3-8. https://experts.arizona.edu/en/publications/design-science-research-in-top-information-systems-journals

Hallikainen, P. (2015). Why People Use Social Media Platforms: Exploring the Motivations and Consequences of Use. In L. Mola, F. Pennarola, & S. Za (Eds.), *From Information to Smart Society* (pp. 9-17). Lecture Notes in Information Systems and Organisation, Vol. 5, Springer. https://doi.org/10.1007/978-3-319-09450-2_2

Hartmann, P., Marcos, A., Castro, J., & Apaolaza, V. (2022). Perspectives: Advertising and Climate Change—Part of the Problem or Part of the Solution? *International Journal of Advertising, 42,* 430-457. https://doi.org/10.1080/02650487.2022.2140963

Jacob, A., Hamre, T., Evensen, G., & Mughal, K. (2003). Developing a Marine Information System by Integrating Existing Ocean Models Using Object-Oriented Technology. *Marine Geodesy, 26,* 87-106. https://doi.org/10.1080/01490410306703

Klaus, H., Rosemann, M., & Gable, G. G. (2000). What Is ERP? *Information Systems Frontiers, 2,* 141-162. https://doi.org/10.1023/A:1026543906354

Lavrentieva, O. O. (2020). Methodology of Using Mobile Apps with Augmented Reality in Students' Vocational Preparation Process for Transport Industry. *CEUR Workshop Proceedings, 2731,* 143-162. http://elibrary.kdpu.edu.ua/xmlui/handle/123456789/4406

Lee, H., & Cho, C.-H. (2019). Digital Advertising: Present and Future Prospects. *International Journal of Advertising, 39,* 332-341. https://doi.org/10.1080/02650487.2019.1642015

Lipsman, A., Mudd, G., Rich, M., & Bruich, S. (2012). The Power of "Like". *Journal of Advertising Research, 52,* 40-52. https://doi.org/10.2501/JAR-52-1-040-052

Marine Digital (2020). *15 Biggest Shipping Companies in the World.* https://marine-digital.com/article_15biggest_shipping_companies

MentalModeler (2023). https://www.mentalmodeler.com/scenario/

Migkos, S. P., Sakas, D. P., Giannakopoulos, N. T., Konteos, G., & Metsiou, A. (2022). Analyzing Greece 2010 Memorandum's Impact on Macroeconomic and Financial Figures through FCM. *Economies, 10,* Article No. 178. https://doi.org/10.3390/economies10080178

Negahban, A., & Yilmaz, L. (2014). Agent-Based Simulation Applications in Marketing Research: An Integrated Review. *Journal of Simulation, 8,* 129-142. https://doi.org/10.1057/jos.2013.21

O'Brien, J., & Marakas, G. (2007). *Management Information Systems*. McGraw Hill Irwin.

Ortiz-Ospina, E. (2019). *The Rise of Social Media*. https://ourworldindata.org/rise-of-social-media

Pearson, K. (1895). Notes on Regression and Inheritance in the Case of Two Parents. *Proceedings of the Royal Society of London, 58,* 240-242. https://doi.org/10.1098/rspl.1895.0041

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A Design Science Research Methodology for Information Systems Research. *Journal of Management Information Systems, 24,* 45-77. https://doi.org/10.2753/MIS0742-1222240302

Polman, P., & Winston, A. (2021). *Net Positive*. Harvard Business Review Press.

Rao, R. J., Stewart, C., Perez, A., & Renganathan, S. M. (2018). Assessing Learning Behavior and Cognitive Bias from Web Logs. In *Proceedings of the 2018 IEEE Frontiers in Education Conference (FIE)* (pp. 1-5). The Institute of Electrical and Electronics Engineers. https://doi.org/10.1109/FIE.2018.8658913

Sakas, D. P., Giannakopoulos, N. T., & Trivellas, P. (2023a). Exploring Affiliate Marketing's Impact on Customers' Brand Engagement and Vulnerability in the Online Banking Service Sector. *International Journal of Bank Marketing*. https://doi.org/10.1108/IJBM-01-2023-0009

Sakas, D. P., Giannakopoulos, N. T., Margaritis, M., & Kanellos, N. (2023c). Modeling Supply Chain Firms' Stock Prices in the Fertilizer Industry through Innovative Cryptocurrency Market Big Data. *International Journal of Financial Studies, 11,* Article No. 88. https://doi.org/10.3390/ijfs11030088

Sakas, D. P., Giannakopoulos, N. T., Nasiopoulos, D. K., Kanellos, N., & Tsoulfas, G. T. (2023b). Assessing the Efficacy of Cryptocurrency Applications' Affiliate Marketing Process on Supply Chain Firms' Website Visibility. *Sustainability, 15,* Article No. 7326. https://doi.org/10.3390/su15097326

Saura, J. R., Palos-Sanchez, P., & Suarez, L. M. (2017). Understanding the Digital Marketing Environment with KPIs and Web Analytics. *Future Internet, 9,* Article No. 76. https://doi.org/10.3390/fi9040076

Semrush (2023). *Traffic Analytics Overview Report Manual*. https://www.semrush.com/kb/895-trafficanalyticsoverview-report

Setiawan, A., Harahap, Z., Syamsuar, D., & Kunang, Y. N. (2020). The Optimization of Website Visibility and Traffic by Implementing Search Engine Optimization (SEO) in Palembang Polytechnic of Tourism. *Communication and Information Technology Journal, 14,* 31-44. https://doi.org/10.21512/commit.v14i1.5953

Terrance, A. R., Shrivastava, S., & Kumari, A. (2017). Importance of Search Engine Marketing in the Digital World. In *Proceedings of the 1st ICITKM* (Vol. 14, pp. 155-158). ACSIS, Polish Information Processing Society.

Tran, T. P., van Solt, M., & Zemanek, J. E. (2020). How Does Personalization Affect

Brand Relationship in Social Commerce? A Mediation Perspective: An Abstract. In F. Pantoja, & S. Wu (Eds.), *From Micro to Macro: Dealing with Uncertainties in the Global Marketplace* (pp. 535-536). Springer International Publishing.

Yan, J. (2011). Social Media in Branding: Fulfilling a Need. *Journal of Brand Management, 18,* 688-696. https://doi.org/10.1057/bm.2011.19