



## **Communication A Conceptual Framework for the Technological Advancement of E-Commerce Applications**

Snezhana Sulova 🕩

Department of Informatics, University of Economics-Varna, 9002 Varna, Bulgaria; ssulova@ue-varna.bg

Abstract: E-commerce is an area in which success largely depends on the e-commerce applications used. Currently, there are many studies that focus on various technological innovations in e-commerce systems, but a comprehensive concept of their improvement is lacking. In this regard, the main objective of the article was to explore the technological possibilities for the improvement of e-commerce systems and to propose a conceptual framework for their maintenance and development. The chosen research approach included a combined methodology–text mining analysis of existing developments and identifying the key themes and trends in papers and deep scientific analyses of the most-cited developments. As a result, a conceptual framework for the maintenance and development of e-commerce applications was proposed. To test the approach, publications from the scientific literature database Scopus, on the topic "e-commerce applications" were used. Experiments and text processing were performed with the software RapidMiner Studio. Several main directions for the development tools; the technological base; and the possibilities of integration. Future research may focus on detailing each direction.

**Keywords:** e-commerce; e-commerce applications; e-commerce platforms; text mining; conceptual framework



Citation: Sulova, S. A Conceptual Framework for the Technological Advancement of E-Commerce Applications. *Businesses* **2023**, *3*, 220–230. https://doi.org/10.3390/ businesses3010015

Academic Editors: Octavian Dospinescu, Lincoln C. Wood and Sabin Buraga

Received: 10 February 2023 Revised: 13 March 2023 Accepted: 14 March 2023 Published: 16 March 2023



**Copyright:** © 2023 by the author. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https:// creativecommons.org/licenses/by/ 4.0/).

### 1. Introduction

In recent years, the COVID-19 pandemic has given impetus to the digitalization processes of retail trade. Electronic forms of commerce have become a natural way of making purchases and sales. In 2022, 75% of EU internet users had bought or ordered goods or services. The proportion of e-shoppers grew from 55% in 2012 to 75% in 2022 [1]. Globally, in 2021, online sales amounted to about 4.9 trillion US dollars and forecasts for the next 4 years will grow by 50% to reach approximately 7.4 trillion dollars in 2025 [2].

Creating e-commerce systems is a complex task that requires first choosing the right software solution and then its maintenance, integration with other systems and improvement. There are different online trading systems depending on the participants: business-to-consumer (B2C), business-to-business (B2B), consumer-to-consumer (C2C), etc. and in this regard, it is necessary to note that in the present study we focus on the B2C sales model.

E-commerce platforms are web-based applications that are accessible from various devices, computers, tablets, and mobile phones. As they can be created using programming languages and technologies for web development or specialized software tools for creating e-stores. Basic front-end technologies for web development include: the basic markup language for describing the structure and content of HTML documents; style sheets, CSS, which specify how elements should be rendered, and the Java Script client-side web scripting language. A server-side programming language is used to build the programming logic of e-commerce systems. According to statistics, most used at the moment are: PHP, ASP.NET, Java, Node.js, Python and Ruby [3,4]. To facilitate development, in most cases, software frameworks are used, which unite various components in larger ones. For example, Laravel is one of the most popular PHP framework systems [5,6]. There

are also specialized tools for developing e-stores. They represent ready-made software systems where basic functionalities of an e-store are built, and only installation, settings and integration are required. The variety in this group of software tools is great. These include software solutions from leading business software developers such as SAP Commerce Cloud, Oracle Commerce, Dynamics 365 Commerce, etc., as well as open-source web platforms for creating online stores such as WordPress WooCommerce, OpenCart, PrestaShop and many others [7].

The choice of a specific software solution largely depends on the requirements of the specific business and on the existing company systems and their integration capabilities. Regardless of which of the listed ways the e-commerce application was created, if merchants want to offer more convenience to their customers, they must constantly improve their platforms, integrate them with other applications, make further refinements and technological updates. The impact of technological change on the development of e-commerce is significant [8].

There is relatively little research focused on methods for evaluating and developing e-commerce systems. Rijayana and Nugraha recommend using the action research design method, which includes the following phases: diagnosing, action planning, action taking, evaluating and learning [9]. Other authors suggest two ways of evaluating e-commerce systems. The first one is based on mathematical algorithms and the second on KPI indicators for the usability of an e-store [10]. Although the research says that the results can be useful to e-store developers, we believe that the results determine the economic efficiency of the activity and are not directly aimed at e-commerce systems.

Other research proposing e-commerce systems evaluation methods is related to ecommerce website usability evaluation based on big data processing [11–13]. A platform model based on the collaboration of systems in a common digital ecosystem was proposed by Aulkemeier, Iacob and van Hillegersberg. Although the model is of a more general nature, the authors have shown the applicability of the platform for integrating systems in the field of e-commerce [14]. Most studies focus on a chosen technological solution, the application of which improves e-commerce systems only in a certain aspect. Such research is related to the application of blockchain technology [15,16], cloud computing [17,18], and machine learning [10,19–21]. According to a number of specialists, automation and the use of systems, tools or algorithms with artificial intelligence to support activities are the basis of the development of the sector [22–24].

All the analyzed studies provide useful guidelines for the improvement of e-commerce systems, but only in a certain aspect. We believe that the development of e-commerce requires the application of innovative solutions, applied both in the organization of the activity and in the software tools, supporting its implementation. In this regard, the main goal of the present study is to propose a conceptual framework, based on an analysis of the existing approaches to the development of e-commerce applications, defining the guidelines for their maintenance and development. The main contributions of the research are related to the method of identifying modern trends for the improvement of e-commerce systems, which allows offering a complete and in line with current trends concept for their development. The chosen research approach includes a combined methodology—text mining analysis of existing developments and identifying the key themes and trends in the papers and deeper scientific analysis of the most-cited developments.

The present research is significant for the technological improvement of e-commercesupporting platforms and aids in the creation of flexible, modern and reliable software support for e-commerce.

The originality of this study is in two directions, firstly, it uses a combined methodology and thus better covers trends in the development of e-commerce systems, and secondly, offers a comprehensive conceptual framework based on numerous studies.

#### 2. Materials and Methods

In this study we used the methodology presented in Figure 1. The methodology was combined and includes two stages of research. It was based on theoretical analyses and summaries of current publications and technologies for automatic natural language processing. Based on the synthesis of the obtained results, a conceptual framework for the maintenance and development of e-commerce applications is proposed.



Figure 1. Research methodology.

The first stage of the research was theoretical and represents a systematic review of the literature and a presentation of the main statements on the considered subject.

To extract the main discussed topics, we used publications that were found in Google Scholar by searching the phrase "technological advancement of e-commerce applications". The PRISMA (preferred reporting of items for systematic reviews and meta-analyses for scoping reviews) statement was used to identify the publications [25].

The second stage was the discovery and extraction of knowledge from research articles, reports that were relevant to the research problem published in scientific journals, conference proceedings and indexed in the Scopus database. This stage included:

- Searching by keywords and setting filters to retrieve publication abstracts in English, published after 2019;
- Application of text mining technologies to extract information from the collection of textual data.

As is known, text extraction covers a wide variety of tasks: text categorization and grouping; extraction of key concepts; finding associations between text, terms; sentiment analysis; creating grammatical taxonomies; annotation of documents, etc. [26]. We use computer natural language processing to identify the main topics discussed in e-commerce research and the applications with which it takes place. Processing the text summaries involves applying techniques for pre-processing the text and converting it into vectors of words and topics modeling using the latent method Dirichlet allocation (LDA).

#### 3. Results of Applying the Methodology

#### 3.1. Literature Review

It is known that when active, an e-shop operates and generates a lot of new data. Using them to obtain information is a tool to engage more with customers and offer better products and services. There are a number of studies in the literature on the application of big data analysis in e-commerce [27,28]. Some of their most used applications are for: the optimization of logistics processes [29]; for customer segmentation [30]; analyses of customer satisfaction [31], etc. In most cases, the analyses use the large amount of structured data. However, it is necessary to note that in order for the obtained information to have a greater value, it is good to analyze both the structured data from the database and the unstructured data that is obtained from comments, clicks, likes, links, etc. [32].

Data analysis and transformation methods are also diverse and in most studies are based on artificial intelligence and machine learning [33]. Analytics based on combined

data are more comprehensive and accurate and are of great importance for risk research [34] and personalization of services for directing users to information that would be most useful to them [35]. They can help to understand how websites for commerce and services are used, what users search for most often, and to assist marketing specialists in market analysis and segmentation.

There are many positive examples of the use of artificial intelligence (AI) technologies in scientific research in e-commerce [20]. Some authors suggest using neural network-based systems to generate "tips" based on the multitude of user comments [36]. Others show how AI e-commerce systems can view their customers' preferences in real time and help them achieve greater sales as well as customer satisfaction [37]. In a study by Metsai et al. the application of AI is in the following main categories: recommendation systems; virtual reality systems and augmented reality systems and recommendation agents [38].

Supporting decision-making in e-commerce by offering real-time communication systems with company employees or with chatbot systems is liked by users. It creates facilities and conveniences for customers, according to research 71% of users use chatbots to solve problems related to purchases [39]. Bots, or more commonly called chatbots, are automated software programs with artificial intelligence that enable human–bot interactions [40]. Chatbots help users with inquiries and information searches, providing answers to frequently asked questions [41]. These applications are usually installed in addition to e-stores and can have different functionalities, some of them are self-learning in the process of operation. It is recommended to integrate chatbot applications based on technologies such as AI, natural language processing (NLP), or deep learning. In general, AI is defined as an important driving force for the development of e-commerce [42].

The mass penetration of social platforms and their possibilities for marketing activities leads to the evolution of e-commerce systems [43]. Their development can be considered in two directions. The first is related to the addition of opportunities for the direct offering of goods and services in social networks and the implementation of so-called social commerce [44]. The social trade is proven useful like additional channels for online commerce [45]. The second direction is related to adding functionalities in e-stores that allow networking and user interactions through social elements such as likes, reviews, recommendations, information sharing. These improvements in e-commerce systems stem from the influence of social networks and help both consumers and businesses in their information sharing and management activities. These recommended functionalities for e-commerce systems are called s-commerce and are considered as a subset of e-commerce where social media elements are used to improve customer interactions and contribute to business promotion [46].

Based on the theoretical analysis of literary sources on the topic of research, we can conclude that the improvement of e-commerce systems is mainly related to the integration of innovative and useful applications for the implementation of recommendations, chatbot systems, and analytical functions for processing large volumes of data and real-time data.

#### 3.2. Automatic Text Analysis

We also used automatic natural language processing technologies to discover and extract knowledge from research articles. For this purpose, a collection of 3099 abstracts of publications in the Scopus database was first created by keyword searches. Abstracts were used because they present the essence of studies in a synthesized form and thus increase the precision of the computer searches [47]. Posts were found by keywords and phrases: "e-commerce applications", "e-commerce systems", "e-commerce" and "innovations". They were for the period from 2010 to 15 January 2023, in English. Their processing was performed according to the scheme shown in Figure 2.



Figure 2. Text mining approach for discovering the main topics in the publications.

The main stages of processing were:

- 1. Scopus database.
- 2. Pre-processing the text to convert it into a vector of words.
- 3. Using the LDA approach to discover the topics.

Text pre-processing included the following actions:

- Tokenization—dividing the text into separate words;
- Transformation of case letter case conversion—to make all words spelled the same way, for example to convert to lowercase letters;
- Filter tokens by length—filtering words according to their length, which allows, for example, to exclude words with a length of up to two or three characters;
- Filtering stopwords—deletion of redundant words according to a predefined dictionary of so-called "redundant" words in the English language;
- Generation of n-Grams (terms)—a sequence of n elements, words, is created.

Topic modeling is used to discover the topics that occur in document abstracts. The LDA approach is based on probability vectors of words that indicate their relevance to the text corpus [47]. LDA is basically an iterative algorithm, which in order to work needs to be given the number of searched topics [48]. Then, one can select the first few words most likely to belong to the particular topic and search for a description of the topic.

The software product Rapid Miner was used to test the approach. Figure 3 shows the most frequent words identified, and Table 1 groups the most used words.



Figure 3. World cloud diagram.

Group 1	Group 2	Group 3
development	social	data
data	business	recommendation
logistics	digital	users
system	customer	learning
technology	factors	reviews
service	data	network
supply chain	analysis	systems
cross	purchase	method

Table 1. The most used words in groups.

Textual analysis shows that the most frequently used words by researchers in the abstracts of their publications were: data, learning, development, recommendation, learning, social, logistics, and technology. Three main topics were identified.

The words in the first group emphasize the importance of logistics, logistics systems and services, and technology. The words in the second group emphasize social networks and customer and purchase analytics. The words from the third group show the importance of data, recommendation systems and the use of different methods of analysis and studying reviews.

Extracting key trends through text mining technologies complemented and strengthened the themes identified through the literature review. We believe that the application of a research trend analysis methodology helps us to identify modern approaches in the development of e-commerce applications. Combining them with the existing requirements for e-shop-type web developments imposed by their specificity allows us to derive the main guidelines for the maintenance and development of e-commerce applications.

# 4. A Conceptual Framework for the Maintenance and Development of E-Commerce Applications

The results of the applied methodology for extracting the key factors for the improvement of e-commerce applications show that in scientific research the influence of one or another factors on the technological development of e-stores is emphasized, but there is a lack of a comprehensive contextual framework that shows all the possibilities for improving this kind of application. In this regard, and based on the nature of e-commerce applications, as well as the identified important features for their development, we can offer a comprehensive conceptual framework for the maintenance and development, which consists of three main groups of factors (Figure 4).

The first group of factors includes the application of modern tools and web technologies for development and web applications that allow the creation of e-stores with an appropriate design, structure, navigation system, content management capabilities, SEO optimization, security mechanisms, and more. In addition, it is important for e-shops to have very good administrative modules, which mainly serve to set up and maintain the created e-shops. They can: set settings for the e-commerce website; construct product catalogs; install payment modules; determine the terms of delivery; and display reference and statistical information.

As already mentioned, the range of front- and back-end technologies used in the development of e-stores is wide. We believe that in order for a software technology to be suitable for e-commerce application, it must meet the following requirements:

- Provide professional development tools;
- Applicable to more complex applications that can be integrated with other systems;
- Must be based on modern Internet technologies and framework systems;

- Support the operation of various types of client devices, including mobile devices in the implementation of the principles of multi-channel access;
- Enable universal access to multiple data sources;
- Reliable and secure [49], as business processes related to payments and confidential information are automated.



Figure 4. Conceptual framework for the technological advancement of e-commerce applications.

The second group of factors that are important for the development of e-commerce applications is based on the development of additional functionalities that apply the concept of data science, the implementation of modern live communications systems and social platform integration. Expanding the functionality of e-commerce applications is mostly related to improving a company's marketing strategy, since one of the main tasks of e-commerce is to influence purchase decisions. The application of new technological solutions based on modern technologies facilitates product information and better decision-making [50]. In this regard, additional functionalities can be many and varied, such as: sentiment analysis of customer opinions [51]; customer segmentation [52]; and the analysis of sequences of actions, events [53], tracking systems [54], and others. The main goal of e-commerce applications is to become a virtual reception, where users are guided when making purchases and can count on real-time help and communications with employees.

As a third group of factors, we have indicated integration with other systems, both internal, such as analytical systems, and external, such as, e.g., the providers' systems. E-commerce applications need to be part of an organization's overall digital platform. This would improve intra- and inter-organizational communications [55]. The integration of e-commerce systems, as part of a company's information security, needs to be considered in the following aspects:

- Application integration. Useful applications to integrate are: referrals, email marketing, and chatbot systems.
- Data level integration. Using an integrated database and integration with external data sources, including unstructured data, to improve analytics.
- Integration with partner and supplier systems. System-level integration with supplier companies is mainly by payment modules and logistics companies.

#### 5. Discussion

The proposed conceptual framework provides e-commerce application developers with guidelines for developing platforms that assist customers in their choices and fully meets their needs. Following the proposed guidelines will allow developers to create applications that are based on the most used and reliable development technologies, and include advanced functionality that allow the creation of smart e-commerce solutions using intelligent software technologies and data analysis methods.

Such modern e-commerce applications are necessary for managers [56] because they provide an opportunity to perform effective market analyses, compare customer reviews of products, discover competitors' strengths and weaknesses, and search for new business opportunities. The information provided in real-time, as well as the accumulated data, can help apply flexible strategies for managing the relationship with clients for dynamic pricing and predicting future trends. Although the idea of using smart technologies in e-commerce is not new [23], the present study systematizes and gives a detailed description of the possible directions for the development of e-commerce applications.

From a practical point of view and considering the extraordinary dynamics of developing web-based systems, the application of the proposed framework provides ease for customers. Applications using modern front- and back-end technologies become easily discoverable by search engines, they are easy and intuitive to use, load quickly and work reliably [57].

It is good practice to monitor the trends in the development of software platforms for creating e-stores and choose the most suitable approaches for implementation [58]. It is necessary to note that the choice of a technological set of software tools for the development and maintenance of an e-store correlates with the experience of the developers in the development and maintenance of online platforms.

#### 6. Conclusions

E-commerce applications play an important role for organizations. They provide the necessary information to customers and help them in the buying process. Their development with modern software tools, as well as the inclusion of a suitable set of functionalities, could give organizations significant competitive advantages. Therefore, in this study, we proposed a conceptual framework to guide the maintenance and implementation of innovative innovations in e-commerce applications. Through it, an assessment can be made regarding which factor an e-store needs developing and to improve online stores. As a result of the application of the conceptual framework for maintenance and development, e-stores will be able to implement innovations in their activity, and create a modern and high-tech virtual environment for online trading.

The present study shows the significance of the choice of platform and technologies for the creation of e-stores. However, it is necessary to note that the study has the following limitations. Only the Scopus database was used for automatic abstract analysis, the analysis did not include all journals and conference proceedings. The publishing period is also limited, and only selected keywords were set. Future research could be based on other parameters regarding publications.

The subject of future developments may be detailing the framework and defining detailed guidelines for the creation of a well-structured and organized e-shop, since web design is an important factor for the success of e-shops [59] and the development of a

model for the support and development of applications created with specific technologies, for example, those using open-source platforms.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The author declare no conflict of interest.

#### References

- Eurostat. E-Commerce Continues to Grow in the EU. Available online: https://ec.europa.eu/eurostat/en/web/productseurostat-news/w/ddn-20230228-2 (accessed on 12 March 2023).
- Shepherd, J. 21 Essential eCommerce Statistics You Need to Know in 2023. Available online: https://thesocialshepherd.com/ blog/ecommerce-statistics (accessed on 14 January 2023).
- Tran, T. Top 7 Server-Side Scripting Languages. 2021. Available online: https://www.orientsoftware.com/blog/server-sidescripting-languages/ (accessed on 15 January 2023).
- 4. W3Techs. Usage Statistics of Server-Side Programming Languages for Websites. Available online: https://w3techs.com/ technologies/overview/programming\_language (accessed on 15 January 2023).
- Bankov, B. Software Evaluation of PHP MVC Web Applications. In Proceedings of the 19 International Multidisciplinary Scientific Geoconference SGEM 2019, Albena, Bulgaria, 28 June–6 July 2019; Informatics, Geoinformatics and Remote Sensing Issue 2.1. Volume 19, pp. 603–610. [CrossRef]
- 6. Nguyen, L.A.; Huynh, T.S.; Tran, D.T.; Vu, Q.H. Design and Implementation of Web Application Based on MVC Laravel Architecture. *Eur. J. Electr. Eng. Comput. Sci.* 2022, *6*, 23–29. [CrossRef]
- 7. Santos, V.; Augusto, T.; Vieira, J.; Bacalhau, L.; Sousa, B.M.; Pontes, D. E-Commerce: Issues, Opportunities, Challenges, and Trends. In *Promoting Organizational Performance Through 5G and Agile Marketing*; IGI Global: Hershey, PA, USA, 2023; pp. 224–244.
- Dimitrova, V.; Kaneva, M. Electronic Commerce and Gross Domestic Product Growth in Bulgaria. In Proceedings of the 5th International Multidisciplinary Scientific Conference on Social Science & Arts: SGEM 2018: Conference Proceedings, Albena, Bulgaria, 24 August–2 October 2018; pp. 297–304.
- 9. Rijayana, I.; Nugraha, U. Development E-Commerce Applications. Turk. J. Comput. Math. Educ. 2021, 12, 985–990.
- 10. Shaytura, S.V.; Kozhayev, Y.P.; Ordov, K.V.; Antonenkova, A.V.; Zhenova, N.A. Performance evaluation of the electronic commerce systems. *Rev. Espac.* 2017, *38*, 1.
- Kumar, B.; Roy, S.; Sinha, A.; Iwendi, C.; Strážovská, L'. E-Commerce Website Usability Analysis Using the Association Rule Mining and Machine Learning Algorithm. *Mathematics* 2023, 11, 25. [CrossRef]
- 12. Farras, M.; Friscily, F.; Gabriela, G.; Sera, S.; Sherinne, S.; Mulyawan, B. Implementation of Big Data in E-Commerce to Improve User Experience. *Adv. Soc. Sci. Educ. Humanit. Res.* 2022, 655, 1985–1989.
- Kumar, B.; Roy, S. An Empirical Study on Usability and Security of E-Commerce Websites. In *Research in Intelligent and Computing in Engineering. Advances in Intelligent Systems and Computing*; Kumar, R., Quang, N.H., Kumar Solanki, V., Cardona, M., Pattnaik, P.K., Eds.; Springer: Singapore, 2021; Volume 1254. [CrossRef]
- 14. Aulkemeier, F.; Iacob, M.E.; van Hillegersberg, J. Platform-based collaboration in digital ecosystems. *Electron Mark.* **2019**, *29*, 597–608. [CrossRef]
- 15. Zhu, X.; Wang, D. Research on Blockchain Application for E-Commerce, Finance and Energy. In *IOP Conference Series: Earth and Environmental Science*; IOP Publishing Ltd.: Bristol, UK, 2019; Volume 252, p. 042126. [CrossRef]
- Himeur, Y.; Sayed, A.; Alsalemi, A.; Bensaali, F.; Amira, A.; Varlamis, I.; Eirinaki, M.; Sardianos, C.; Dimitrakopoulos, G. Blockchain-based recommender systems: Applications, challenges and future opportunities. *Comput. Sci. Rev.* 2022, 43, 100439. [CrossRef]
- 17. Almarabeh, T.; Majdalawi, Y.K. Cloud Computing of E-commerce. Mod. Appl. Sci. 2019, 13, 27–35. [CrossRef]
- 18. Sohaib, O.; Naderpour, M.; Hussain, W.; Martinez, L. Cloud computing model selection for e-commerce enterprises using a new 2-tuple fuzzy linguistic decision-making method. *Comput. Ind. Eng.* **2019**, *132*, 47–58. [CrossRef]
- Jabbar, J.; Urooj, I.; JunSheng, W.; Azeem, N. Real-time sentiment analysis on E-commerce application. In Proceedings of the 2019 IEEE 16th International Conference on Networking, Sensing and Control (ICNSC), Banff, AB, Canada, 9–11 May 2019; pp. 391–396. [CrossRef]
- Fayyaz, Z.; Ebrahimian, M.; Nawara, D.; Ibrahim, A.; Kashef, R. Recommendation Systems: Algorithms, Challenges, Metrics, and Business Opportunities. *Appl. Sci.* 2020, 10, 7748. [CrossRef]
- Sheikh, A.S.; Guigourès, R.; Koriagin, E.; Ho, Y.K.; Shirvany, R.; Vollgraf, R.; Bergmann, U. A deep learning system for predicting size and fit in fashion e-commerce. In Proceedings of the 13th ACM Conference on Recommender Systems, Copenhagen, Denmark, 16–20 September 2019; pp. 110–118. [CrossRef]

- 22. Bawack, R.E.; Wamba, S.F.; Carillo, K.D.; Akter, S. Artificial intelligence in E-Commerce: A bibliometric study and literature review. *Electron Mark.* 2022, *32*, 297–338. [CrossRef]
- Song, Z.; Sun, Y.; Wan, J.; Huang, L.; Zhu, J. Smart e-commerce systems: Current status and research challenges. *Electron. Mark.* 2019, 29, 221–238. [CrossRef]
- Vanneschi, L.; Horn, D.M.; Castelli, M.; Popovič, A. An artificial intelligence system for predicting customer default in e-commerce. Expert Syst. Appl. 2018, 104, 1–21. [CrossRef]
- 25. Cano, J.A.; Londoño-Pineda, A.; Rodas, C. Sustainable Logistics for E-Commerce: A Literature Review and Bibliometric Analysis. *Sustainability* **2022**, *14*, 12247. [CrossRef]
- Žižka, J.; Dařena, F.; Svoboda, A. Text Mining with Machine Learning Principles and Techniques, 1st ed.; CRC Press Taylor & Francis Group: Boca Raton, FL, USA, 2020.
- 27. Li, L.; Zhang, J. Research and Analysis of an Enterprise E-Commerce Marketing System Under the Big Data Environment. *Organ. End User Comput.* **2021**, 33, 1–19. [CrossRef]
- Alrumiah, S.S.; Hadwan, M. Implementing big data analytics in e-commerce: Vendor and customer view. *IEEE Access* 2021, 9, 37281–37286. [CrossRef]
- Zhao, Y.; Zhou, Y.; Deng, W. Innovation Mode and Optimization Strategy of B2C E-Commerce Logistics Distribution under Big Data. Sustainability 2020, 12, 3381. [CrossRef]
- 30. Ballestar, M.T. Editorial: Segmenting the Future of E-Commerce, One Step at a Time. *J. Theor. Appl. Electron. Commer. Res.* 2021, 16, I–III. [CrossRef]
- Zhao, Y.; Xu, X.; Wang, M. Predicting overall customer satisfaction: Big data evidence from hotel online textual reviews. *Int. J. Hosp. Manag.* 2019, 76, 111–121. [CrossRef]
- 32. Wu, P.J.; Lin, K.C. Unstructured big data analytics for retrieving e-commerce logistics knowledge. *Telemat. Inform.* **2018**, *35*, 237–244. [CrossRef]
- Xu, F.; Pan, Z.; Xia, R. E-commerce product review sentiment classification based on a Naive Bayes continuous learning framework. *Inf. Process. Manag.* 2020, 57, 102221. [CrossRef]
- 34. Li, J. E-Commerce Fraud Detection Model by Computer Artificial Intelligence Data Mining. *Comput. Intell. Neurosci.* 2022, 2022, 8783783. [CrossRef]
- 35. Chen, S. Analysis of Customization Strategy for E-Commerce Operation Based on Big Data. *Wirel. Commun. Mob. Comput.* 2021, 2021, 6626480. [CrossRef]
- 36. Luo, H.; Song, W.; Zhou, W. TipScreener: A Framework for Mining Tips for Online Review Readers. J. Theor. Appl. Electron. Commer. Res. 2022, 17, 1716–1740. [CrossRef]
- Thandekkattu, S.G.; Kalaiarasi, M. Customer-Centric E-commerce Implementing Artificial Intelligence for Better Sales and Service. In *Proceedings of Second International Conference on Advances in Computer Engineering and Communication Systems*; Reddy, A.B., Kiranmayee, B., Mukkamala, R.R., Srujan Raju, K., Eds.; Algorithms for Intelligent Systems; Springer: Singapore, 2022. [CrossRef]
- Metsai, A.I.; Tabakis, I.M.; Karamitsios, K.; Kotrotsios, K.; Chatzimisios, P.; Stalidis, G.; Goulianas, K. Customer Journey: Applications of AI and Machine Learning in E-Commerce. In *New Realities, Mobile Systems and Applications: Proceedings of the 14th IMCL Conference*; Springer International Publishing: Cham, Switzerland, 2022; pp. 123–132. [CrossRef]
- Needle, F. How Chatbots Can Improve User Experience. 2021. Available online: https://blog.hubspot.com/service/chatbotsuser-experience (accessed on 14 January 2023).
- Oguntosin, V.; Olomo, A. Development of an E-Commerce Chatbot for a University Shopping Mall. *Appl. Comput. Intell. Soft* Comput. 2021, 2021, 6630326. [CrossRef]
- 41. Leng, J.; Sha, W.; Wang, B.; Zheng, P.; Zhuang, C.; Liu, Q.; Wuest, T.; Mourtzis, D.; Wang, L. Industry 5.0: Prospect and retrospect. J. Manuf. Syst. 2022, 65, 279–295. [CrossRef]
- 42. Xia, S.; Shiqi, Y.; Ziqing, H.; Tao, H. The Application of Artificial Intelligence in Electronic Commerce. *Phys. Conf. Ser.* 2019, 1302, 032030. [CrossRef]
- Anastasiei, B.; Dospinescu, N.; Dospinescu, O. The impact of social media peer communication on customer behaviour—Evidence from Romania. Argum. Oeconomica 2022, 48, 247–264. [CrossRef]
- 44. Agrawal, S. The Advent of Social Commerce in the Light of COVID-19 Pandemic. Contemp. Res. Commer. Manag. 2022, 1, 98.
- 45. Madias, K.; Szymkowiak, A. Functionalities of Social Commerce used by SME during Pandemic. *Int. J. Mark. Commun. New Media* 2022, 11, 30–44. [CrossRef]
- Attar, R.W.; Almusharraf, A.; Alfawaz, A.; Hajli, N. New Trends in E-Commerce Research: Linking Social Commerce and Sharing Commerce: A Systematic Literature Review. Sustainability 2022, 14, 16024. [CrossRef]
- 47. Hartley, J. Clarifying the abstracts of systematic literature reviews. Bull. Med. Libr. Assoc. 2000, 88, 332.
- 48. Blei, D.; Ng, A.Y.; Jordan, M.I. Latent dirichlet allocation. J. Mach. Learn. 2003, 3, 993–1022.
- Akour, I.; Alnazzawi, N.; Alshurideh, M.; Almaiah, M.A.; Al Kurdi, B.; Alfaisal, R.M.; Salloum, S. A Conceptual Model for Investigating the Effect of Privacy Concerns on E-Commerce Adoption: A Study on United Arab Emirates Consumers. *Electronics* 2022, 11, 3648. [CrossRef]
- Babalola, I.H.; Aigbavboa, C.O. Evaluating Communication Features of Human Resource Management Practices: The Construction Industry in Lagos State, Nigeria. Businesses 2022, 2, 471–485. [CrossRef]

- 51. Huang, W.; Lin, M.; Wang, Y. Sentiment Analysis of Chinese E-Commerce Product Reviews Using ERNIE Word Embedding and Attention Mechanism. *Appl. Sci.* 2022, *12*, 7182. [CrossRef]
- 52. Tabianan, K.; Velu, S.; Ravi, V. K-Means Clustering Approach for Intelligent Customer Segmentation Using Customer Purchase Behavior Data. *Sustainability* 2022, 14, 7243. [CrossRef]
- 53. Chen, L.; Zhu, H. Behavior prediction based on a Commodity Utility-Behavior Sequence model. *Mach. Learn. Appl.* **2022**, *9*, 100314. [CrossRef]
- 54. Peicheva, M. Data analysis from the applicant tracking system. *Choveshki Resur. Tehnol. HR Technol. Creat. Space Assoc.* 2022, 2, 6–15.
- 55. Hussain, A.; Shahzad, A.; Hassan, R. Organizational and Environmental Factors with the Mediating Role of E-Commerce and SME Performance. J. Open Innov. Technol. Mark. Complex. 2020, 6, 196. [CrossRef]
- 56. Helfat, C.E.; Raubitschek, R.S. Dynamic integrative capabilities for profiting from innovation in digital platform-based ecosystems. *Res. Policy* **2018**, *47*, 1391–1399. [CrossRef]
- 57. Lewandowski, D. Search Engine Optimization (SEO). In *Understanding Search Engines*; Springer: Cham, Switzerland, 2023. [CrossRef]
- Shishmanov, K.; Tashkova, M.; Markova, M. Savremenni Tendentsii v Sazdavaneto na Prilozheniya za Elektronna Targoviya; Scientific Research Almanac, D.A., Ed.; Tsenov Academy of Economics: Svishtov, Bulgaria, 2020; Volume 28, pp. 243–272. (In Bulgarian)
- 59. Ramya, P.; Jai Sai Chaitanya, K.; Fardeen, S.K.; Prabhakar, G. Web Design as an Important Factor in the Success of a Website. *Lect. Notes Netw. Syst.* **2023**, *558*, 51–60. [CrossRef]

**Disclaimer/Publisher's Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.