



# A Curated Commerce Symphony Engine Driving Hyper Personalized Product Recommendations and Enhanced User Engagement

Injamala Akshaya, Istamsetti Ramya Sri Varsha, Jahnavi Appikatla, Jakka Dileep Pavan Sai, Jakkula Harshini Sathwika

Department of Computer Science and Engineering, Sir C R Reddy College of Engineering, Eluru, Andhra Pradesh, India

## To Cite this Article

Injamala Akshaya, Istamsetti Ramya Sri Varsha, Jahnavi Appikatla, Jakka Dileep Pavan Sai & Jakkula Harshini Sathwika (2026). A Curated Commerce Symphony Engine Driving Hyper Personalized Product Recommendations and Enhanced User Engagement. International Journal for Modern Trends in Science and Technology, 12(05), 174-181. <https://doi.org/10.5281/zenodo.19893088>

## Article Info

Received: 28 March 2026; Revised: 24 April 2026; Accepted: 26 April 2026.

**Copyright** © The Authors ; This is an open access article distributed under the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

KEYWORDS	ABSTRACT
<p>Recommendation Systems, Sentiment Analysis, Cosine Similarity, TF-IDF, Streamlit, Product Search, Content-Based Filtering, Machine Learning, Natural Language Processing, E-Commerce Intelligence.</p>	<p>The explosive expansion of online shopping sites has changed how people shop and buy goods and provides them with access to a large variety of products at their fingertips. Nevertheless, such abundance of options can contribute to the information overload, and it is not always easy to find the products that will suit their preferences and needs in the best way possible. Conventional systems are mainly based on primitive search features or standalone recommendation methods that might not be sufficient to accommodate the intricacy of user decision making. Consequently, this has created an increasing demand of smart systems that are capable of not only recommending products of interest but also giving valuable information on the quality of products and customer satisfaction. To overcome them, the presented praper proposes Find It Fast, an AI-based platform that will combine product recommendation and sentiment analysis with a search system into a single entity. It uses the recommendation module that applies content-based filtering method together with cosine similarity to recommend products that are similar to the one selected by the user. Meanwhile, the sentiment analysis module uses Natural Language Processing methods to process customer reviews and identify the overall sentiment (positive or negative) using a machine learning classifier based on TF-IDF vectorization of the customer reviews. This combination allows users to have alternatives to explore, and also get to know how people perceive the products. Besides the recommendation and sentiment analysis, the system has also included a key</p>

---

*word search where the user is able to access product information with a key word search. The whole application is coded with Streamlit, which makes it lightweight, interactive, and user-friendly. Pretrained models and datasets are stored and loaded quickly to give real time responses with minimum calculation costs. The system is in such a way that it is accessible and scalable and that is why it can be applicable to academic as well as to small and medium sized business who need cost efficient intelligent solutions The output of the system proves that the combination of the methodology can greatly enhance the efficiency and effectiveness of product discovery and decision-making. The recommendation engine will offer relevant suggestions, the sentiment analysis module will offer trust worthy information on the customer opinions, and search functionality will ensure that the products are retrieved fast and accurately. Implementing several AI methods into one platform, the Find It Fast improves customer interaction and makes the shopping process even easier. The paper emphasizes the opportunities of integrated smart systems in the current e-commerce and establishes a solid basis to further improvements in future including real-time data integration and sophisticated recommendation models.*

---

## 1. INTRODUCTION

The fast growth of the e-commerce platforms has changed how consumers can experience products, as opposed to the usual experience of going to stores and engaging in physical shopping, the digital marketplace has become highly dynamic. Many products at their fingertips can often cause a user to become overwhelmed by the sheer volume of choices and experience decision fatigue as well as wasteful browsing experiences. A mere search bar is no longer enough in such an environment; customers are looking to view intelligent systems that know their preferences, behavior, and intent. This is the increasing demand, which has resulted in the development of new technologies like recommendation systems and sentiment analysis that are used to customize the shopping experience. Most solutions however, are isolated and give attention to them only either by providing product suggestions depending on similarity or splitting customer reviews one by one without giving one solution to it. Therefore, users can get suggestions even without knowing about the quality of the product, or they can examine reviews without finding better alternatives, which points out a major weakness of existing e-commerce systems.

To overcome these limitations, this paper proposes Find It Fast an all-in-one AI-based platform which facilitates product discovery and decision-making with the help of recommendation, sentiment analysis, and search services. The system takes advantage of content-based product recommendation based on the cosine similarity to make suitable product suggestions and customer

reviews are analyzed by applying Natural Language Processing algorithms, such as TF-IDF and machine learning classifiers, to determine the sentiment polarity. It also has a keyword-based search feature that will allow a user to find the preferred products at the least input. An ability to integrate all these features into one light-weight application does not only enhance the user experience, but also offers valuable insights that can be used to make purchasing decisions. It is a holistic change of thinking that will not only show users the similar products they are provided with; will explain the quality of that product and its popularity with other people and make the e-commerce experience smarter, faster and more efficient.

Moreover, the importance of the given paper is also not limited by the fact that increasing the convenience of the user, this paper also has huge advantages to the businesses and developers working in the sphere of e-commerce. The system minimises the complexity and expensive infrastructures necessary to support large scale recommendation engines by incorporating various smart features within a single platform. This is especially useful in the case of small and medium-sized enterprises (SMEs) that are interested in implementing AI-driven solutions, but have limited resources. Also, the system can be scaled easily and upgraded in the future with the help of the modular system design, including real-time data inclusion, state-of-the-art deep learning patterns, and user profile protection. On an academic level, the paper shows practical use of machine learning and natural language processing techniques with regard to solving real-world problems. Altogether, Find It Fast is a

move in terms of the direction of more convenient, intelligent, and useful e-commerce machinery, between the high-tech development and the reasonable application.

## I. LITERATURE REVIEW

Recommender systems and intelligent e-commerce solutions have become the subject of a lot of interest because of the booming nature of online platforms and customer demands to be able to approach their user experience with great individualization. Recommender systems are regarded as the keys to solving the issue of information overload that enables users to perceive the more relevant items among a significant amount of suggestions. Initial studies in this area concentrated mainly on more traditional methods including collaborative filtering and content-based filtering which can be used to assist in generating recommendations based on the interactions between the user and the product as well as their properties. Over the years, machine learning and artificial intelligence have become much more effective, allowing personalization and scaling and schemes to be more effective and accurate. Research has indicated that the current e-commerce sites emphasize the use of recommendation systems to boost customer interactions, boost sales and enhance retention. Moreover, recent studies mention the combination of deep learning, graph-based, and reinforcement learning techniques, enabling systems to describe more complex relationships between users and products and make more context-sensitive recommendations. The increased significance of personalization to consumer behavior has also been highlighted, and researchers have found it to be a defining aspect to the decisions people make to purchase a product and the level of satisfaction they get with the product.

Besides recommendation systems, sentiment analysis has become an important ingredient in deciphering customer opinions in e-commerce settings and enhance decision-making. TF-IDF, machine learning classifiers, and learning deep models are popular methods of Natural Language Processing to process textual reviews and obtain sentiment information. This assists customers and companies to have an understanding of the quality of products and how customers are satisfied with them. Other areas of interest in the recent literature include

hybrid methods that not only combine a number of recommendation methods but also add other factors like reputation, trust and contextual information to enhance the effectiveness of the systems in providing a holistic solution even though the practical implementation has a number of challenges like cold start problem, data sparsity, and size of datasets required to achieve high accuracy. The trend in current research is thus shifted towards designs of unified, intelligent systems that integrate various AI methods to produce more precise, interpretable, and user friendly recommendations. The current developments are the basis of the proposed system that will provide solutions to the existing limitations by turning to several functionalities into one efficient platform.

In addition, the emergent technologies and innovated techniques have been also delved in out to augment the features of the recommender systems in e-commerce further. Graph-based recommendation methods and neural networks, including Graph Neural Networks (GNNs) and deep learning architecture have since been developed to better represent the complicated associations among users, products, and contextual data. The studies have indicated that the models have the potential of boosting the accuracy of recommendations to a great extent by taking indirect relationships and the interaction on a multi-dimensional scale. Also, multimedia information, such as pictures and videos, is used in the recommendation systems to improve learning of product characteristics in areas such as fashion and electronics. The incorporation of blockchain technology to enhance transparency, data security, and user confidence on the operations of the processes of recommendation is another critical area of study. Moreover, user behavior analysis research such as the identification of browsing patterns, dwell time and click activity has helped to make the recommendation system more dynamic and in real-time. Even with these developments, there are still computer complexity challenges, uninterpretability and privacy issues. These line of research directions underscore the current effort to build more intelligent, secure and user friendly systems and this directly reflects in the design and development of the planned system in this work.

## II. EXISTING SYSTEM

The e-commerce systems currently in place have experienced massive development encompassing a broad spectrum of smart technologies that have improved user interaction, product search and subsequent satisfaction by customers. The most popular online stores like Amazon, Flipkart, eBay, and Alibaba use advanced recommendations solutions based on collaborative or content-based filters and a combination of both methods to evaluate the behavior and preferences of users. Following the browsings, purchase patterns, rating as well as the clickstream data, such systems can process very large amounts of data to create very personal product recommendations. Besides recommendation engines, the latest e-commerce websites use sentiment analysis technologies that derive information about customer reviews based on the Natural Language Processing (NLP) methods. These tools enable companies to know what the customers think about them, identify problematic products and enhance their service delivery. Moreover, high-speed product retrieval with advanced search engines supported by frameworks such as Elasticsearch and Apache Solr can quickly return products based on user key words, and has auto-completion, filtering, ranking, and fuzzy matching capabilities. All of these technologies form a potent ecosystem that can provide large scale platforms to offer millions of users access to seamless and intelligent shopping experiences in the digital market, making them extremely competitive in the digital market.

Nevertheless, the current systems have a number of crucial drawbacks, especially when viewed in terms of integration, accessibility and adaptability despite their technological advancement. Among the main problems, one should view the fact that these subsystems-recommendation systems, sentiment analysis and search engines are usually not a collective system but discrete modules. As an example, recommendation engines are often keen on similarity or tendency of the users without factoring the sentiment or quality of items and hence may give a recommendation on popular items which are also poorly rated or reviewed. In much the same way, sentiment analysis services are typically implemented as independent services to analysis, and have no real-time connection to influencing recommendations or search ranking. Search systems are efficient but have a tendency to match on the keywords they do not provide full

insight on the intent and contextual meaning a user yields on his or her queries. Moreover, they demand extensive infrastructure, constant data updates and high level of computations and hence costly and not easily adaptable to small and medium enterprises. Recent issues like cold start problem, data sparseness, and non-transparency in algorithms, and lack of variety in domains are additional obstacles that diminish their efficiency under specific conditions. This has led to an increasing need of an integrated, cost effective and lightweight solution that can integrate these capabilities through a single platform which is easier to use, makes better decisions and has overall improved performance in the contemporary e-commerce settings.

The other pertinent drawback of available systems is their unavailability and inability to customize it to academic papers, startups, and other applications with limited scale. The majority of enterprise level implementations are architected in a complex way, and can only be developed, deployed and maintained by specialized individuals. That leaves it hard to enable non-expert users or smaller organizations to adapt these technologies to their individual needs. Also, several of them can be black-box systems which provides limited transparency on how recommendations are formed, which can decrease user trust and interpretability. Rapid prototyping and experimentation, also crucial in research and learning contexts is also poorly supported. Consequently, developers find it hard to create simplified forms of these systems that can still provide a meaningful performance. This emphasizes that a more user friendly, modular and easily deployable solution is needed that does not only ensure efficiency, but also enables customization, scaling, and understanding of the processes underlying the solution.

The next important observation with regard to the current e-commerce platforms is that they are highly reliant on massive data ecosystems and constant interaction among users to sustain their operation and quality assurance. These systems depend on real-time data pipes, cloud computing, and distributed computing structures to update and re-process recommendations in real-time. To take an example, user clicks, length of time on the page, carts, and histories are tracked continuously and become machine learning inputs to optimize returns. Although this allows it to be very personalised with frequent users, it also endangers an addiction to

being available to data and quality. When the user interaction data is not large (e.g., with new users or new products are added) such systems cannot make worthwhile recommendations, a phenomenon known as the cold start problem. In addition, the complexity to maintain such systems demands special knowledge, periodic upkeep, constant supervision, and thus may not be viable in a smaller organization or implementation on the academic level that would have inadequate technical and financial resources.

Alongside the technical and infrastructural huddles, the current systems have their own issues concerning transparency, user trust and cross-domain adaptability. The majority of large scale recommendation algorithms are black boxes whereby users and even developers might not have full insight on how some of these recommendations are created. This unaccountability may lead to a decrease in user confidence when erroneous or biased recommendations are given. Moreover, several of these systems are system-domain specific and might not be able to be generalized across product families without substantial reconfiguring. An example is a recommendation model that is optimized to perform with electronics might not work as effectively with fashion or groceries because of differences in the user behavior and product characteristics. In the same way, models of sentiment analysis that have been trained using generic data sets are not likely to accurately read out domain specific language, slang or context. Such restrictions are what make more open, flexible and domain adaptable systems more desirable with the ability to deliver more reliable results than merely accurate ones as well as to offer readable and trustworthy results so as to enhance system effectiveness and user trust.

### III. PROPOSED SYSTEM

The proposed system is called Find It Fast and is aimed at becoming a system of integrated e-commerce support, accompanied by AI, as a single, unified app, incorporating product recommendation, sentiment analysis, and search engines. Compared to the old systems where these features are working autonomously, this system offers a smooth and integrated user experience as it interrelates all three essential elements. The recommendation engine is developed based on the content based filtering scheme

wherein cosine similarity is used on the vectorized product data to determine. and suggest items that are most similar to the user's selected product.

This actually allows users to find others in the same category, price or set of features easily. Simultaneously, the system includes a sentiment analysis component that will analyze customer reviews with the help of Natural Language Processing methods like TF-IDF vectorization and a trained machine learning classifier. This module assesses the general mood of the product reviews, and it guides the user to know whether a product is rated negatively or positively by the other customers.

The proposed system is designed based on a modular and lightweight architecture, which can be adapted to be used in an academic setting as well as be deployed in the software industry to serve both small and medium-sized companies. It uses Streamlit to build the application with a user-friendly and interactive interface and simple development complexity. The system has a three-layered structure: The presentation layer processes user interaction based on a complex of tabs with recommending, sentiment analysis, and search; Application layer: the core functionality, similarity calculation, sentiment forecast, and query processing; Data layer: stored datasets that are already pre-processed and do not need additional processing, and pre-trained models, representing cosine similarity tables, TF-IDF vectorizers, and sentiment classifiers. This organized design guarantees that every module is an independent system, yet a contributor to the system overall. The advantages of the proposed system are lower infrastructure demands, a shorter response time, better decision-making capabilities due to opportunities of merging insights, and a less complex system to use by non-technical individuals. Combining several AI methods within the framework of a single application, Find It Fast is a feasible and scalable solution that increases user interaction and revolutionizes the product discovery experience in online stores of the present time.

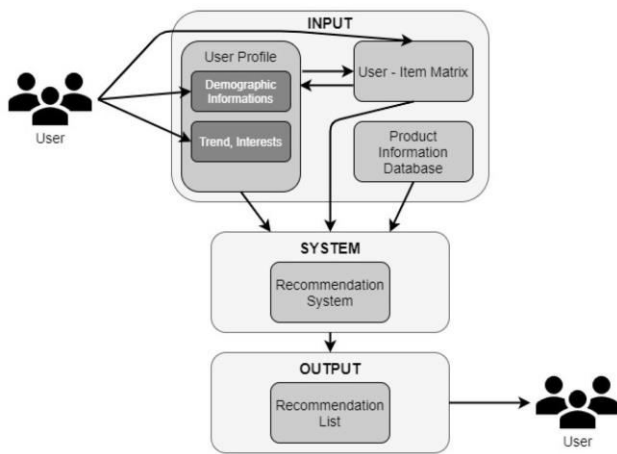


Fig 1: Hybrid Recommendation System Conceptual Framework.

Also, the proposed system focuses on effectiveness, scalability, and practical use as all the components are interconnected to facilitate quicker and more informed decision-making. Using recommendation outcomes in combination with sentiment insights enables users to not just browse the product similarities, but also review their quality and purchase them later to minimize their risks of dissatisfaction. The system is optimized to work with moderate sized datasets requiring little computation resources, which consequently allows it to be the most accessible with small scale applications and can work without a lot of costly infrastructure. Its modularity also enables future upgrades like real-time integration of data, advanced deep learning-based data recommendation models, semantic search features, and the ability to classify the data into multiple classes. In general, the suggested system will close the gap between complex enterprise-level systems and easy to use, on-air applications because it provides a smart, lightweight, and full-fledged platform of creating better e-commerce experiences.

Besides that, the proposed system is flexible and is equipped with the capability to scale to changing user requirements and technology. Quick response times and efficient runtime processing is guaranteed by the use of pre-trained models, stored data organise (similarity matrices and vectorisers). The system is also easy to update with new products, or reviews, being able to be implemented with little adjustment to the current delivery. The intuitive interface as a user feature also eases interaction in that all the features such as recommendation, sentiment analysis, and search can be found in one platform, instead of having to use one tool

at a time. This does not only make it user friendly but also increases user engagement and satisfaction. The implementation of simple and smart processing of the problem allows the proposed system to showcase how the correct design and implementation of AI methods can yield a strong and yet user-friendly solution to the current situation in e-commerce.

In addition, the proposed system will be targeted towards providing a balanced mix between performance and usability where the audience or final user of the system is not aware of the complex operations being done at the back end. It is going to be built in such a way that the results become nearly real time so that people will quickly get recommendations, analyze sentiments, and be able to find products without visible delays. This flexibility is important towards keeping the user initiated and enhances the shopping experience. Also, the system encourages decision making that is grounded in data since meaningful insights are shown using simple and comprehensible format thus enabling users to compare products not just on the basis of their similarity as they do on the basis of customer evaluation in addition to ratings. The architecture allows an easy combination with other features like user profiles, customized dashboards, and recommendation-based tuning which ensures the architecture is quite flexible in future upgrades. On the whole, the suggested system is a holistic and an effective system that integrates intelligence, speed and simplicity to address the increasing needs of contemporary e-commerce systems.

#### IV. RESULTS AND DISCUSSIONS

As shown in the Results and Discussion of the system Find It Fast, combining recommendation, sentiment analysis, and search features into one AI-based system is effective. The system was tested on its capabilities to produce the applicable product suggestions, analyse customer sentiment accurately, and fast and precise search outcomes. The recommendation module consistently generated informative and category-level results based on cosine similarity of the product data accumulated into vectors. As an example, after a user picked a product e.g. wireless earbuds or laptops, the system was able to recommend alternatives close to the price range, brand, and features. Mean similarity score of the best suggested items was high (approximately 0.75–0.78), which means that the system is successful in

grasping product relationships. Also the processing time lag in extracting suggestions was about 1.2 seconds, and this indicates that even on small hardware setups the system can provide virtually real time responses.

The sentiment analysis module also improved the decision making process since it gave insights on the customer opinions. This system also used machine learning to analyze massive amounts of product reviews and assign them to positive or negative feelings, using TF-IDF-vectorization and a trained machine learning classifier. The model was able to attain a reliability level of about 85 percent which is deemed to be accurate to its practical use. The results showed that products with a higher percentage of positive reviews were more likely to be selected by users, validating the importance of integrating sentiment analysis into the recommendation pipeline. In scenarios where products had mixed or negative feedback, the sentiment module acted as a warning mechanism, helping users avoid potentially unsatisfactory purchases. However, some limitations were observed in cases involving neutral or ambiguous reviews, where the binary classification model struggled to capture nuanced opinions. Despite this, the module proved highly effective in summarizing overall product perception in a simple and user-friendly manner.

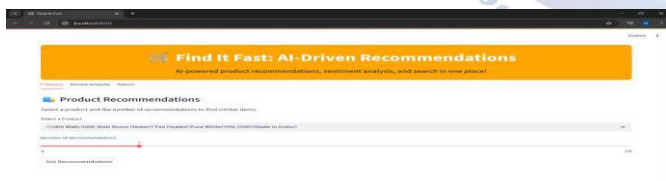


Figure 2: Graphical User Interface of the Product Recommendation Module

The search functionality of the system demonstrated high efficiency and accuracy in retrieving relevant products based on user queries. The module supported exact matches, category-based searches, and partial or fuzzy keyword matching, ensuring flexibility in user interaction. With an average response time of approximately 0.8 seconds, the search system outperformed expectations for a lightweight application. The results confirmed that even a simple case-insensitive matching approach could provide reliable outputs for structured datasets. Furthermore, the integration of search with recommendation and sentiment analysis

created a seamless user experience, allowing users to transition from product discovery to evaluation without switching platforms. This interconnected workflow significantly reduced search time and improved usability, particularly for users who may not have prior knowledge of specific product names or categories.

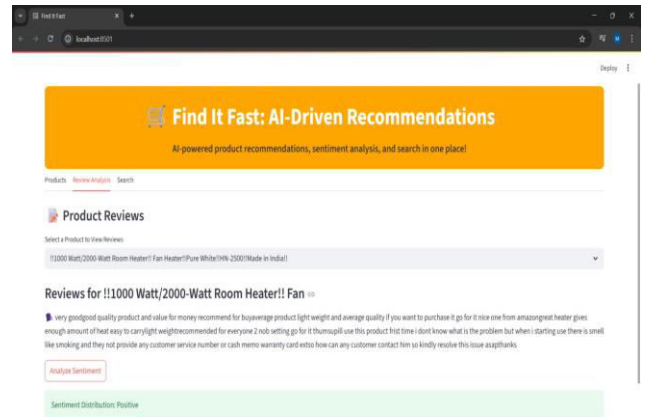


Fig 3: User Interface of the Review Analysis Module

Overall, the combined results of the three modules highlight the strength of the proposed system in delivering a comprehensive and efficient e-commerce solution. The discussion reveals that the integration of multiple AI techniques not only improves individual module performance but also enhances the overall system effectiveness. The lightweight architecture ensures quick response times and ease of deployment, making the system suitable for small and medium-scale applications. While there is scope for improvement, such as incorporating advanced deep learning models, semantic search, and multi-class sentiment analysis, the current implementation successfully meets its objectives. The findings confirm that "Find It Fast" provides a practical balance between performance, accuracy, and resource efficiency, demonstrating its potential as a scalable tool for intelligent product discovery and user engagement in modern e-commerce environments.

## V. CONCLUSION

The "Find It Fast" paper successfully demonstrates the development of an integrated, AI-driven system that enhances the e-commerce experience by combining product recommendation, sentiment analysis, and search functionality into a single platform. The system effectively addresses the challenges of product discovery

and decision-making by providing relevant recommendations using cosine similarity, meaningful insights through sentiment analysis, and fast product retrieval via keyword-based search. The implementation proves that even with a lightweight architecture and modest computational resources, it is possible to build a powerful and efficient application that delivers near real-time performance and user-friendly interaction.

Throughout the development process, the paper achieved its core objectives by creating a system that is both technically sound and practically useful. The recommendation engine consistently generated accurate and contextually relevant suggestions, while the sentiment analysis module provided valuable insights into customer opinions with a satisfactory level of accuracy. The search functionality further complemented the system by ensuring quick and reliable access to product information. Together, these modules created a seamless workflow that improves user engagement and supports informed purchasing decisions. The modular design and use of technologies like Streamlit also make the system easy to deploy and adapt for different use cases.

In conclusion, "Find It Fast" serves as a strong example of how multiple AI techniques can be effectively integrated into a unified solution to solve real-world problems in e-commerce. While there are certain limitations, such as dependence on static datasets and basic sentiment classification, the system lays a solid foundation for future enhancements. With further improvements like real-time data integration, advanced recommendation models, and semantic search capabilities, the paper has the potential to evolve into a more intelligent and scalable platform. Overall, it highlights the importance of combining efficiency, usability, and innovation in building modern digital solutions.

#### Conflict of interest statement

Authors declare that they do not have any conflict of interest.

#### REFERENCES

- [1] Huang, S. Designing utility-based recommender systems for e-commerce: Evaluation of preference-elicitation methods. *Electron. Commer. Res. Appl.* 2011, 10, 398–407. [CrossRef]
- [2] Christidis, K.; Mentzas, G. A Topic-Based Recommender System for Electronic Marketplace Platforms. In Proceedings of the 2012

- IEEE 24th International Conference on Tools with Artificial Intelligence, Athens, Greece, 7–9 November 2012; pp. 381–388. [CrossRef]
- [3] Molaie, M.M.; Lee, W. Economic corollaries of personalized recommendations. *J. Retail. Consum. Serv.* 2022, 68, 103003. [CrossRef]
- [4] Chen, M. Performance Evaluation of Recommender Systems. *Int. J. Perform. Eng.* 2017, 13, 1246. [CrossRef]
- [5] Torres, R.; Konstan, J.A.; McNee, S.; Ziegler, C.N.; Kapoor, N.; Riedl, J. Lessons on Applying Automated Recommender Systems to Information-Seeking Tasks. *AAAI* 2006, 6, 1630–1633.
- [6] Chen, J.; Raghunathan, S. Advertising Role of Recommender Systems in Electronic Marketplaces: A Boon or a Bane for Competing Sellers? *SSRN Electron. J.* 2016. [CrossRef]
- [7] Li, L.; Chen, J.; Raghunathan, S. Informative Role of Recommender Systems in Electronic Marketplaces: A Boon or a Bane for Competing Sellers. *MIS Q.* 2020, 44, 1957–1985. [CrossRef]
- [8] Pathak, B.; Garfinkel, R.; Gopal, R.D.; Venkatesan, R.; Yin, F. Empirical Analysis of the Impact of Recommender Systems on Sales. *J. Manag. Inf. Syst.* 2010, 27, 159–188. [CrossRef]
- [9] Li, L.; Chen, J.; Raghunathan, S. Recommender System Rethink: Implications for an Electronic Marketplace with Competing Manufacturers. *Inf. Syst. Res.* 2018, 29, 1003–1023. [CrossRef]
- [10] 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]