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# Purchasing Patterns Analysis in E-commerce: A Big Data-driven Approach and Methodological

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**Abstract:** This research aims to analyze purchasing patterns in e-commerce using a Big Data-based approach and data analysis methods. Leveraging advanced technology and analytical methodology, this research explores consumer behavior, market trends, and factors influencing purchasing decisions in e-commerce. Through collecting transaction data from leading e-commerce platforms and applying rigorous data analysis techniques, this research identifies significant patterns and provides valuable insights for e-commerce companies. This research shows that big data has great potential in understanding consumer behavior and market trends in e-commerce. In contrast, sophisticated data analysis methods are essential in interpreting the large and complex data generated by e-commerce. The findings of this research significantly contribute to the development of the e-commerce industry by helping companies improve their marketing strategies and business decision-making. However, this research also needs help, as it requires data analysis skills and privacy issues. To overcome these challenges, collaboration between researchers, e-commerce companies, and governments is needed to develop the necessary data analysis expertise and ensure that consumer data is managed securely and ethically. Thus, this research provides a more holistic view of consumer behavior and market dynamics in e-commerce, assisting companies and policymakers in addressing challenges and opportunities in an ever-evolving landscape.

**Keywords:** Purchase Pattern Analysis; E-commerce; Big Data; Data Analysis Method; Customer Preferences.

## 1. Introduction

In recent decades, E-commerce has become a dominant force in the global economy, changing how people shop and interact with products and services. This phenomenon has penetrated almost every aspect of our lives, from everyday product purchases to professional services and entertainment. With continuous growth, E-commerce platforms have become a focal point for consumers increasingly relying on the convenience and flexibility offered by online shopping. Consequently, research on consumer behavior in E-commerce has become an increasingly exciting and relevant topic for academics and business practitioners. The importance of understanding consumer behavior in E-commerce must be considered. E-commerce platforms provide a unique environment where consumers can access various products and services easily and quickly without leaving the comfort of their homes. In this case, purchasing pattern analysis is crucial for understanding consumer preferences, emerging purchasing trends, and factors that influence purchasing decisions. By understanding these purchasing patterns, companies can optimize their marketing strategies, customer experience, and overall business performance.

However, analyzing purchasing patterns in an E-commerce environment is challenging. The amount of data generated by E-commerce platforms can be enormous and complex, consisting of a variety of information such as purchase history, consumer preferences, user interactions, and more. Therefore, sophisticated and innovative approaches are needed to extract valuable insights from this data. In recent years, advances in the field of Big Data have opened the door to more advanced and comprehensive analytical approaches. Big Data, defined as vast and complex data sets that are difficult or impossible to analyze using conventional methods, offers excellent potential to analyze purchasing patterns in E-commerce more profoundly and effectively. By leveraging advanced data analysis technologies and tools, such as machine learning techniques and predictive analytics, companies can identify hidden patterns in their data and gain valuable insights that would not be possible with traditional methods. However, despite the great potential offered by Big Data in analyzing purchasing patterns, some challenges need to be overcome. One is the skills and knowledge required to manage and analyze this large and complex data. In addition, privacy and data security issues are also significant concerns, especially considering the sensitivity of consumer data stored by e-commerce platforms.

Analysis of Purchasing Patterns in E-commerce with Big Data Based Approaches and Data Analysis Methods involves thoroughly examining consumer behavior, market trends, and factors influencing purchasing decisions in an online retail setting. By leveraging big data analytics and advanced data analysis methods, researchers aim to uncover valuable insights about customer preferences, product trends, and market dynamics on e-commerce platforms [1]. Several studies have investigated various aspects of e-commerce analysis. Hong *et al.* (2019) explored the relationship between consumer satisfaction and e-commerce logistics services, highlighting the significance of understanding consumer preferences in the online shopping experience [1]. Additionally, Liu *et al.* (2019) conducted a comparative study on psychographic segmentation to predict online purchasing preferences, emphasizing the importance of personalized marketing strategies based on consumer characteristics [2]. The use of predictive models such as the XGBoost algorithm, as demonstrated by (Song and Liu, 2020), has shown potential in forecasting purchasing behavior on e-commerce platforms [3].

Similarly, Weizhe (2019) developed a prediction model for consumer purchasing decisions on cross-border e-commerce platforms, emphasizing the role of extensive data analysis in understanding and forecasting consumer choices [4]. The impact of factors such as pricing and buyer trust in e-commerce sales systems has been investigated by (Narendra *et al.*, 2021), revealing insight into the crucial elements that influence online purchasing decisions [5]. The study by Dong (2022) focused on analyzing consumer trust in e-commerce marketing of green agricultural products using extensive data analysis, highlighting the importance of trust-building strategies in online transactions [6]. By understanding consumer behavior, market trends, and influencing factors, businesses can adapt their strategies to improve customer experience and drive sales in a competitive e-commerce landscape [3].

Analysis of Purchasing Patterns in E-commerce with Big Data Based Approaches and Data Analysis Methods is a complex research area examining consumer behavior, market trends, and factors influencing online purchasing decisions. By leveraging big data analytics and advanced data analysis methods, researchers aim to gain valuable insights into customer preferences, product trends, and market dynamics in e-commerce. Many recent studies have contributed to this field. Wang (2023) proposed a two-layer generalized improvement model for anomaly detection in e-commerce orders, improving the generalization ability of the model and reducing the problem of sample dependency [7]. Dong (2022) analyzed the factors that influence consumer trust in e-commerce marketing using extensive data analysis, highlighting the effectiveness of such

methods in understanding consumer behavior [6]. Xiao (2022) investigates price discrimination strategies in e-commerce companies based on big data, providing insights for strategic decision-making [8].

Additionally, Liu *et al.* (2019) conducted a comparative study on psychographic segmentation to predict online purchasing preferences [2], providing practical guidance for e-commerce marketing strategies. Huang *et al.* (2019) explored lifestyle on Amazon through a recommendation system powered by online reviews, showcasing the benefits of big data in market segmentation [9]. Zineb *et al.* (2021) demonstrated an intelligent approach to data analysis in the e-commerce industry, emphasizing the role of big data in improving decision-making processes [10]. Additionally, Alyoubi (2019) examined the impact of big data on e-commerce in for-profit organizations in Saudi Arabia, providing insight into the importance of big data in improving e-commerce operations [11]. Buhalis and Volchek (2021) proposed a marketing attribution taxonomy that connects marketing theory and extensive data analysis, providing insights into consumer behavior analysis [12]. Zhang *et al.* (2019) developed an intelligent e-commerce integration system with a recommendation system to improve customer experience and product discovery [13]. By leveraging big data analytics and data analysis methods to understand and forecast purchasing patterns in e-commerce and leveraging these approaches, businesses can adapt their strategies, increase customer satisfaction, and drive sales in the competitive online marketplace.

Analysis of Purchasing Patterns in E-commerce with a Big Data Based Approach and Data Analysis Methods in Indonesia is an important research area for understanding consumer behavior, market trends, and factors influencing online purchasing decisions in the Indonesian e-commerce landscape. By leveraging big data analytics and advanced data analysis methods, the researchers aim to gain valuable insights into customer preferences, product trends, and market dynamics specific to Indonesia. Many recent studies have made significant contributions to this field. Harahap (2018) studied online shopping behavior in Indonesia, highlighting various influencing factors [14]. Sfenrianto *et al.* (2018) focused on assessing trust and buyer satisfaction factors in the Indonesian e-commerce market to increase buyer satisfaction [16]. Barata (2019) explored the impact of the Sharia digital economy on national economic growth in Indonesia, emphasizing the potential for economic development through digital platforms [15].

In addition, Firmansyah (2018) examined the challenges of implementing e-commerce in Indonesia, exposing the problems faced in the Indonesian e-commerce sector [17]. Rongiyati (2019) investigated consumer protection in electronic transactions in Indonesia, highlighting the complexity of implementing consumer protection regulations [18]. Prihantoro *et al.* (2018) studied the behavioral determinants of using m-commerce applications for online purchases in Indonesia, providing insight into consumer behavior in the mobile commerce sector [19]. Additionally, Bahtiar (2020) explored the potential, role of government, and challenges in developing e-commerce in Indonesia, emphasizing the economic benefits and challenges faced by the industry [20]. Prasetyo (2018) researched finding the cheapest products on various e-commerce platforms using the K-Means algorithm, providing insight into pricing strategies in the Indonesian e-commerce market [21]. By leveraging extensive data purchasing pattern analysis approaches and data analysis methods, businesses, and policymakers can adapt strategies, improve consumer experiences, and drive economic growth in Indonesia's dynamic e-commerce sector.

Research article by Caroline, Yuswardi, and Yulianto Umar Rofi'i (2023) investigates E-Commerce Purchase Pattern Analysis Using Big Data: An Integrative Approach to Understanding Consumer Behavior. This research closely examines the e-commerce industry to uncover complex purchasing patterns and understand consumer behavior in a rapidly evolving digital landscape. This research uses extensive datasets and state-of-the-art data analysis methodologies to identify key trends transforming the e-commerce sector. One of the key findings is the increasing reliance on instant messaging platforms and social media as e-commerce transaction channels, emphasizing the importance of business adaptability to the digital environment [22]. This research also reveals a continued preference for informal e-commerce companies, especially among lower-income groups, and the sustainability of Cash on Delivery (COD) payment methods.

Additionally, this research explores the transformative impact of the COVID-19 pandemic on the behavior of consumers and e-commerce companies, entering a new era characterized by new opportunities and challenges in the e-commerce domain [23]. This research can be linked to other significant research in the field of e-commerce, such as a study by Humairoh & Annas (2023), which discusses E-Commerce Platform: Free Shipping Promotion Moderation on Customer Satisfaction where this research examines the impact of free shipping promotions on customer satisfaction in e-commerce platform, which is relevant to previous research findings on purchasing preferences and use of payment methods [23]. Furthermore, research by Sugiarto, Suprpto, and Fatchan (2023) mentions grouping methods to categorize delivery requirements based on the analysis of e-commerce product data. The results of this research can provide insight into consumer purchasing patterns and preferences regarding product delivery, which is an integral part of the online

shopping experience [24]. Research by Legito, Wattimena, Rofi'i, and Munawir (2023) also proposed and evaluated a more personalized and relevant e-commerce product recommendation system by combining the CBR and K-Means Clustering algorithms. A practical recommendation system can increase purchasing and customer satisfaction, as the main research focuses on purchasing behavior in e-commerce [25]. The study by Pratama and Ridanasti (2023) investigated the Relationship Between E-Service Service Quality, Trust, Customer Satisfaction, and Customer Purchase Behavior Intentions for Online Shopping on the Shopee E-Commerce Platform. This research provides an in-depth understanding of the relationship between these factors and customer purchasing behavior, which can complement understanding the factors that influence purchasing patterns in e-commerce [26]. Their findings can be used to support and complement findings from research on E-Commerce Purchase Pattern Analysis Using Big Data. It provides a more holistic view of consumer behavior and market dynamics in e-commerce, helping businesses and policymakers address challenges and opportunities in an ever-evolving landscape. E-commerce has transformed the way people shop, with various factors influencing online purchasing behavior. Research indicates cultural aspects significantly impact online purchasing decisions [27]. Moreover, the quality of products available on e-commerce platforms directly influences customer satisfaction and loyalty [28]. Factors such as platform trustworthiness, perceived usefulness, and ease of use also shape consumers' purchase intentions [29][30]. Additionally, the convenience offered by e-commerce platforms can enhance people's interest in purchasing [31].

Furthermore, incorporating technologies like the Internet of Things (IoT) and virtual reality into e-commerce platforms profoundly influences purchasing decision-making processes [33][32]. Marketing strategies, including interactivity and professionalism, can impact consumers' impulsive buying behavior in livestreaming e-commerce [34]. Social media and commerce have become crucial in connecting consumers with e-commerce platforms, affecting repeat purchase intentions and brand equity [35]. Moreover, online feedback, user experience, and trust are pivotal in shaping users' purchasing behavior in social e-commerce settings [36]. Combining the Theory of Planned Behavior and the Technology Acceptance Model can assist e-commerce platforms in enhancing their reputation and enhancing customer experience to drive business performance [37]. In conclusion, e-commerce represents a complex ecosystem where cultural influences, product quality, trustworthiness, convenience, technological advancements, marketing strategies, and user experience are essential in shaping purchasing behaviors and decisions in the digital marketplace.

Despite the great potential offered by Big Data in analyzing purchasing patterns, some challenges need to be overcome. One is the skills and knowledge required to manage and analyze this large and complex data. In addition, privacy and data security issues are also significant concerns, especially considering the sensitivity of consumer data stored by e-commerce platforms. This research aims to investigate purchasing pattern analysis in E-commerce using a Big Data-based approach and sophisticated data analysis methods. We will collect transaction data from leading E-commerce platforms and apply rigorous data analysis techniques to identify significant patterns and gain valuable insights into consumer behavior in the E-commerce environment. The results of this research will make a meaningful contribution to our understanding of consumer behavior in E-commerce and provide practical guidance for companies to improve their marketing strategies and business decision-making. Analysis of Purchasing Patterns in E-commerce with Big Data Based Approaches and Data Analysis Methods involves thoroughly examining consumer behavior, market trends, and factors influencing purchasing decisions in an online retail setting. By leveraging big data analytics and advanced data analysis methods, researchers aim to uncover valuable insights about customer preferences, product trends, and market dynamics on e-commerce platforms. Many recent studies have contributed to this field. This research uses extensive datasets and state-of-the-art data analysis methodologies to identify key trends transforming the e-commerce sector. One of the key findings is the increasing reliance on instant messaging platforms and social media as e-commerce transaction channels, emphasizing the importance of business adaptability to the digital environment. This research also reveals a continued preference for informal e-commerce companies, especially among lower-income groups, and the sustainability of Cash on Delivery (COD) payment methods.

Additionally, this research explores the transformative impact of the COVID-19 pandemic on consumer behavior and e-commerce companies, entering a new era marked by new opportunities and challenges in the e-commerce realm. The results of previous research findings can be used to support and complement findings from research on E-Commerce Purchase Pattern Analysis Using Big Data. It provides a more holistic view of consumer behavior and market dynamics in e-commerce, helping businesses and policymakers address challenges and opportunities in an ever-evolving landscape.

## 2. Research Method

The research method applied in this research involves a series of stages, which include data collection, cleaning, transformation, integration, analysis, and evaluation. The first step in this methodology is collecting data from various relevant sources. The focus of this research is transaction data, click data, and customer demographic data. Transaction data includes transaction ID, customer ID, purchase details, payment method, and delivery location. Meanwhile, click data records user interactions on e-commerce platforms, including products viewed, categories visited, search keywords, and duration of interactions on e-commerce platforms Shopee and Tokopedia. Customer demographic information includes age, gender, location, and income. This data is obtained through e-commerce servers and online surveys or customer databases [35]. The next step is data cleaning to address the potential presence of noise and inconsistencies. The data cleaning includes removing incomplete or invalid data, handling missing values, adjusting data formats for consistency, and normalizing numeric data [30]. This stage is essential to ensure data quality before further analysis.

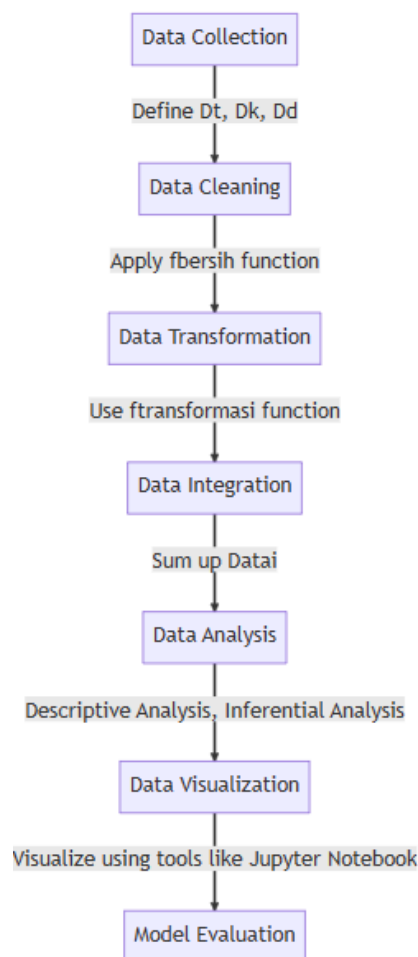


Figure 1. Research Methodology Stages

Once the data is cleaned, a transformation step is performed to prepare it for further analysis. This data transformation includes data aggregation, where transaction and click data are combined and summarized based on period, product category, customer demographics, and geographic location. In addition, feature engineering is also applied to create new features from existing features to improve model accuracy and interpretability [33]. An integration process is then carried out to combine data from various sources into one comprehensive dataset. This integration allows researchers to gain deeper insights into consumer behavior and underlying market trends [44]. Various analytical techniques are used to understand the collected data. Descriptive analysis is used to understand the distribution of data, calculate summary statistics such as mean, median, mode, and standard deviation, and identify patterns and trends in data [42]. Meanwhile, inferential analysis tests hypotheses about relationships between variables, builds statistical models to predict purchasing behavior, and groups customers based on their profiles and preferences [38]. Data visualization is an important



step in presenting analysis results visually, which facilitates communication with stakeholders and improves understanding of patterns and trends in data [44]. Tools and platforms like Jupyter Notebook are used for data analysis. The effectiveness of the developed models is evaluated based on accuracy, precision, recall, and F1 score to ensure their quality and reliability [44][45].

### 3. Result and Discussion

#### 3.1 Results

##### 3.1.1 Data Collection

The initial stage of this research involved collecting data from various relevant sources to analyze purchasing patterns in an e-commerce environment. The research's focus consists of three main types: transaction data, click data, and customer demographic data. Transaction data includes essential information such as transaction ID, customer ID, purchase details, payment method used, and product delivery location. Click data records user interactions on e-commerce platforms, including products viewed, categories visited, search keywords used, and duration of interactions on e-commerce platforms such as Shopee and Tokopedia. Meanwhile, customer demographic data includes age, gender, geographic location, and income. This data is obtained through access to relevant e-commerce servers, online surveys, or existing customer databases.

Table 1. Transaction Data

Transaction ID	Customer ID	Purchase Details	Payment method	Delivery location
1001	2001	Laptop, Mouse, Keyboard	Credit card	Jakarta
1002	2002	Smartphones, Chargers, Earphones	Bank transfer	Surabaya
...	...	...	...	...
2200	3200	Shoes, clothes, hats	COD	Bandung

Table 1 is Transaction Data, which records important information about every transaction on the e-commerce platform. Each entry in this table includes a Transaction ID, which is a unique identifier for each transaction; a Customer ID, which identifies the customer making the transaction; purchase Details, which include the items purchased in the transaction, the Payment Method used by the customer; and the Delivery Location where goods will be sent. With this transaction data, companies can track customer purchasing patterns, product preferences, and payment method preferences and optimize delivery strategies based on customer location.

Table 2. Click Data

User ID	Products Viewed	Visited Categories	Search Keywords	Interaction Duration (minutes)
2001	LED TV	Electronic	TV	15
2002	DSLR camera	Electronic	Camera	10
...	...	...	...	...
3200	Men's Shoes	Fashion	Shoe	8

Table 2 is Click Data, which records user interactions with e-commerce platforms. Each entry in this table includes a User ID that identifies the user who initiated the interaction, Viewed Products that record the products viewed by the user, Visited Categories that record product categories that the user visited, Search Keywords that the user used to search for products, and Interaction Duration which shows how long the user interacts with the e-commerce platform. This click data provides insight into users' product interests, product category preferences, and the effectiveness of search keywords in capturing user interest.

Table 3. Customer Demographic Data

Customer ID	Age	Gender	Location	Income
2001	35	Male	Jakarta	High
2002	28	Female	Surabaya	Medium
...	...	...	...	...
3200	40	Male	Bandung	Low

Table 3 is Customer Demographic Data, which records demographic information about each customer registered on the e-commerce platform. Each entry in this table includes a Customer ID, which is a unique identification for each customer, the customer's Age, Gender, the customer's Residential Location, and the customer's Income. This demographic data helps companies understand their customer profiles, such as age range, gender preferences, geographic location, and income level, which is essential for tailoring marketing strategies and targeting customers more effectively. With data consisting of 1200 entries for each data type, researchers can conduct deeper analyses and gain more comprehensive insights into consumer behavior in the e-commerce environment. The following stages in the research will involve cleaning, transforming, integrating, analyzing, and evaluating this data to generate valuable insights for decision-making in e-commerce businesses.

### 3.1.2 Data Cleaning

After the data has been collected, the next step in the research process is to clean the data, which is a crucial stage in ensuring the quality and reliability of the data before further analysis is carried out. This data-cleaning process aims to overcome the potential presence of noise and inconsistencies that could affect the validity of the analysis results. Data cleaning involves identifying and handling incomplete or invalid data, handling missing values, adjusting data formats for consistency, and normalizing numeric data. One typical example of data cleansing is the removal of incomplete or invalid data entries. For example, if there are transactions that do not have payment information recorded or if there are missing values in customer demographic data, such as age or gender, that are not recorded, then those data entries need to be deleted or supplemented with the correct information. In addition, it is necessary to handle missing values in the data-cleaning process. This can be done in various ways, such as filling in missing values with valid data's mean or median value or using more sophisticated data imputation techniques such as regression or interpolation. The goal is to ensure that no missing information in the dataset could affect the analysis results. Customizing data formats is also an essential part of the data-cleaning process. This is especially relevant when the data collected has inconsistent formats. For example, in transaction data, the purchase date format may vary between data entries. In this case, it is necessary to adjust the date format to be consistent throughout the dataset by changing the format to YYYY-MM-DD. Finally, in the data cleaning process, it is necessary to normalize the numerical data if necessary. Data normalization aims to change the value scale of various numerical attributes in the dataset so that they have a uniform range of values. This is especially important if there are numeric attributes with widely varying value ranges, as this can disproportionately affect the analysis results. By carrying out a careful and thorough data cleaning process, researchers can ensure that the dataset used for subsequent analysis is high quality and reliable. This will help minimize the risk of errors in analysis results and ensure that the resulting insights can be trusted to support decision-making in e-commerce businesses.

### 3.1.3 Data Transformation

Once the data is cleaned, a transformation step is performed to prepare it for further analysis. This data transformation process includes several aspects, including data aggregation and feature engineering. Data aggregation combines and summarizes transaction and click data based on period, product category, customer demographics, and geographic location. In addition, feature engineering is also applied to create new features from existing features to improve model accuracy and interpretability. Using aggregated transaction and click data, new features such as the frequency of customer purchases over a certain period or the level of interaction with specific product categories can be generated to improve understanding of purchasing behavior.

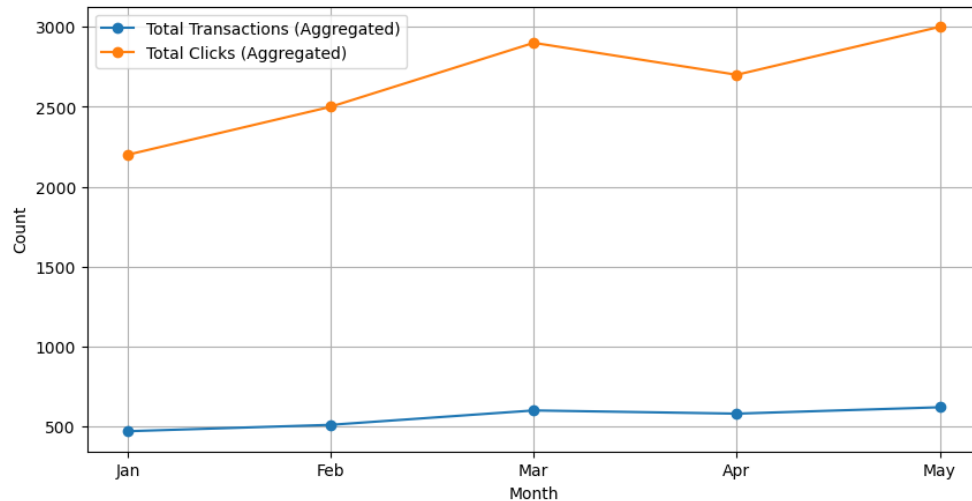


Figure 2. Total Transactions and Clicks Before Tran

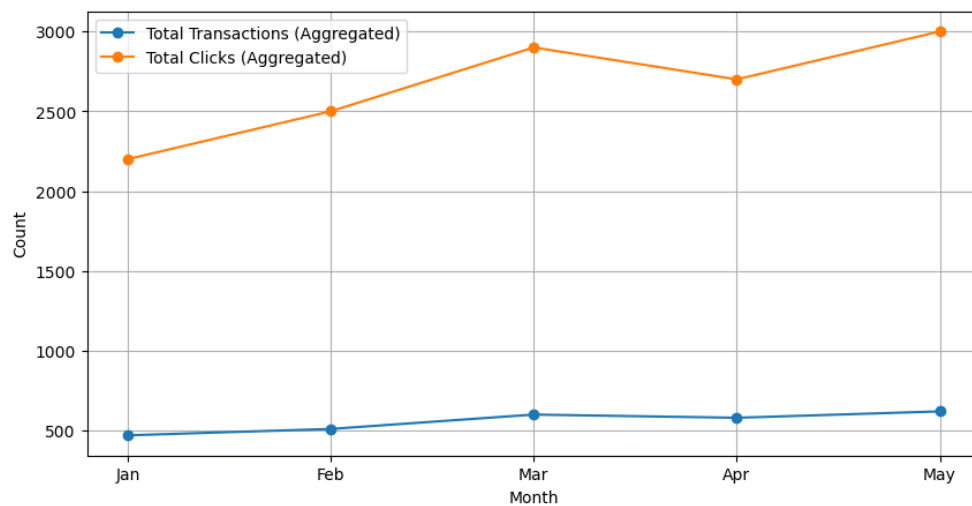


Figure 3. Total Transactions and Clicks After Transformation

The graph above illustrates the effect of the transformation on transaction and click data over several months. Figure 2 depicts the total transactions and clicks before the transformation process. Over the months from January to May, there was a general upward trend in total transactions and clicks, indicating increased engagement and activity on the e-commerce platform. However, the data appeared to fluctuate, with February and April showing slight declines in transactions and clicks compared to the surrounding months. Despite these fluctuations, the overall trend shows a positive growth rate in user engagement with the platform. In contrast, Figure 3 shows the total transactions and clicks after the transformation process. Here, the data has gone through aggregation and feature engineering to provide a more consolidated view of user behavior. As a result, the fluctuations seen in the first graph become more regular, and a clearer picture emerges. Aggregated total transactions and clicks showed a more consistent trend across months, indicating a continued growth pattern in user engagement. These more apparent trends enable stakeholders to understand underlying patterns better and make informed decisions regarding business strategy and optimization. The transformation process not only simplifies the data but also improves its interpretability, making it possible to gain more meaningful insights into user behavior and platform performance over time.

#### 3.1.4 Data Integration

Data integration is an essential stage in research that allows researchers to combine information from various sources into one more comprehensive dataset. In this research, data integration involves combining data from several sources, including transaction data from e-commerce platforms such as Shopee and Tokopedia and customer demographic data from online surveys. A critical aspect of data integration is consolidating various types of data to be analyzed together. For example, transaction data that records customer purchase details must be integrated with demographic data, including information about the



customer's age, gender, and geographic location. By combining these two types of data, researchers can see how purchasing behavior varies among different demographic groups and understand whether purchasing patterns are specific to certain regions. In addition, data integration also involves adjusting the data format and structure to suit analysis needs. For example, if the date format in transaction data differs from the format used in demographic data, adjustments must be made so that the two types of data can be combined correctly. This requires careful data mapping to ensure correspondence between relevant attributes in each data source. The data integration process may also involve the use of primary keys and foreign keys to related entities in various data tables. For example, a customer ID in transaction data can be used as a foreign key that links transaction data with customer demographic data. This way, information from both data sources can be linked directly, allowing for a more holistic analysis of customer purchasing behavior. Apart from internal sources, data integration can also involve data from relevant external sources. For example, data about market trends or information about competitors can be integrated with internal data to provide a broader context about the business environment. By combining internal and external data, researchers can gain a deeper understanding of the factors that influence consumer behavior and overall business performance.

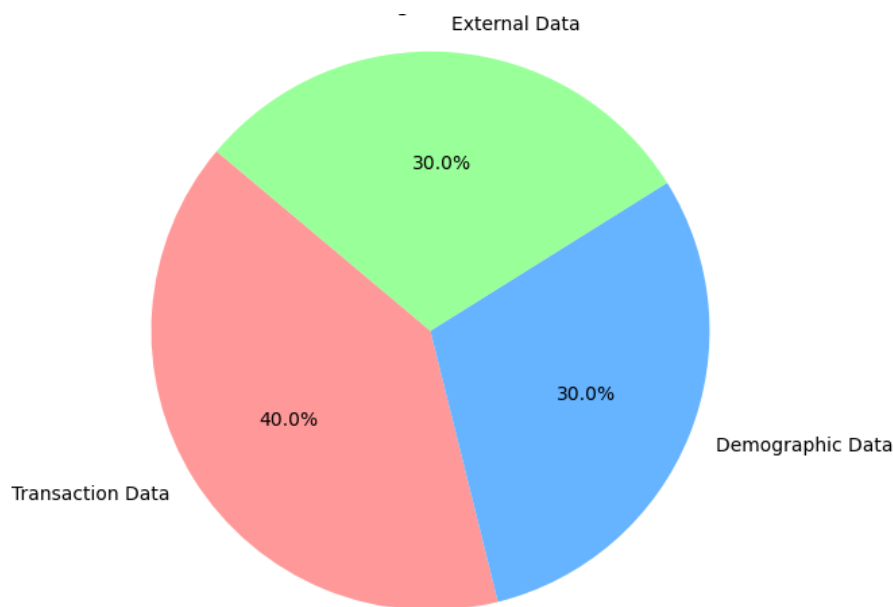


Figure 4. Data Integration Process

Figure 4 above displays the three primary data sources in the data integration process: Transaction, Demographic, and External Data. This graph shows that transaction data makes the most significant contribution, with 40%, followed by demographic and external data, with 30% each. This graph provides a clear visual representation of the proportion of the contribution of each data source in the integration process. Thus, researchers or stakeholders can quickly identify which data sources significantly impact understanding of consumer behavior and market trends. During the data integration process, data quality issues such as duplication, inconsistency, or incompleteness of data. Therefore, additional cleaning steps may be required to ensure high data integrity before further analysis. Data integration plays a crucial role in enabling researchers to gain a comprehensive understanding of consumer behavior and market trends. By combining information from multiple sources, researchers can identify previously unseen patterns and make more informed business and marketing strategy decisions.

### 3.1.5 Data Analysis

Once the data is integrated, various analysis techniques are used to understand the collected data. Descriptive analysis is used to understand the distribution of data, calculate summary statistics such as mean, median, mode, and standard deviation, and identify patterns and trends in data. Meanwhile, inferential analysis tests hypotheses about relationships between variables, builds statistical models to predict purchasing behavior, and groups customers based on their profiles and preferences. This analysis provides an in-depth understanding of consumer behavior in the e-commerce environment and the factors influencing purchasing decisions.

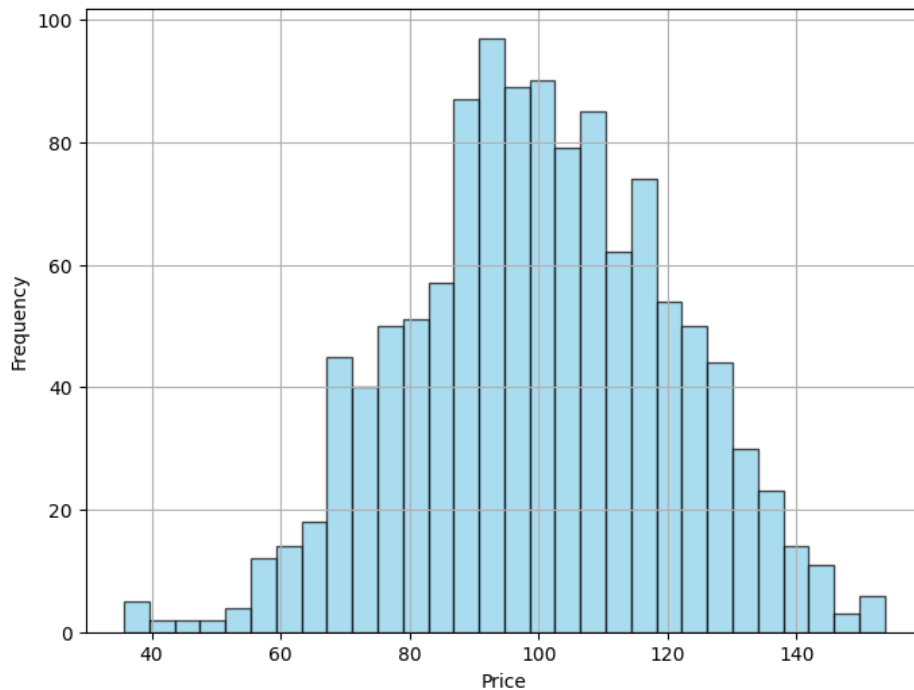


Figure 5. Product Price Distribution

The histogram above displays the distribution of product prices in this research dataset, which involves 1200 transaction data from e-commerce customers. This distribution provides insight into the price variations of products customers purchase within a specific period. Researchers can explore customer purchasing behavior more deeply by understanding this price distribution. From the histogram, it can be seen that most of the product prices are centered around an average value of around 100. This shows that products with this price are a common choice among customers. However, there is also significant price variation across the range of possible values, reflected in the width of the distribution seen in the histogram. This price distribution analysis provides a deeper understanding of customer purchasing preferences and product purchasing patterns in an e-commerce environment. This information can be the basis for making pricing strategies, product promotions, or inventory management decisions. Additionally, by comparing price distributions across products or product categories, researchers can identify market trends and potential opportunities to increase sales.

### 3.1.6 Data Visualization

Data visualization is an essential step in presenting analysis results visually, which facilitates communication with stakeholders and improves understanding of patterns and trends in data. Graphs, diagrams, and maps can be used to illustrate analysis results in an easy-to-understand and interpretable way. This data visualization allows stakeholders to directly see key findings from data analysis, such as dominant purchasing trends, customer demographic distribution, or user interaction patterns on e-commerce platforms.

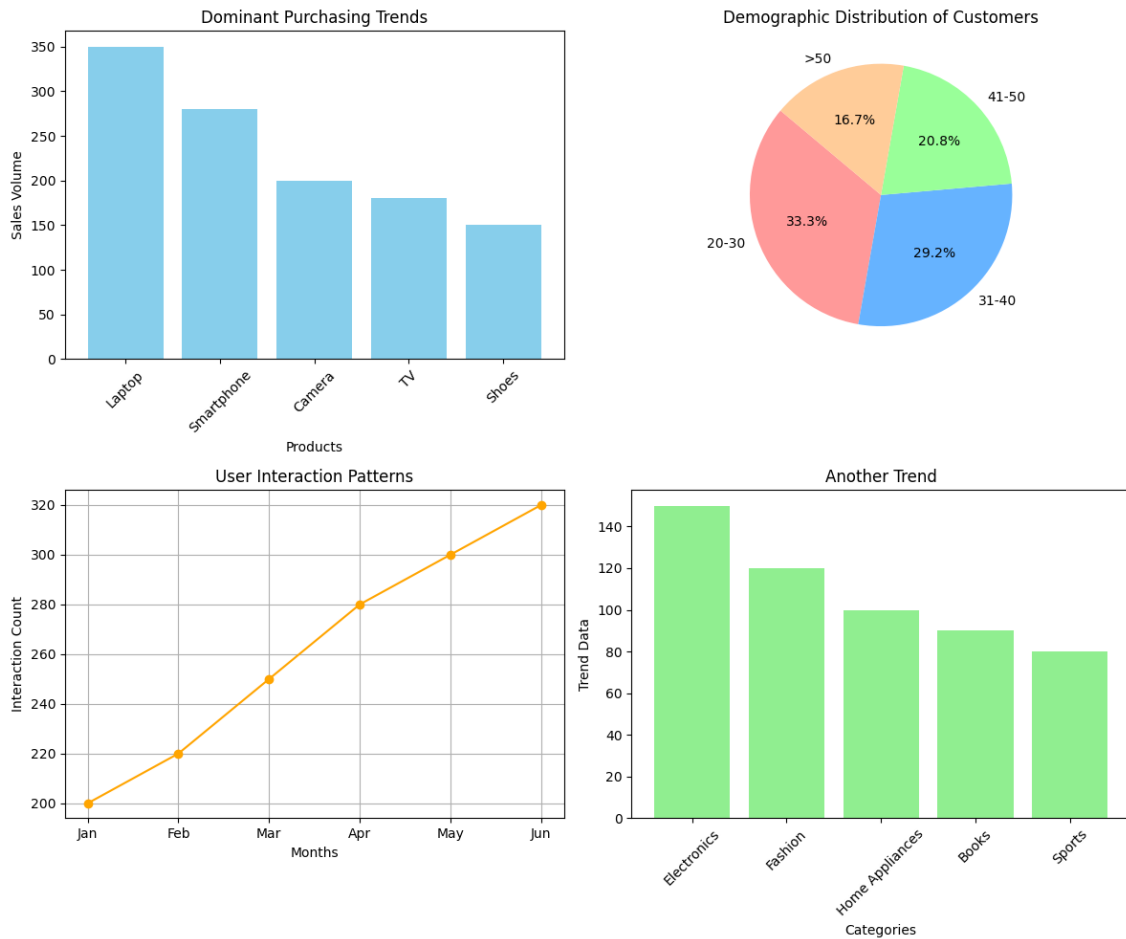


Figure 6. Purchasing Trends

Figure 6 illustrates purchasing behavior, customer demographics, and user interactions on e-commerce platforms. The first graph highlights four dominant purchasing trends, showing the products that customers are most interested in. Products such as laptops, smartphones, and cameras dominate sales. At the same time, other products, such as TVs and shoes, also significantly contribute to total sales. Next, the demographic distribution of customers is presented as a pie chart, illustrating the proportion of customers by age group. This visualization shows that the 20-30-year age group is the largest customer segment, followed by the 31-40-year age group. This information provides a better understanding of the customers who use this e-commerce platform and their age distribution. User interaction patterns on e-commerce platforms are represented through line graphs, which show user activity trends over the last six-month period. This visualization increases monthly, increasing user interest and engagement with the platform. This can provide valuable insights for decision-makers to optimize user experience and marketing strategies. Finally, graph sales trends based on specific product categories. By looking at categories such as Electronics, Fashion, and Home Appliances, this visualization allows stakeholders to understand the relative performance of each product category on the e-commerce platform.

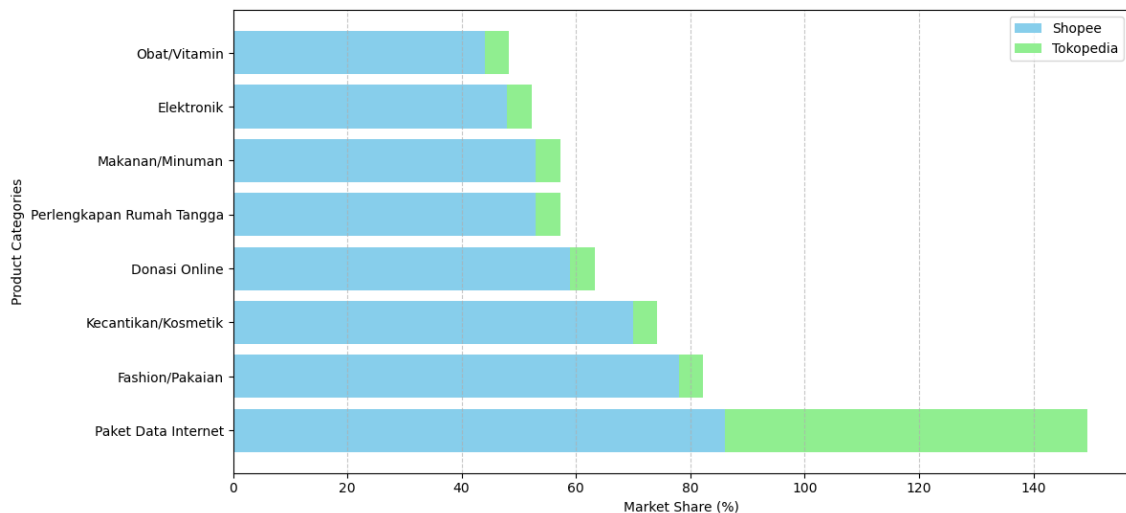


Figure 7. Market Share of Product Categories (Shopee vs Tokopedia)

Figure 7 above depicts a comparison of market shares between two e-commerce platforms, namely Shopee and Tokopedia, for specific product categories. This graph has several product categories: Internet Data Packages, Fashion/Clothing, Beauty/Cosmetics, Online Donations, Household Appliances, Food/Drinks, Electronics, and Medicine/Vitamins. From the graph, Shopee has a much larger market share than Tokopedia for almost all product categories. The product category with the highest market share for Shopee is Internet Data Packages, followed by Fashion/Clothing and Beauty/Cosmetics. Meanwhile, Tokopedia only has a significant market share in the Internet Data Package category, while its market share is much smaller in other categories. This shows Shopee's dominance in the e-commerce industry, especially for specific product categories. Even though Tokopedia still has a significant market share in the Internet Data Package category, its contribution is much smaller in other categories than Shopee. This graph provides a better understanding of how much influence each platform has in selling various product categories to consumers in Indonesia. Thus, parties in the e-commerce industry can use this information to create more effective marketing and sales strategies according to market characteristics and consumer preferences.

### 3.2 Discussion

Analysis of Purchasing Patterns in E-commerce with a Big Data Based Approach and Data Analysis Methods explores consumer behavior, market trends, and factors influencing online retail purchasing decisions. In the ever-evolving digital era, this analysis has become increasingly crucial for understanding the complex dynamics behind e-commerce. By leveraging big data analytics and advanced data analysis methods, researchers strive to generate valuable insights that companies and policymakers can use to improve their strategies. Purchasing pattern analysis in e-commerce involves collecting, cleaning, transforming, integrating, analyzing, and visualizing data related to e-commerce transactions. The main goal is to identify purchasing patterns, customer preferences, and market trends that can provide valuable insights for business decision-making. Big data plays a role in addressing the volume, speed, and diversity of data generated by e-commerce platforms. The use of big data technology allows researchers to process and analyze large and complex data in an efficient time. Various data analysis methods were used in this study, including descriptive analysis, inferential analysis, segmentation analysis, and predictive models. This approach helps uncover hidden patterns in data and make predictions useful for decision-making. Previous studies have made significant contributions to understanding consumer behavior and market trends in e-commerce. Some crucial findings include consumer preferences for informal e-commerce platforms, the impact of free shipping promotions on customer satisfaction, and the relationship between e-service service quality and customer purchasing behavior.

Analysis of purchasing patterns in e-commerce has significant implications for businesses and policymakers. With a better understanding of consumer behavior and market trends, companies can adapt their marketing strategies to improve customer experience and drive business growth. Additionally, policymakers can use the insights gained to develop regulations supporting the e-commerce sector's sustainable development. Despite the great potential offered by purchasing pattern analysis using big data, several challenges still need to be overcome, including the skills and knowledge required to manage large and complex data, as well as data privacy and security issues. However, by overcoming these challenges,

purchasing pattern analysis in e-commerce can become a highly effective tool for improving business performance and understanding consumer needs. Analysis of Purchasing Patterns in E-commerce with a Big Data Based Approach and Data Analysis Methods is an important research area in understanding market dynamics and consumer behavior in e-commerce. By using advanced analysis technologies and methodologies, we can gain valuable insights that can be used to improve business strategy and decision-making.

#### 4. Related Work

Related studies are essential in analyzing purchasing patterns in e-commerce with a Big Data-based approach and data analysis methods to strengthen arguments, show knowledge gaps, and provide a robust theoretical foundation. In this study, researchers will discuss several studies that are relevant to the research topic. One significant related study is the work by Wang (2023), who proposed a two-layer general improved model for anomaly detection in e-commerce orders [7]; it is stated that addressing the problem of fraud and anomalies in e-commerce transactions, which is one of the problems major in purchasing pattern analysis. By improving the generalization ability of the model and reducing the problem of sample dependency, the model proposed by Wang provides an in-depth view of how big data and data analysis methods can be used to improve the security of e-commerce transactions—study by Dong (2022) in the analysis of e-commerce purchasing patterns [6]. Dong analyzes the factors influencing consumer trust in e-commerce marketing using extensive data analysis. This research highlights the importance of understanding consumer psychology and building trust to increase customer satisfaction and influence purchasing decisions. By leveraging big consumer data, Dong provides valuable insights on how to build strong relationships between e-commerce companies and their customers [6]. In addition, research by Xiao (2022) is also relevant in analyzing e-commerce purchasing patterns. Xiao investigates price discrimination strategies in e-commerce companies based on big data. This study reveals how companies can use customer data to adjust prices and increase their profitability dynamically. Although controversial, price discrimination strategies effectively increase e-commerce companies' revenues, and research by Xiao provides valuable insight into best practices in implementing these strategies [8].

Another study by Humairoh and Annas (2023) discusses the impact of free shipping promotions on customer satisfaction in e-commerce platforms. This research provides a deeper understanding of customer preferences for shipping methods and how free shipping promotions can influence purchasing decisions. Using e-commerce transaction data, Humairoh and Annas identified significant patterns in customer purchasing behavior and provided practical recommendations for e-commerce companies to increase customer satisfaction [23]. Furthermore, research by Pratama and Ridanasti (2023) is also relevant in analyzing e-commerce purchasing patterns. They investigated the relationship between e-service quality, trust, customer satisfaction, and purchase behavior intentions of online shopping customers on the Shopee e-commerce platform. This research provides a deeper understanding of the factors influencing customer satisfaction and purchase intentions in e-commerce, which can provide valuable insights for companies to improve their customer service and experience [26]. From this related study, analysis of purchasing patterns in e-commerce using a Big Data-based approach and data analysis methods has received significant attention from researchers. Leveraging advanced technology and analytical methodology, this research has provided valuable insights into consumer behavior, market trends, and factors influencing purchasing decisions in e-commerce. Although there are still some challenges that need to be overcome, such as the required data analysis skills and data privacy issues, this research continues to progress and makes significant contributions to the development of the e-commerce industry.

To analyze purchasing patterns in e-commerce effectively, researchers can utilize various methods. Leveraging big data analytics can provide valuable insights into consumer behavior and preferences. Path analysis and indirect testing methods like the Sobel test can help uncover the mediating effects of variables such as brand awareness on online purchasing decisions Osak & Pasharibu (2020) [39]. In the healthcare sector, employing content analysis techniques in virtual spaces can offer insights into user interactions and preferences, contributing to a deeper understanding of consumer behavior [40]. Additionally, regression analysis can assist in assessing the impact of e-commerce on the revenue of Small and Medium Enterprises (SMEs) during the COVID-19 pandemic [43].

Furthermore, sentiment analysis through text mining on online product reviews can provide valuable information on consumer sentiments and preferences, aiding in understanding purchasing patterns [44]. Utilizing the E-Service Quality method can help evaluate the quality of services provided by e-commerce platforms, directly impacting user satisfaction and loyalty [45]. In conclusion, by combining methodologies



such as path analysis, content analysis, regression analysis, sentiment analysis, and E-Service Quality assessment, researchers can gain a comprehensive understanding of purchasing patterns in e-commerce, enabling businesses to tailor their strategies effectively to meet consumer needs.

These references provide valuable insights into applying big data analytics in e-commerce. Akter and Wamba (2016) emphasize the increasing emphasis on big data analytics in e-commerce, highlighting its significance in decision-making processes [46]. Li and Zhang (2021) discuss how introducing big data and sales data analysis can enhance sales performance and product positioning in e-commerce enterprises [47]. Dong (2022) delves into the analysis of influencing factors of consumer trust in e-commerce marketing of green agricultural products using extensive data analysis, shedding light on consumer behavior in this sector [48]. By leveraging big data analytics, businesses can gain a deeper understanding of consumer preferences and market trends and effectively optimize their marketing strategies and business decisions in the e-commerce domain.

## 5. Conclusion

This research concludes that analysis of purchasing patterns in e-commerce with a Big Data-based approach and data analysis methods is an important and promising research area. Leveraging advanced technology and analytical methodology, this research has provided valuable insights into consumer behavior, market trends, and factors influencing purchasing decisions in the e-commerce context. First, this research shows that big data has great potential in understanding consumer behavior and market trends in e-commerce. By collecting and analyzing transaction data from e-commerce platforms, researchers can identify significant patterns and gain deep insights into customer preferences and market dynamics. Second, this research highlights the importance of sophisticated data analysis methods in interpreting the large and complex data generated by e-commerce. Using sophisticated algorithms and analysis techniques, researchers can identify complex relationships between factors influencing purchasing decisions, such as price, promotions, and customer satisfaction. Third, this research reveals several significant findings that can help e-commerce companies improve their marketing strategies and business decision-making. For example, findings about customer preferences for payment and delivery methods can help companies adapt their services to increase customer satisfaction. However, this research also faces several challenges, such as the required data analysis skills and data privacy issues. Addressing these challenges requires collaboration between researchers, e-commerce companies, and governments to develop the necessary data analysis expertise and ensure that consumer data is managed securely and ethically. Overall, this research has significantly contributed to the development of the e-commerce industry. By understanding consumer behavior, market trends, and factors that influence purchasing decisions, e-commerce companies can improve their strategies, increase customer satisfaction, and strengthen their position in the competitive landscape.

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