The application of Big Data Analytics in improving eCommerce processes.

The Retail sector user experience

HAMK
HÄMEEN AMMATTIKORKEAKOULU
HÄME UNIVERSITY OF APPLIED SCIENCES

![HAMK - HÄMEEN AMMATTIKORKEAKOULU - HÄME UNIVERSITY OF APPLIED SCIENCES]

This paper explores the application of Big Data analytics in enhancing user experience within the retail sector. The first chapter of this paper provides an overview of eCommerce's current landscape and the challenges retailers face in delivering a seamless user experience. It highlights the importance of user experience in driving customer satisfaction, loyalty, and, ultimately, business growth. The second chapter delves into the concept of Big Data analytics and its potential to address the challenges retailers face. It discusses the different data types generated in eCommerce processes, including customer, transaction, and social media data.

Furthermore, it explores various techniques and technologies in Big Data analytics, such as data mining, machine learning, and predictive analytics. The third chapter focuses on the specific applications of Big Data analytics in improving user experience in the retail sector. It examines how retailers can leverage Big Data analytics to personalize product recommendations, optimize pricing strategies, streamline inventory management, and enhance customer service. The fourth chapter discusses the challenges and considerations of implementing Big Data analytics in retail. It addresses issues related to data privacy, data security, data quality, and the need for skilled data analysts.

Moreover, it explores the ethical implications of using customer data for business purposes. Finally, the paper emphasises the potential benefits of integrating Big Data analytics into ecommerce processes to enhance user experience. It highlights the importance of retailers adopting a data-driven approach to gain valuable insights and improve their operations, ultimately leading to improved customer satisfaction and increased competitiveness in the retail sector.

Keywords: eCommerce, retail sector, big data analytics, machine learning, personalisation, sentiment analysis.

Pages   38 pages

Content

Table of Figures

Appendices

Appendix 1. Material Management Plan

1   **Introduction**

According to several definitions, ecommerce is an interface between buyers and sellers. Information is exchanged, purchases are made, and sales are conducted online today. In retail ecommerce, most products and services are sold online, which helps companies increase their earnings and brand awareness. As online shopping has become a phenomenon, consumers can only purchase goods or items online via their website. It makes the customer quick to shop and saves time by online shopping. It is difficult to handle many goods and more customers in the current ecommerce system; by utilising Big Data, companies gain insights into their markets, customers, and environments through analytics.

This thesis aims to contribute to Big Data analytics in ecommerce by highlighting how it helps retail ecommerce reach its current demands and utilise its applications. This thesis outlines the current state and future developments of the ecommerce industry by reviewing several examples of literature-based research on the new ecommerce sector.

Secondly, detailed research analysis on Big Data analytics in ecommerce gives an overview of the application types, characteristics, and benefits. The last chapter will highlight insights into how Big Data analytics support their business processes, the benefits involved, and the current analytics applications that concern ecommerce to help these companies.

The following research questions are discussed, analysed, and answered in this thesis:

- What are the values of implementing Big Data Analytics in ecommerce?
- How does Big Data Analytics impact ecommerce vendors in the retail sector?
- What are the roles and challenges of Big Data Analytics in ecommerce?

2   Ecommerce industry

This chapter explores the dynamic landscape of the eCommerce industry, examining its evolution, key players, and the factors that have contributed to its unprecedented success. We will delve into the various models and strategies businesses employ to establish a solid online presence, attract customers, and optimise their operations to meet the demands of the digital marketplace. Additionally, this chapter will analyse the impact of eCommerce on traditional retail and its implications for consumers, businesses, and the overall economy. We will examine eCommerce companies' advantages, challenges, and emerging trends and innovations shaping the industry's future.

2.1   Ecommerce business models

Ecommerce, or electronic commerce, refers to commercial transactions conducted electronically through the internet. It involves buying and selling consumer products, marketplace services, customer support, and other activities, such as online auctions, payment gateways, ticketing, and Internet banking. Ecommerce is usually classified based on numerous business models, which include Business to Business (B2B), Business to Customer (B2C), Customer to Business (C2B) and Customer to Customer (C2C). It offers various benefits to the seller, such as a global reach, minimal transaction costs, higher margins of profit, direct communication between the parties involved and quick delivery of goods and services. (IMARC, 2022)

Companies can lower their distribution costs and increase efficiency by distributing their products and services without maintaining physical locations. Ecommerce is helping businesses (especially those with a limited reach, such as small businesses) to gain access to and establish a more comprehensive market presence, thus reducing infrastructure, communication, and overhead costs (IMARC, 2022). Ecommerce, or electronic commerce, encompasses various online business models and types. Here are six more straightforward types of ecommerce.

  i.   Business-to-Consumer (B2C) - The most well-known type of ecommerce, businesses sell products or services directly to individual consumers. Examples include Amazon, Zappos, and Walmart. (Lee I., 2019)

    ii.   Business-to-Business (B2B) - This type of ecommerce involves the sale of goods or services between businesses. Examples include Alibaba, Grainger, and Cisco. (Laudon, 2018)

    iii.   Consumer-to-Consumer (C2C) - This type of ecommerce involves the sale of goods or services between individual consumers. Examples include eBay, Craigslist, and Poshmark. (Lee I., 2019)

    iv.   Consumer-to-Business (C2B) - This type of ecommerce involves individual consumers selling goods or services to businesses. Examples include Shutterstock, Upwork, and Fiverr. (Lee I., 2019) (Laudon, 2018)

    v.   Business-to-Government (B2G) - This type of ecommerce involves the sale of goods or services from businesses to government agencies. Examples include FedBid, GovDeals, and GSA Advantage. (Lee I., 2019) (Laudon, 2018)

    vi.   Consumer-to-Government (C2G) - This type of ecommerce involves individual consumers selling goods or services to government agencies. Examples include eBay for Government and GovPlanet. (Lee I., 2019) (Laudon, 2018)

Figure 1 shows six types of ecommerce, each representing a different combination of participants involved in the various ways online transactions occur, catering to varying combinations of buyers and sellers in the digital marketplace. Also, the diagram mentions some of the types not mentioned above.

Figure 1 Types of Ecommerce (Ben Lutkevich)

6 types of e-commerce

B2B
Business to business

Businesses sell products or services to other businesses, such as through an online directory or product website.

B2C
Business to consumer

Businesses sell products or services to non-business customers, such as in an online retail store.

C2C
Consumer to consumer

Consumers sell products or services to other consumers, such as on eBay and Craigslist.

C2B
Consumer to business

Consumers sell products or services to businesses. For example, Google AdSense and influencer marketing services enable bloggers and other web content providers to sell advertising space to businesses.

B2A
Business to administration

Businesses conduct transactions with public administration or government bodies, such as an ammunition manufacturer selling to U.S. Army.

C2A
Consumer to administration

Consumers conduct transactions with public administration or government bodies, such as filing taxes.

Most businesses have an online store and platform for eCommerce marketing and sales activities, logistics and fulfilment. According to estimates, more than a fifth of all retail sales will be generated by eCommerce in 2022. Despite a slowdown in growth, they estimated that total spending would surpass $7 trillion by 2025. (BigCommerce, 2021)

2.2 The Growth and Impact of Ecommerce

Since 1969, when CompuServe launched, ecommerce has come a long way. As a result of technological advancements and global conditions, eCommerce is increasing and shows no signs of slowing down. As of 2019, 14.1% of retail sales were generated by online retailers. By 2023, that number will rise to 22%. The digital wallet has helped the total volume of ecommerce payments is expected to exceed half by 2024 (BigCommerce, 2021).

 E-commerce has provided businesses with the opportunity to connect with a broader audience and extend their reach on a global scale. This digital platform has the added advantage of lowering operational expenses, given that online stores entail fewer overhead costs compared to traditional physical establishments. A study conducted by the National Retail Federation predicts a growth in total retail sales ranging from 4% to 6% in the year 2023. This forecast implies a potential increase to a range between $5.13 trillion and $5.23 trillion, encompassing sales from both brick-and-mortar outlets and various online and non-store channels. The 2023 forecast is above the pre-pandemic average annual retail sales growth rate of 3.6%. (Conley, 2023)

The growth of ecommerce has significantly impacted the global economy, with online sales contributing to the growth of many industries, including retail, transportation, and logistics. According to a report by the World Economic Forum, ecommerce has created new business models and enabled the growth of small and medium-sized enterprises (Weforum, 2019). However, ecommerce also presents challenges, such as increased competition and the need to constantly adapt to changing consumer preferences and technology. It also raises concerns about data privacy and security and the impact on traditional retail jobs.

2.3 Future of Ecommerce

The future of ecommerce looks promising as more people shop online, and businesses shift their focus to digital platforms and increasing innovation in the industry. Consumers strongly impact the future of eCommerce, and there are numerous possibilities and trends that

retailers and brands can harness to help them prepare. Attention to consumer and business trends will help the retail plan; between 2021 and 2025, the eCommerce industry is predicted to grow by almost $11 trillion (Shopify, 2021). Drone deliveries will be an integral part of the ecommerce future. Several businesses are already testing drone deliveries, such as food, and it seems that this will happen soon.

In addition to automating shipping in different sizes, delivery drones can handle orders of different magnitudes without human intervention. As the statistics demonstrate, a growing number of people use online services; however, physical retail will not disappear since it is not just an option but also an amenity and convenience for consumers. Typically, customers act most conveniently and practically at that time (Anusha, 2021).

The use of mobile devices for online shopping is expected to increase, with projections indicating that by 2025, over 70% of all ecommerce transactions will be made using mobile devices. Retailers must focus more on mobile optimisation and ensure their websites and apps are mobile-friendly to keep up with the competition (Shopify , 2021). Voice commerce is expected to grow significantly, and voice-activated devices like Amazon's Alexa and Google Home will become more prevalent, increasing voice commerce (Business Insider, 2019). Ecommerce has already become a part of everyday life, and these technologies will dominate the future of online shopping. Social media platforms such as Instagram and Facebook are increasingly used by ecommerce businesses to sell their products. This trend will likely continue, with more companies leveraging social media to reach new customers and drive sales. Social commerce is projected to account for 10% of ecommerce sales by 2024 (eMarketer, 2019).

Consumers are becoming more conscious of their environmental impact and the ethics of the companies they purchase. Brands prioritising sustainability and ethical practices are expected to gain a competitive edge in the ecommerce market. As a result, we can expect to see more ecommerce companies adopting sustainable and ethical practices, such as using eco-friendly packaging or sourcing materials from fair trade suppliers (Business Insider , 2021) (BigCommerce, 2021). Omnichannel retail involves using multiple channels, such as online, in-store, and mobile, to create a seamless customer shopping experience. This trend is expected to continue growing as retailers look to provide a more personalised shopping experience for consumers (eMarketer, 2019)

AI and machine learning are expected to play a significant role in the future of ecommerce. Retailers can leverage these technologies to provide personalised recommendations,

improve search functionality, and optimise pricing (Forbes, 2023). Same-day delivery will become more common, with businesses partnering with delivery services like Uber and Postmates to offer faster delivery times (Taylor, 2019). Consumers increasingly expect personalised and customised experiences and ecommerce companies respond by using data and AI to provide tailored recommendations and experiences (McKinsey & Company, 2019). Overall, the ecommerce industry is expected to continue to evolve and multiply in the coming years, driven by changing consumer preferences and technological advancements

3 The definition of big data analytics in ecommerce

In recent years, the amount of data generated by ecommerce platforms has grown exponentially, presenting new business challenges and opportunities. Big data analytics has emerged as a powerful tool for ecommerce companies to extract insights from this vast amount of data and make informed decisions that drive growth and improve customer experience. This chapter will explore the definition of big data analytics in ecommerce and how it is being used to transform the industry. We will also discuss essential techniques, characteristics and technologies involved in big data analytics and provide examples of successful implementations in ecommerce.

3.1 Big data and their distinctive characteristics

The concept of Big Data is generating significant interest worldwide with various definitions. A "Big Data" dataset is an extensive collection of large data capable of being captured, communicated, grouped, stored, and analysed. (Manyika, et al., 2011) It is also possible to explain the Big Data phenomenon by focusing on the increasing number of sources that generate it, including Internet clicks, mobile transactions, user-generated content, social media, and purposefully generated data, such as customer information and purchase transactions, developed by sensor networks. (McAfee & Brynjolfsson, 2012).

The term Big Data has no definition, as it refers to the collection of data from both traditional and digital sources within and outside an organisation, resulting in a large volume of data that can only be analysed on a large scale (Mayer-Schönberger, 2013). Big Data has distinctive characteristics such as volume, variety, velocity, integrity, and value that can easily distinguished from the traditional form of data used in analytics. Over the past few years, business-related big data has been overgrown in the ecommerce industry (Beath, 2012). Repositories contain a large amount of data, which is volume. Every day, a wide range of technologies accumulating data generation is increasing exponentially because of the Internet of Things (IoT). It is a term used to describe the enormous amount of data generated by various social networking sites every second. Examples include Twitter messages, emails, video clips, Facebook, etc. Because millions of users upload such a large amount of data daily, the amount of data uploaded daily by users is increasing rapidly. (Kaushal, 2019)

Netflix analysed over one billion reviews to determine how to catalogue movies and customers' movie tastes. Ample storage space is needed to store this data, as the degree of data stored in the arsenal has grown from GBs to Petabytes. Analytics is using valuable extract data from a mixture of the whole volume. Velocity refers to data generation and data delivery (Russom, 2011). Also, it relates to the speed at which new data can be generated and moved around. Data is flowing at an extraordinary rate and should be dealt with promptly. Smart metering and RFID sensors are the requirements to deal with fast-moving data in near-real-time. Dealing with data velocity is a great challenge for many organisations. Velocity is directly proportional to data processing speed. Big data must be used for time-sensitive processes such as catching fraud. It flows into an enterprise to maximise the value (Kaushal, 2019)

The variety of sources and formats from which big data is generated is another critical characteristic, such as text, web, tweets, audio, video, click-streams, log files (Russom, 2011). Since the data are divided into several categories, as Russom pointed out, raw, structured, unstructured, semi-structured, and numeric data may be challenging for traditional databases to handle emails, videos, audio, unstructured text documents, and financial transactions. It is challenging for many organisations to manage and merge different kinds of data. Variety measures the amount of information represented by images, text, video, sensor data, and audio. Approximately 78% of all data worldwide is unstructured, including various formats, from XML to audio to SMS. This process involves organising the raw data into the necessary information (Kaushal, 2019). Data types that contain uncertainty are another essential characteristic of big data. Quality and security considerations must be met when verifying these data. Having high-quality data in ecommerce is necessary for better prediction. The quality of captured data varies highly. The data stored in various database systems may be noisy and unfiltered. The accurate analysis of data depends on the reliability of the source data. (Kaushal, 2019)

A large amount of data characterises an extensive data analysis. So, the size of the data determines its value. Prolonged changes in data and its value will affect decision-making. All ecommerce systems and enterprises are passionate about upgrading their customer association by providing value-added services. Consequently, it is necessary to monitor market trends and attitudes. Users also use data store queries to gather information on recent trends in the business so they can adjust their strategies and plans accordingly (Kaushal, 2019).

Figure 2 illustrates the 5 V's of Big Data - Volume, Velocity, Variety, Veracity, and Value - capture the fundamental characteristics of Big Data and provide a framework for understanding the challenges and opportunities associated with processing and analysing large and complex datasets and how these five dimensions interact with each other, So, in simple terms, Big Data is about dealing with vast amounts of data that come in fast and in many different forms, making sure it is reliable, and using it to find valuable insights.

Figure 2 Big Data in Terms of the 5 V's. (Al-Shiakhli, 2019)
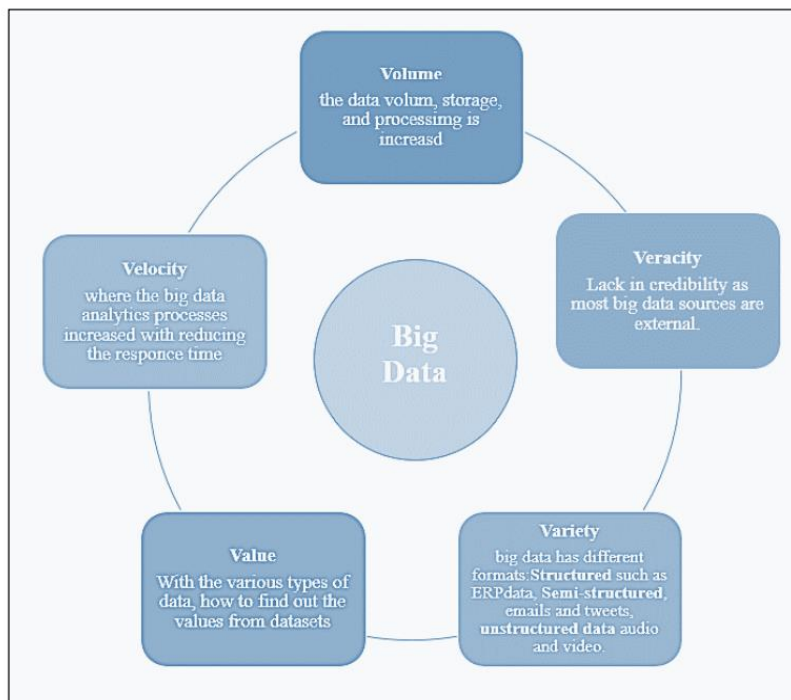
3.2 Types of Big Data Used in Ecommerce.

In ecommerce, big data is used to gather and analyse data about customers, products, and transactions to make data-driven decisions that can improve business operations and customer experience. Online transactions refer to the sale of goods or services over the internet. Online transactions can be either one-time (e.g., Amazon, Zappos, eBay, Expedia) or ongoing (e.g., Netflix, Match.com, LinkedIn).

The types of big data used in ecommerce are illustrated in Figure 3; one can see that big data in ecommerce is a valuable resource that allows businesses to extract meaningful insights from various data sources like business transactions, clickstream data, voice data, and video data. By analysing and interpreting this data, ecommerce companies can make

informed decisions, improve customer experiences, optimise operations, and drive business growth.

Figure 3 Types of big data in ecommerce (Frost, 2013)
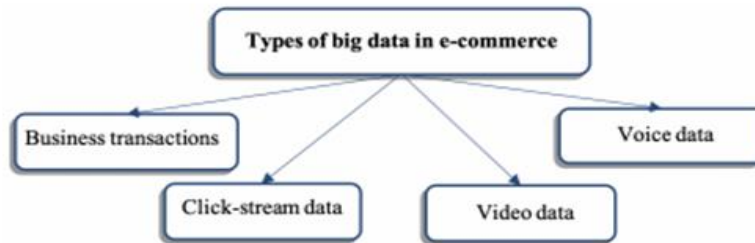
The first industry to adopt big data analytics was ecommerce since it dealt with structured and unstructured data (e.g., personal information). A general classification of these categories can be as follows: Ecommerce is an industry that relies heavily on transactional data and business activity data to make informed decisions about customer behaviour, sales trends, payment data and overall business performance (Klipfolio Inc.). The data associated with transactions or business activities are constantly evolving due to customer and company exchanges. As a result, the data covers many sources, including customer relationship management programs (e.g., profiles of customers maintained by the organisation and customer complaints) and sales transactions (Wamba, 2016).

In ecommerce, clickstream data can track customer behaviour, such as browsing history, product views, clicks, and purchases. Data from click-streams is derived from the web and online advertisements and social media posts by ecommerce businesses, such as tweets, blogs, and Facebook wall postings. A vital part of today's creative marketing strategy is social media and online advertising, such as click-stream data, which is essential to management to make informed, strategic, and tactical decisions (Wamba, 2016). The use of clickstream data to predict customer purchases in an online retail business provides insights into factors that influence customer behaviour and purchasing decisions (Jiayu Chen, 2017)

The video has become an increasingly popular format for ecommerce websites and has been shown to increase engagement, conversion rates, and customer satisfaction. According to a study by Wyzowl and Brightcove, 84% of people say they have been convinced to buy a product or service by watching a brand's video. In comparison, 76% of consumers have

purchased a product after watching a video about it (Wyzowl, 2021) (Brightcove, 2021). Videos are also effective at driving traffic and improving SEO. According to Forrester Research, a video is 53 times more likely than text pages to appear on the first page of a search engine (Forrester Research). Finally, live streaming has become a popular way for retailers to engage with customers and promote products. A report by Coresight Research found that in 2020, the live-streaming market in China alone was worth $125 billion, with sales from live-streaming events increasing by 400% from 2019 (Coresight Research). These statistics suggest that video can be a powerful tool for ecommerce businesses looking to boost engagement, drive traffic, and increase sales.

Voice data analysis in ecommerce involves using speech recognition technology to transcribe and analyse voice data to gain insights that can help improve customer experience, increase sales, and streamline operations. With the increasing use of smart speakers and voice assistants, voice search is becoming popular for customers to find products and services online. Voice search data analysis can help ecommerce companies understand how customers search for products using voice commands, what types of queries are most common, and what language they use (PwC , 2019). In conclusion, voice data analysis is becoming essential for ecommerce companies to understand customer behaviour, preferences, and buying patterns. By leveraging voice data, ecommerce companies can improve their marketing messages, personalise offers, and enhance the customer experience, increasing sales and customer loyalty.

3.3 Benefits of Big Data to eCommerce Businesses

A business can increase revenue through Ecommerce by analysing big data, gaining a deeper understanding of their customers, predicting market trends, and creating a better customer experience. It is not easy to imagine operating an eCommerce business without using extensive data analysis for decision-making. Big data analytics and eCommerce are inseparable when creating personalised shopping experiences and improving customer service. For this reason, the ecommerce industry can gain many benefits from big data analytics. The purchasing journey of a shopper in ecommerce typically involves several stages, including awareness, consideration, decision, and post-purchase evaluation. Web analytics tools like Google Analytics can provide valuable insights into user behaviour on one's website by tracking metrics like page views, bounce rates, and conversion rates, identifying areas of the site that may be causing users to drop off or become disengaged. Monitoring the purchasing journey of shoppers in ecommerce is critical to understanding customer behaviour and optimising sales processes. Businesses can gain valuable insights

into customers' needs and preferences using tools like Google Analytics, CRM software, heat mapping, A/B testing, and social media monitoring (Shad.). Customer security is essential for providing a top-of-the-line shopping experience.

The analysis of extensive data can assist in recognising atypical spending behaviours in customers and notifying them when they occur. An organisation may alert various fraudulent activities, such as purchases made with the same credit card within a short period or multiple payment methods originating from a single IP address. (Talend, 2022). Ecommerce businesses must choose a secure payment method to protect their customer's sensitive information and prevent fraud. In addition to using a secure payment gateway, businesses can implement additional security measures such as SSL encryption, two-factor authentication, and fraud monitoring (Shopify).

Additionally, big data can increase customer satisfaction by providing a more personalised shopping experience. Approximately 86% of consumers believe that personalisation influences their purchasing decisions. Millennials are inclined to make online purchases as they anticipate receiving personalised recommendations. Using big data analytics, ecommerce companies can enhance their understanding of their customers from all angles. This view allows ecommerce companies to segment their customers according to gender, location, and social media presence. This information will enable companies to create and send emails with custom discounts, use different marketing strategies to reach different target audiences, and develop products that speak directly to specific population segments (Talend, 2022). Personalisation has become an essential aspect of eCommerce, as it enhances the customer experience and boosts sales. According to a study by Epsilon, personalised emails have a 29% higher open rate and 41% higher click-through rate than non-personalized ones (Epsilon, 2018).

To improve customer service quality, the customer service staff monitors the average response speed to increase the overall response time; they also send out questionnaires and collect feedback from customers, allowing them to gain first-hand information about ways to improve the quality of service and reduce the risk of poor service delivery. Using tracking software, e-store owners can identify potential problems with delivery and prevent them from occurring. (Milly, 2021) To increase sales from online purchases, ecommerce companies use big data analytics to pinpoint the most competitive price for specific customers. There may be early access to deals for customers loyal to a company for some time, and prices may vary based on the consumer's location. Using Big data to tailor recommendations and coupons to

customer preferences is an essential benefit for e-retailers. Personalised customer experiences result in high traffic and higher profits. Ecommerce businesses can also benefit from big data by running more targeted marketing campaigns, offering more relevant coupons, and reminding customers that they still have something in their trolley (Talend, 2022) .

Stocking plays a significant role in the eCommerce industry. Insufficient stock will result in product deficiencies and negatively impact customer satisfaction; however, too many stocks may result in high costs. A product with a short shelf life would be significantly negatively affected by this since the cost would be irreversible. Using big data can facilitate the planning of marketing campaigns and estimating future stockings based on experience. Online retailers can predict future sales in the warehouse based on historical sales data. Social listening allows them to uncover new buzzwords and act promptly to capitalise on golden opportunities for sales growth (Milly, 2021).

Figure 4 illustrates the benefits of big data in the ecommerce industry; by doing so, retailers can better understand how big data benefits them and how it simplifies and simplifies their operations. In conclusion, the figure highlights how big data can drive significant benefits for eCommerce companies, enabling them to understand better and serve their customers, optimise their operations, and achieve higher levels of success.

Figure 4 Common problems big data solves in ecommerce (Altynpara, 2023)
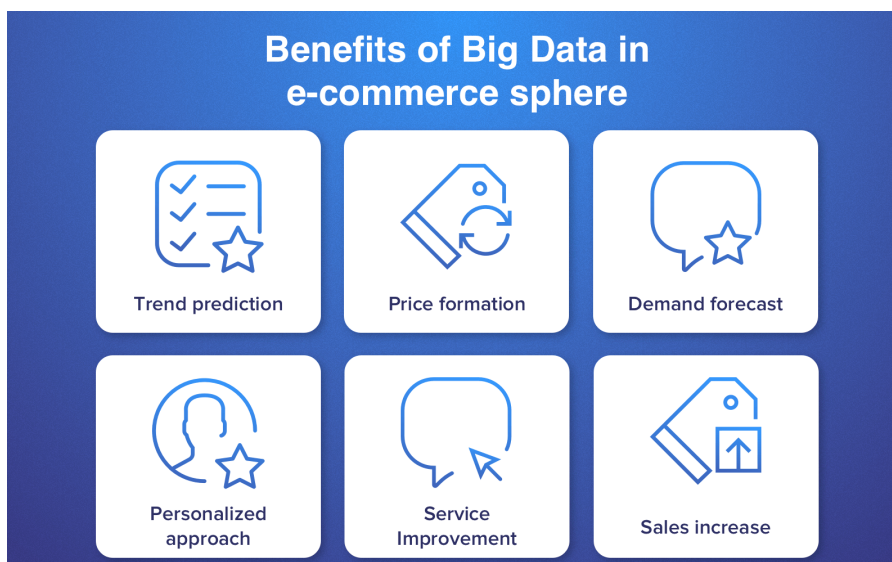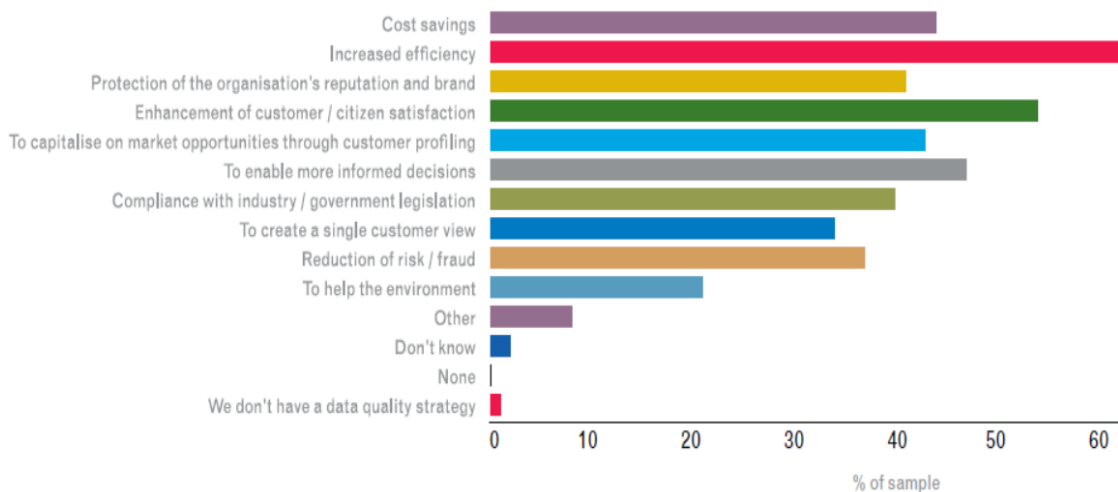
3.4 **Data in ecommerce business**

A data set is a collection of information about a customer, a product, or a store. The information may include, for example, order quantities, shipping addresses, sale histories, the performance of the market, buyers' profiles (gender, email address, and telephone number) (Dayal, 2022)

Collecting and analysing data is essential for ecommerce businesses as it allows them to understand their customers' needs and preferences, identify areas of the business that need improvement, and make data-driven decisions to optimize their operations (Digital Marketing Institute). Also, there is a need to maintain high-quality data in ecommerce business because this helps companies save, boost their productivity, save time, and enhance their customer's trust.

Figure 5 demonstrates the data gathered by a company on how to boost their sales by asking questions and getting feedback on what to change to meet their customer's demands and needs. With such information, the company can manage effectively to support their business activities and decision-making. Also, maintaining high-quality records is critical to running a successful ecommerce retail business. It helps ensure efficient operations, customer satisfaction, financial management, and legal and regulatory requirements compliance.

Figure 5 Maintaining high-quality records by A survey by (Experian Data Quality)

Ecommerce businesses use this data to make informed decisions, from product development to marketing strategy. For example, they can analyse customer behaviour data to determine which products are most popular and adjust inventory levels accordingly. They can also use website traffic data to optimise their website design and improve SEO performance (Kevel , 2021). In conclusion, data is a critical component of an ecommerce business, and analysing it effectively can lead to increased sales, improved customer satisfaction, and a more successful online presence.

4 Big data analytic techniques and their application in ecommerce

As the volume and variety of data generated by ecommerce platforms continue to increase, businesses are turning to big data analytics to extract valuable insights and improve decision making. In this new chapter, we will explore the various big data analytic techniques used in the ecommerce industry and how they are applied to enhance customer experience, optimise pricing strategies, and boost sales. From machine learning algorithms to natural language processing, we will explore the cutting-edge tools and technologies driving innovation in this field. By the end of this chapter, one will have a solid understanding of the latest big data analytic techniques and how they can be leveraged to gain a competitive advantage in the fast-paced world of ecommerce.

4.1 Social media analytics and ecommerce

Social media analytics (SMA) refers to gathering information from social media sites and applications (such as wikis, Facebook, Twitter, Google Plus, blogs) and data analysis to obtain insights or knowledge. Unlike traditional networks of interconnected individuals, social media sites serve as virtual communities where individuals interact, exchange information, and share opinions. These activities are capable of influencing consumers' perceptions of a particular brand. (Edosio U. Z., 2014) In the eCommerce industry, social media analytics are increasingly being used for the following reasons:

- It is intended to enhance business value and gain a competitive advantage.
- Drive customer traffic
- Boost customer loyalty and retention
- Improve sales and revenues, improve customer satisfaction, and, most importantly, create brand awareness and reputation.

Figure 6 illustrates the current and future use of social media that has enabled companies to understand their customers better and communicate directly with them regarding improving their services. Furthermore, social media has become an integral part of many companies' marketing strategies, with more than 90% of businesses using it to reach and engage with their target audience. In recent years, social media platforms have evolved beyond just being a means of communication to become a tool

for businesses to increase brand awareness, influence sales, generate leads, customer engagement, and drive sales.

Figure 6 Current and Future Use of social media (MarketingCharts, 2021)
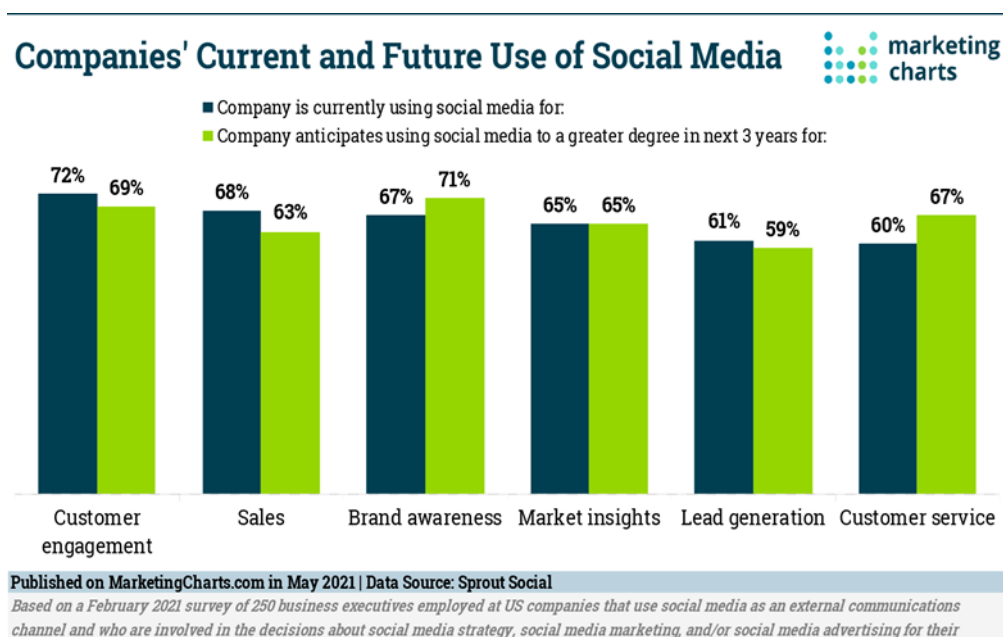
4.2 **The technology behind the analysis of social media data**

Social media has become a rich source of information for researchers and businesses alike. Analysing social media data involves using various technologies to extract insights from the vast information on social media platforms. Analysing these data involves using multiple tools, technologies, and algorithms to extract insights and patterns from large datasets generated by social media platforms. Some of these techniques are seen below:

Text mining is a powerful tool in eCommerce that allows retailers to analyse large amounts of text-based data such as product reviews, customer feedback, and social media posts. The relevance of an issue is usually assessed in this technique, which relies heavily on text-based content from blogs and social media sites. A keyword filter is used to retrieve relevant knowledge from the collected text. The ecommerce marketer generates a list of keywords about the product being monitored (Lee S., 2017). In conclusion, text mining is powerful for ecommerce companies to gain insights into customer preferences, opinions, and behaviour. By analysing textual data generated from various ecommerce channels, companies can improve product

development, marketing strategies, and customer service, increasing sales and customer satisfaction.

Natural Language Processing (NLP) is a branch of artificial intelligence that deals with the interaction between computers and humans using natural language. It is a critical technology in social media data analysis, as it enables machines to understand and analyse text data, including social media posts, comments, and messages (Liu B., 2012). Machine learning algorithms and artificial intelligence are employed in this analytics technique to detect sentiments regarding a particular product or service. Using natural language processing (NLP) and machine learning algorithms, eCommerce companies can gain valuable insights into customer behaviour, product preferences, and overall sentiment towards their brand (Lee S., 2017). Each word obtained from the big data is analysed and tagged, then referenced with a predefined word or synonym that interprets whether the opinion is positive. Sentiment analysis is a type of NLP that aims to identify and extract subjective information from text data. It is used in social media data analysis to determine the sentiment (positive, negative, or neutral) of social media posts, comments, and messages. (Newman, 2010)

Big Data Analytics and Social Network Analysis this technology helps social media platforms to generate vast amounts of data, which requires robust data storage and processing technologies to manage and analyse. Big data analytics tools like Hadoop, Spark, and NoSQL databases commonly handle large volumes of social media data (Liu B., 2012). Social Network Analysis (SNA) is a technique used to analyse the structure and dynamics of social networks. SNA can be used to identify influencers, communities, and other network properties that can inform social media marketing and engagement strategies (Boyd, 2007). Furthermore, data visualisation tools transform social media data into visual representations easily interpreted by analysts and decision-makers. Examples of data visualisation tools include Tableau, PowerBI, and D3.js (Kim, 2018)

4.3 **Predictive analysis**

Predictive analysis is a technique that ecommerce companies use to analyse historical data and predict future trends, customer behaviour, and business outcomes. It uses statistical algorithms, machine learning, and data mining techniques to identify patterns and generate insights. Figure 7 shows the usage of predictive analytics, which also refers to analysing data and making predictions based on machine learning (Stephen,

2013). Using historical data, predictive models can forecast future trends, optimise inventory management, and improve customer experience.

Figure 7 Uses of Predictive Analytics in an Organisation (Stephen, 2013)

Following the definitions above, predictive analytics uses data to evaluate and identify potential future events. Even though predictive analytics has been around, adoption has been low due to its complexity and high cost. With Big Data analytics platforms (in conjunction with data mining and machine learning algorithms), ecommerce vendors can predict consumer behaviour more quickly, efficiently, and at a lower cost using Big Data analytics. (Mosavi, 2013). Predictive analytics has many applications across various industries, including healthcare, finance, retail, and marketing.

Figure 8 Benefits of predictive analytics (Stephen, 2013)

As shown in Figures 7 and 8, organisations benefit from using predictive analytics, demonstrating the competitive edge and revenue growth top list in achieving the competitive advantages by 68%, with new revenue opportunities at 55%, with 52% increased profitability. Customer service also stands at 45%, with operational efficiencies at 44%. It is estimated that 67% of businesses intend to use predictive analytics in the future to devise more effective marketing campaigns, and 68% see the competitive advantage as the main benefit of predictive analytics. The following is a general overview of how predictive analytics is been applied to ecommerce:

- Recommendations for products
- Management of prices
- Search prediction

Additionally, predictive analysis can help identify patterns and trends that would be difficult or impossible to detect using traditional methods.

4.4 **Mobile Analytics in Ecommerce**

Mobile analytics collects, measures, and analyses data generated by mobile devices to gain insights into user behaviour and preferences. In ecommerce, mobile analytics can provide valuable information about how consumers interact with online stores through mobile devices, helping ecommerce businesses optimise their mobile strategies and improve user experience. The use of mobile phones has also undergone a radical

change as well. In the past, mobile phones were primarily used as communication instruments. However, in the present era, mobile phones are now utilised for many functionalities, including receiving emails, playing games, tracking people (via GPS), carrying out banking transactions, and shopping online. Figure 8 below illustrates how mobile phones are used. 35% of smartphone users report using their phones to shop online (Tao, 2012) (Ververidis, 2002). Ecommerce can, therefore, be propagated through mobile devices.

Figure 9 shows the flowchart for a Bluetooth-enabled location-based advertisement system, which is a visual representation that shows the step-by-step process of how the system works. It illustrates how Bluetooth technology delivers targeted advertisements based on the user's location.

Figure 9 Flowchart of a Bluetooth-enabled location-based advertisement system based on (Li, 2012)
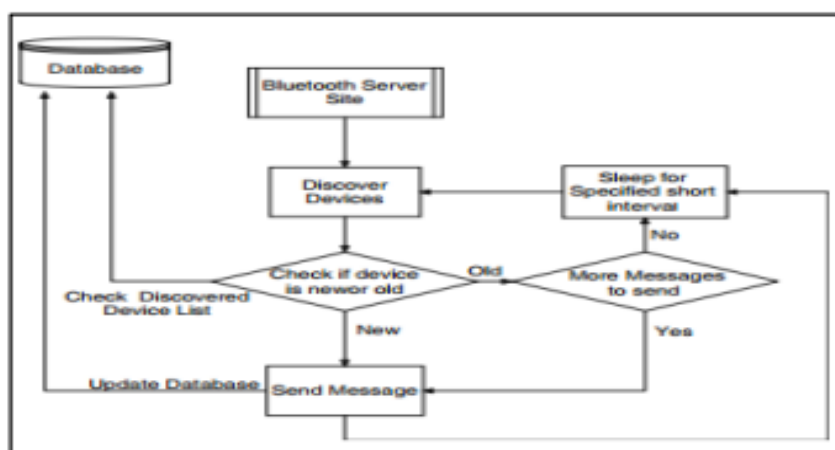
In addition to geo advertisement and location-based discounts, eCommerce companies can benefit from analysing big data generated by mobile phone data exchange. Additionally, ecommerce vendors can use existing customer data to identify location patterns to communicate customised messages to prospects in an efficient manner (Ofcom, 2009). Among the benefits of using mobile phone analytics are the following: Compared to other media platforms, it is much cheaper, more effective, and timelier for marketing products and services to consumers (Ververidis, 2002). GPS information gathered from customers' mobile phones and real-time advertising can be sent based on location and store proximity (Tao, 2012) . Mobile phone analytics can provide

valuable insights into user behaviour that can be used to drive revenue growth. For example, businesses can use analytics to identify which user segments are most likely to make in-app purchases and target those users with personalised offers and promotions (Harsh, 2021).

5 The role of big data analytics in helping retail ecommerce business

The retail industry has undergone a massive transformation in recent years thanks to the rapid growth of ecommerce. With the increasing popularity of online shopping, retailers have had to adapt their strategies to keep up with the changing market trends. One of the most significant advancements in this area has been using big data analytics to help retailers make data-driven decisions. In this chapter, we will explore the role of big data analytics in the retail ecommerce business and how it has revolutionized the industry. We will delve into the benefits of using big data analytics in retail, the challenges that retailers face when implementing big data analytics, and the best practices that retailers can adopt to leverage the power of big data analytics for their ecommerce businesses.

5.1 The positive factors of applying big data analytics.

Various services can be provided by Big Data analytics to community members, including information search, recommendation systems, dynamic pricing, and customer service. To satisfy customers, companies can collect information regarding geographical distribution, consumer behaviours, buying patterns, social relationships, and hobbies and then utilise this information to facilitate demand orientation, preference orientation, relationship orientation, and other customer satisfaction strategies. (Liaw, 2017) Some of these factors are as follows.

Searching for information indicates high information quality and search service quality. The value of a website's information determines the user's perception of its quality. Information quality is determined by many characteristics of information, such as updating, helpfulness, accuracy, and completeness. A real-time customer support system is available to online retailers based on the preferences and actions of their customers. Customers may gain satisfaction through this action as one of their competitive advantages. Famous websites like Amazon, eBay, Netflix, Monster, and other retail stores use recommendation systems. E-vendors facilitate a relationship with buyers in which buyers provide information, such as hobbies and preferences, and e-vendors provide recommendations tailored to everyone's needs. It describes in detail how recommendation systems work based on the following principles: user-based collaborative filtering, which uses similarities between users' rankings to predict their

interests, and item-based collaborative filtering, which uses points in an item space to indicate their interests (Liaw, 2017)

Big data analytics enables organisations to analyse large volumes of structured and unstructured data to gain insights and improve decision-making. This helps businesses to make data-driven decisions based on real-time information. It also helps identify inefficiencies in business processes, enabling organisations to optimise operations and reduce costs. It can also help automate repetitive tasks, freeing up staff time to focus on higher value tasks (Forbes, 2022). By analysing customer data to gain insights into customer preferences and needs. This information can personalise marketing messages, improve product offerings, and deliver a better customer experience. Likewise, to gain a deeper understanding of customer behaviour and preferences, this information can be used to create personalised experiences, improve customer satisfaction, and drive revenue growth. A competitive advantage also assists in identifying market trends and staying ahead of competitors. It can also help organisations to innovate and develop new products and services that meet customer needs. (Techtarget , 2021)

Mitigated risks are discovered before they become significant issues. This can be especially important in finance, healthcare, and insurance industries. Big data analytics can scale to handle large volumes of data, making it suitable for businesses of all sizes. This allows organisations to grow and expand their operations without worrying about data storage and processing limitations. (Forbes, 2022)

5.2 **Negative factors of applying big data analytics.**

Besides the benefits of applying BDA, which bring about customer value, using BDA may give customers some adverse effects. The following subchapter s provide detailed descriptions. A further concern related to Big Data is privacy and data security. Ecommerce environments are characteristically characterised by Big Data, which may raise privacy and security concerns. Hackers are attracted to this data type because of its high volume and concentration. The larger the volume of data, the greater the likelihood that the data files and documents may contain sensitive and valuable information. Data for Big Data analytics are thus a potential goldmine for cybercriminals (Kshetri, 2014). Behavioural addictions such as shopping addiction are frequently under-recognised. Individuals who become addicted to substance abuse fail to recognise the intensity of post-addiction cravings and cannot control their desires (Lo &

Harvey, 2012, 1,). Shopaholics are prone to become unable to control their shopping habits. They not only buy products they need or like but also spend their money foolishly and are afraid they may miss an opportunity to purchase something. These products, after purchase, would not be of use. In addition to recommending other products as substitutes or complementary items to customers, the website can also recommend other products using Big Data analytics. This application benefits customers with products they want to buy but harms them. They will have to spend more time reviewing more products to decide. It also recommends other complementary products customers need to purchase to increase the effects.

The website, for instance, recommends appropriate bags and shoes for a customer who has purchased a beautiful pink dress. They are preferred combined to give customer satisfaction. There is an excellent opportunity for customers to buy these complementary products for less money, although they must spend considerable time and effort. Shopping addictions are shown under two primary dimensions the tendency to spend and post-purchase feelings. (Lejoyeux & A., 2013).

Consumers are influenced by groups they believe they belong to or aspire to. Group influences can sometimes make customers change their intentions by reviewing group thinking. It is uncommon for consumers to avoid brands they feel will place them in a group they do not want to belong to; they purchase products to express their identities and connections with others of the same mind. An individual selection can change under social networks affected by group emotion, and consumers post their feedback after purchasing products or services on the website. Feedback could not be considered forged in online marketing. It has a strong perception in the human mind of assertive social communication. (Nawaz;Vveinhardt;& Ahmed, 2014)

6 The implementation of big data analytics in ecommerce

Today, ecommerce websites record a lot of customer data, including the content of their searches, stay period, purchase time, order information, and purchase feedback (B. Zhao, 2018) (Y. Chen, 2017). Through analysing these data, e-vendors can gain a competitive advantage and improve their marketing efforts. Besides, BDA supports the ecommerce business values in some of these implementations, as stated below.

BDA supports customer satisfaction by providing tailored products based on customer requirements (B. M. Avinash, 2017). Moreover, based on mobile devices' growth, analysing mobile data helps customise advertisements based on customer location (Edosio U., 2014). Using a dynamic pricing strategy, BDA can assist ecommerce companies in attracting more customers (B. M. Avinash, 2017). This method adjusts prices to reflect various factors, including the time of day, the season, the competitors' fees, and the level of demand (K. Arya, 2016.) These variables are assessed to determine prices dynamically and offer customised discounts (Edosio U., 2014). Two customers may purchase the same product at different prices as a result. Companies providing ecommerce services analyse customer information to determine how to meet their needs, produce advertisements and offers, and improve their recommendations. Using BDA systems made it possible to understand the customer's needs to improve their service (B. M. Avinash, 2017). For instance, BDA reduces the response time when serving a customer. A BDA solution provides customers and ecommerce firms with the information they require to stay informed, including product availability, order status, and tracking (K. Arya, 2016.), (B. M. Avinash, 2017).

BDA plays an essential role in detecting fraudulent behaviour, and abnormal actions can be managed and controlled to prevent fraudulent activity (B. M. Avinash, 2017), (K. Arya, 2016.). The use of predictive analytics can be described as including (a) product recommendation, (b) pricing, i.e., dynamic pricing, and (c) predictive search (Edosio U., 2014). Amazon's product recommendation system allows customers to personalise their shopping experience by recommending products tailored to their tastes (Edosio U., 2014). In addition to preventing some business problems, predictive analytics also aids in preventing losses of customers (B. M. Avinash, 2017). Thanks to the BDA search capabilities, a significant increase in search speed was achieved (Edosio U., 2014). The implementation of BDA improves customer loyalty, in other words, the

willingness of customers to purchase again in the future (B. Pavithra, 2016), (C. Liu, 2020.), (J. Liu, 2017).

Moreover, (Y. Sutisnawati and W. K. Maulani, 2019,) argue that business process analysis may have the following advantages in ecommerce: Retailers can enhance their e-shopping experience by anticipating customer needs using different data sources, such as social media. BDA facilitates the prediction of high product demand. Based on consumer tastes and behaviour, BDA supports personalised product recommendations. The customer experience is enhanced, while customers' needs must be considered to limit the loss of customers and increasing revenue is essential. Therefore, BDA improves tax compliance through auditing systems (W. Huang, 2018). Aside from that, BDA has contributed to the innovation of business models (J. Liu, 2017)

7   Big data analysis impact on the ecommerce retailer sector

Based on an analysis of customer purchasing behaviour, (B. Zhao, 2018) and (L. Li, 2018.) investigated the preference of many customers for shopping online in the mornings. A logistic strategy known as the early purchase period refers to delivering morning orders within the same day (B. Zhao, 2018). Furthermore, women have a different approach to shopping than men. It has been observed that women prefer to make purchases at any time, especially in the afternoon, while men prefer to complete their purchases earlier in the day (B. Zhao, 2018).

 In addition, it is noted that more orders are placed during the week than during the weekend. Using customer purchase analysis as a guide, ecommerce vendors can plan promotions at the right time (B. Zhao, 2018), (L. Li, 2018.). On the other hand, special events, such as the New Year event and Black Friday, can be utilised to activate promotions and other activities designed to catch the attention of customers (B. Zhao, 2018). The use of BDA in ecommerce marketing has improved the effectiveness of marketing strategies and provided new services, such as customisable, personalised, and recommendation-based services (Liu B., 2017,), (T. M. Le, 2017.) According to (B. Pavithra, 2016), (L. Li, 2018.) and (T. M. Le, 2017.), BDA is considered to be a powerful tool for ecommerce as it does the following;

(i)   Increase sales on the market,
(ii)   Identify the behaviour of their customers,
(iii)   To attain higher levels of customer satisfaction,
(iv)   Gain a more significant number of customers,
(v)   Ensure that shopping cart rejections are limited.

Also, BDA drives decision-making processes and shows the direction of ecommerce operations. Amazon, for instance, is using BDA to analyse consumer behaviour and observed a reduction of 3 minutes in the average order processing period because of using BDA, which led to a tripled efficiency of the processing process. According to Amazon's experience, analysing consumers' feedback enhanced their purchasing quality (Y. Chen, 2017). Besides, BDA capabilities increased the competition intensity between ecommerce vendors and changed the way of thinking (J. Liu, 2017).

In conclusion, big data analysis has transformed the ecommerce retailer sector by enabling personalised customer experiences, improving demand forecasting, optimising pricing strategies, enhancing fraud detection and security, streamlining supply chain operations, analysing customer sentiment, and conducting market research. The effective utilisation of big data analytics has become a crucial competitive advantage for ecommerce retailers in today's digital era.

8 Roles and challenges of big data analytics in ecommerce

Ecommerce without BDA is like shooting with blindfolds and hoping to catch something. This phrase is because the role of data analytics allows one to maximize one's operational efforts, which helps to find and exploit patterns. Here are some key roles and challenges of big data analytics in ecommerce. Data tells which product to promote, such as seldom situations where one must equally promote all products (when items are on offer or in sale). Looking at the data, one can find products with the best traffic, revenue, or profit generators and use this info to promote these products, depending on the companies' current needs. (Chen, 2015)

Which products to bundle together? Suppose one notices that some items are purchased together more often. In that case, the knowledge acquired is either to enhance the product suggestions automation/site exposure or by literally lumping them together and selling at a reduced price. Automation of repetitive tasks saves not only time but also resources. Additionally, it enhances the customer experience. Chatbots can improve accuracy and response time for customer service, for example. Identify repetitive tasks and automate them by asking each employee to describe them. (Singh, 2020). As a result, in the past retailers analysed fraud based on samples or subsets of their data because it was too costly and time-consuming to use the complete data set. As an additional benefit of Big Data solutions, analysing historical transactions over the past week, month, or year allows the detection of new fraud patterns, which can be automatically added to the fraud rules and included in the real-time approval process. (MEHRA, 2013). Furthermore, these are some challenges that eCommerce in BDA faces as stated below;

With budget and time constraints and limited resources, most small-scale online businesses may be unable to implement data-driven marketing strategies (Brookes, 2018). Failure in transforming data into actions is one of the most common problems small business owners face with their lack of time to get valuable insights from their data and act on them. The speed of an online business is crucial in today's highly competitive market. (Brookes, 2018). Providing an omnichannel experience in this digital and mobile era, the path to purchase has become more complex. Nowadays, consumers shop across a wide range of devices and channels. Additionally, contemporary consumers expect a consistent shopping experience across all platforms, as they often transfer from a physical store to an online one. They utilise desktop and mobile technologies as they move closer to conversion (Brookes, 2018).

Failing to gain a more significant market share by taking advantage of one store's marketing data, one can create unique opportunities for driving sales to their website. However, if one focuses solely on their ecommerce store and does not consider their competitors, they are missing a vital part of their digital marketing strategy (Brookes, 2018). Insufficient data and bad data are any inaccurate or missing information about customers, products, or stores that leads to bad customer experiences and revenue in an eCommerce business (Dayal, 2022).

To conclude, big data analytics is a game changer in the ecommerce industry. It enables businesses to enhance customer experiences, streamline operations, and make data-driven decisions. However, implementing big data analytics in ecommerce is not without its challenges. Overcoming these challenges is essential for realising the full potential of big data in ecommerce and staying competitive in the rapidly evolving digital marketplace.

9 Research methodology

This chapter outlines the methodology used in the study, including the research design, literature review, data analysis procedures and conclusion. The research involves a qualitative approach, using a literature review to gather data and analyse the findings. The research was conducted with a mixed-methods approach for a more comprehensive understanding of the research questions by combining the strengths of both primary and secondary sources with a focus on recent literature and peer-reviewed articles. The research begins with a comprehensive review of relevant literature on big data analytics, ecommerce, and related fields. The review aims to identify gaps in knowledge and areas of research that require further investigation.

This thesis aims to review big data analytics literature and discuss the different perspectives on big data applications. The central sources of big data applications are identified through systematic research on specific topics and related articles. Journal articles, collection works, reference works, books, and websites reviewed during the research process. A classic literature review is employed for this research, which is essential since big data analytics is an important modern topic requiring a solid research foundation. During a literature review, the available knowledge within a given area is reconstructed so that a subsequent literature analysis can be based on it.

Figure 10 describes a literature search as querying scholarly databases with keywords and conducting backwards or forward inquiries based on the findings. It is common for researchers to show literature reviews of this type during a given period, and this type of research can be used to support their ideas. Moreover, it is equipped to search by citations, which enables the retrieval of relevant articles backwards and forwards in time. A forward search involves finding more recent articles that cite the report, whereas a backward search is conducted to identify older articles that influenced the author's work.

Figure 10 Research method according to (Watson, 2002)
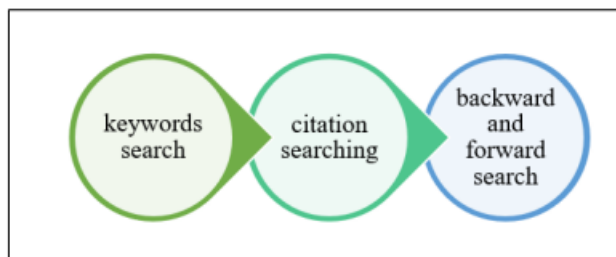
The author developed this thesis after reading several recent articles regarding the relevance of Big Data in retail. A simple web search and database search are used as a starting point. Various sources were consulted, including Sciencedirect.com, SAGE journals, SpringerLink, ResearchGate, Google Scholar, and Open Access Journal. Among others, search keywords in finding the relevant information needed were as follows; "Big Data in Retail Ecommerce", "Big Data Applications", "Benefits of Big Data in Ecommerce", "what is eCommerce in the retail sector", "consumer analytics in the big data era", "Big data usage in the retail industry" were applied to gather the data and theoretical part needed for this thesis. This research aims to contribute to the knowledge base on using big data analytics in improving eCommerce processes and enhancing the user experience in the retail sector. The findings will provide insights and recommendations for retail organisations to leverage big data effectively, optimise their eCommerce processes, and deliver customers a personalised and seamless user experience.

10 Conclusion

In conclusion, the application of Big Data Analytics in ecommerce processes has the potential to significantly improve the user experience of customers and the overall performance of ecommerce websites. In the retail sector, Big Data Analytics can create a personalised shopping experience tailored to the individual customer. However, some challenges must be addressed, such as privacy and security concerns and the complexity of Big Data Analytics. Retailers must have the expertise and resources to implement and manage Big Data Analytics solutions effectively.

10.1 Results

This chapter presents the results of our research study, which aimed to investigate the values, impacts, roles, and challenges of implementing Big Data Analytics in the ecommerce sector, with a particular focus on ecommerce vendors in the retail industry. The research addressed three key questions:

Investigating the values of implementing Big Data Analytics in ecommerce revealed several key findings. First and foremost, it was evident that Big Data Analytics plays a pivotal role in enhancing decision-making processes within ecommerce organisations. The analysis of various fact-finding and reviews indicated that by harnessing the power of big data, ecommerce businesses could gain valuable insights into customer behaviour, preferences, and trends. These insights, in turn, enable companies to optimise product offerings, personalise customer experiences, and increase customer retention rates. Additionally, implementing Big Data Analytics often leads to improved operational efficiency, reduced costs, and increased revenue through targeted marketing efforts. The data-driven approach also helps identify and mitigate risks, ultimately contributing to the overall growth and sustainability of ecommerce businesses.

The impact of Big Data Analytics on ecommerce vendors in the retail sector was a central focus of this study. The analysis revealed that ecommerce vendors effectively leverage Big Data Analytics to experience substantial advantages. Specifically, these vendors are better equipped to tailor their product assortments to meet customer demands, resulting in increased sales and customer satisfaction. Additionally, Big Data Analytics empowers ecommerce vendors to optimise pricing strategies, inventory management, and supply chain operations, improving profitability and competitiveness.

Furthermore, the study found that vendors using Big Data Analytics are more adept at identifying and capitalising on emerging market trends and customer preferences, thus gaining a competitive edge in the ever-evolving ecommerce landscape.

Exploring the roles and challenges of Big Data Analytics in ecommerce illuminated the multifaceted nature of this technology. The functions encompassed data collection, storage, processing, analysis, and interpretation, all contributing to informed decision-making. Additionally, Big Data Analytics catalyses innovation, enabling ecommerce vendors to develop and implement novel business strategies. However, the study also identified several challenges associated with adopting Big Data Analytics in ecommerce. Key challenges included data security and privacy concerns, the need for substantial investments in technology and talent, and the complexity of managing and extracting value from large and diverse data sets. Furthermore, the rapid pace of technological advancements presented an ongoing challenge for ecommerce businesses striving to stay up to date with the latest tools and methodologies.

In conclusion, the results of this study underscore the undeniable value of implementing Big Data Analytics in eCommerce. It enhances decision-making, positively impacts ecommerce vendors in retail vendors, and plays pivotal roles in ecommerce operations. Nonetheless, ecommerce businesses must navigate the associated challenges to fully harness the potential benefits of Big Data Analytics.

10.2 Evaluation and Reflection

The evaluation of the thesis findings indicates that Big Data Analytics has significantly impacted the ecommerce and retail industry. Companies have gained a deeper understanding of their target audience by leveraging vast amounts of data from various sources, including customer interactions, social media, and transaction records. They have been able to identify patterns, detect anomalies, and predict future trends, allowing for targeted marketing campaigns, inventory optimisation, and improved supply chain management. Furthermore, implementing recommendation systems powered by Big Data Analytics has enhanced the user experience by providing personalised product suggestions and tailored promotions. This has increased customer engagement and fostered brand loyalty and repeat purchases. The research showed that Big Data Analytics has revolutionised ecommerce and retail businesses. The ability to extract valuable insights from massive data sets has created a competitive advantage for companies willing to invest in analytics capabilities.

However, addressing specific challenges such as data privacy, security, and ethical considerations is crucial to maintaining customer trust and complying with regulations. Additionally, it is essential to acknowledge that Big Data Analytics is an ongoing journey. As technology evolves, new tools and techniques will emerge, providing even more opportunities for organisations to leverage data for business growth. Continuous learning and adaptation are crucial to staying ahead in this rapidly changing landscape.

10.3 Implementation and Follow-Up Plans

Several follow-up actions recommended to advance further research on applying Big Data Analytics in ecommerce and retail. First, businesses should continue to invest in infrastructure and technology that can handle the processing and analysis of large-scale data. Additionally, there is a need for ongoing research and development in machine learning and artificial intelligence to enhance the capabilities of analytics tools. Moreover, collaborations between academia, industry, and government can facilitate knowledge sharing and the development of best practices in utilising big data for retail purposes.

Implementing Big Data Analytics in retail requires a strategic and phased approach. Businesses should start by identifying their specific goals and objectives, such as improving customer segmentation, optimising pricing strategies, or enhancing inventory management. They should then assess their data infrastructure, ensuring that it can handle the volume, variety, and velocity of data required for practical analysis. Next, organisations should invest in analytics tools and talent by hiring data scientists or partnering with external experts. Finally, a culture of data-driven decision-making should be fostered within the organisation, with regular monitoring and evaluation of the implemented strategies to measure their effectiveness. Overall, the application of Big Data Analytics in improving ecommerce processes and enhancing the user experience in the retail sector holds great promise. By harnessing the power of data, businesses can gain a competitive advantage, drive innovation, and deliver a personalised and seamless shopping experience for customers.

10.4 Limitations and Future research

During this study, some limitations were encountered by the researcher. Due to the absence of interviews, surveys or working for a company to determine how Big Data is conducted to enhance their business and what applications have been used, a

conclusion is drawn with caution. Conducting a more comprehensive analysis of any research study is beneficial to research on a larger and more detailed scale. In addition, there is the possibility of researcher bias, which is inherent in all research studies but is especially prevalent when the data collection is not structured. To be aware of and avoid being influenced by researcher bias, this researcher made every effort to be vigilant. It is impossible to eliminate research bias, but the researcher is confident that valid results have been achieved, which can be applied to more subjects. Additionally, the collected data type leaves greater scope for interpretation than, for example, numeric data.

Future research could explore the role of big data analytics in enhancing personalised customer experiences in the retail sector. It could include studying the effectiveness of recommendation systems, customised marketing strategies, and targeted promotions based on customer behaviour and preferences. As the boundaries between online and offline retail continue to blur, there is a need for research on integrating big data analytics across different sales channels. Investigating how data from online platforms can be leveraged to enhance the in-store experience and vice versa can provide valuable insights for retailers. Most existing research on big data analytics in the retail sector focuses on large enterprises. Future studies could examine the challenges and opportunities for SMEs in adopting and leveraging big data analytics to improve their eCommerce processes and enhance the user experience.

Comparative studies across different retail sectors and geographical regions can help identify sector-specific challenges and opportunities in applying big data analytics. It can contribute to a better understanding of the contextual factors that influence the effectiveness of big data analytics in the retail sector. Further Research also explores the ethical implications of using big data analytics in the retail sector and develops guidelines or frameworks for honest data collection, usage, and algorithmic decision-making. It can help ensure the responsible and transparent use of big data in improving the user experience in eCommerce processes.

11 Summary

The process of writing the thesis on the application of Big Data Analytics in improving eCommerce processes, with a focus on the retail sector user experience, provided valuable insights into the transformative potential of Big Data in the eCommerce industry. The research highlighted the importance of user experience, data management, data-driven decision-making, and ethical considerations, ultimately showing that when used effectively, Big Data Analytics can be a game-changer for businesses aiming to excel in the competitive world of online retail.

Furthermore, answering research questions in a literature review thesis is a meticulous process that involves systematic research, analysis, and synthesis of existing literature. By defining research questions, conducting a thorough literature search, critically evaluating sources, categorizing and organizing materials, and providing critical insights, the author could address the research questions effectively and contribute to the existing body of knowledge in the field of Big Data. This structured approach ensured that the literature review was a valuable and integral component of this thesis.

The application of Big Data Analytics in the retail sector has revolutionized eCommerce processes, leading to enhanced user experiences, increased sales, and improved vendor efficiency. The values of Big Data Analytics in eCommerce are evident in its ability to provide valuable insights, enhance customer experiences, and streamline operations. eCommerce vendors must adapt to these changes and overcome the associated challenges to remain competitive in the dynamic online retail landscape. Big Data Analytics has become a cornerstone in the ongoing evolution of eCommerce, and its importance is expected to grow as technology advances.

The thesis will contribute to a deeper understanding of how Big Data Analytics can be leveraged to enhance eCommerce processes in the retail sector, providing valuable insights for both academics and industry practitioners. The research aims to inform and guide eCommerce vendors and industry stakeholders in pursuing improved user experiences and business outcomes through data-driven decision-making.

12 References

Coresight Research. (n.d.). "Livestreaming in China: A Key Driver of E-Commerce Growth".

Experian Data Quality . (n.d.). *Experian Information Solutions, Inc. .* Retrieved from Experian: https://www.experian.co.uk/business/data-quality/solutions/data-management-solutions?researchpaper=makingdatawork

Kevel . (2021). Retrieved from https://www.kevel.co/blog/what-is-e-commerce-data/

Al-Shiakhli, S. (2019). *Big Data Analytics: A Literature Review.* Luleå University of Technology.

Altynpara, E. (2023, March 23). *Cleveroad Inc. .* Retrieved from https://www.cleveroad.com/blog/big-data-in-ecommerce-industry-application-reasons-you-can-t-ignore/

Anusha. (2021, December 17). *StartupTalky .* Retrieved from StartupTalky : https://startuptalky.com/future-of-e-commerce/

B. M. Avinash, B. M. (2017). "Big data analytics for E-commerce–Its impact on value creation,". *Int. J. Adv. Res. Comput. Commun. Eng., vol. 6, no. 12,*, pp. 181–188.

B. Pavithra, M. N. (2016). "The study of big data analytics in E-commerce,". *Int. J. Adv. Res. Comput Commun. Eng., vol. 5, no. 2,*, pp. 126–131.

B. Zhao, H. H.-D. (2018). A preliminary study of E-commerce user behavior based on mobile big data-invited paper,. *In Proc. IEEE 87th Veh. Technol. Conf (VTC Spring), Porto, Portugal,*, pp. 1–5.

Beath, C. B.-F. (2012). *Finding value in the information explosion.* MIT Sloan Management Review,.

Ben Lutkevich, W. C. (n.d.). *TechTarget.* Retrieved from TechTarget Website: https://www.techtarget.com/searchcio/definition/e-commerce

BigCommerce. (2021, January). *"Ecommerce Trends That Will Transform Your Business in 2021 and Beyond.* Retrieved from BigCommerce Website.

BigCommerce. (2021). *BigCommerce.* Retrieved from BigCommerce Website: https://www.bigcommerce.com/articles/ecommerce/#growth-of-ecommerce

BLOOMENTHAL, A. (2021, September 16). *Investopedia.* Retrieved from Investopedia Website: https://www.investopedia.com/terms/e/ecommerce.asp#toc-understanding-ecommerce

Boyd, D. &. (2007). Social network sites: Definition, history, and scholarship. . *Journal of Computer-Mediated Communication, 13(1), 210-230.*, 13(1), 210-230.

Brightcove. (2021). The Science of Social Video: Turning Views into Value.

Brookes, E. (2018, January 10). *hypepotamus.* Retrieved from hypepotamus: https://hypepotamus.com/community/data-driven-marketing-e-commerce/

Business Insider . (2021). Retrieved from https://www.businessinsider.com/consumers-demand-sustainability-in-ecommerce-heres-what-that-means-for-retailers-2021-6

Business Insider. (2019). *4 Predictions for the Future of E-commerce.*

C. Liu, S. W. (2020.). ''Exploring E-commerce big data and customer-perceived value: An empirical study on Chinese online customers,'' . *Sustainability,* , vol. 12, no. 20, p. 8649.

Chen, Y. &. (2015). *Customer lifetime value prediction for new customers in online retailing: A case of book retailing. .* Industrial Management & Data Systems, 115(2), 311-329.

Conley, P. (2023, March 29). *DigitalCommerce360.* Retrieved from https://www.digitalcommerce360.com/2023/03/29/nrf-forecasts-12-percent-rise-in-online-sales-in-2023/

Daria, R. (2021, September 10). *cleveroad.* Retrieved from https://www.cleveroad.com/blog/big-data-in-ecommerce-industry-application-reasons-you-can-t-ignore/

Davenport, T. H. (2007b). The dark side of customer analytics. . *Harvard Business Review*, 85, 37.

Dayal, G. (2022, March 21). *WP Swings.* Retrieved from WP Swings: https://wpswings.com/blog/bad-data-hurt-your-ecommerce-business/

Digital Marketing Institute. (n.d.). Retrieved from Digital Marketing Institute WebSite: https://digitalmarketinginstitute.com/blog/the-importance-of-data-analytics-in-e-commerce.

Edosio, U. (2014). 'Big data analytics and its application in E-commerce,''. *In Proc. E-Commerce Technol., Bradford, U.K.,* , pp. 1–12.

Edosio, U. Z. (2014). Big Data Analytics and its Application in E-Commerce. *Conference: E-Commerce TechnologiesAt: University of BradfordVolume: 1*, 4 - 8.

eMarketer. (2019). Retrieved from eMarketer Website: https://www.emarketer.com/content/social-commerce-2019-how-brands-are-using-pinterest-instagram-and-snapchat-to-sell-to-consumers.

Epsilon. (2018). The Power of Me: The Impact of Personalization on Marketing
Performance.

Forbes. (2022, February 09). Retrieved from
https://www.forbes.com/sites/forbestechcouncil/2022/02/09/the-benefits-of-big-
data-analytics-for-business/?sh=23047d2f4ca7

Forbes. (2023, March 21). Retrieved from Forbes Website:
https://www.forbes.com/sites/forbesmarketplace/2023/03/21/the-future-of-e-
commerce-trends-to-watch-in-2023/?sh=781e9f6a631e

Forrester Research. (n.d.). "How Video Will Take Over the World".

Frost, R. S. (2013). *E-marketing. .* Upper Saddle River, NJ: Pearson Prentice Hall.

Harsh, S. (2021, July 8). *Appinventiv.* Retrieved from appinventiv.com/blog/benefits-of-
mobile-app-analytics-for-business/.

IMARC. (2022). *IMARC.* Retrieved from IMARC Web Site:
https://www.imarcgroup.com/e-commerce-market

J. Liu, L. S. (2017). ''The electronic commerce in the era of Internet of Things and big
data,'' . *in Proc. IEEE Int.Conf. Comput. Sci. Eng. (CSE) IEEE Int. Conf.
Embedded Ubiquitous Comput. (EUC), vol. 2, Guangzhou, China, ,* pp. 360–
363.

Jiayu Chen, X. H. (2017). Predicting customer purchase in an online retail business: A
clickstream data analysis.

K. Arya, T. K. (2016.). ''Big data analytics of global Ecommerce organisations: A study,
survey And analysis,'' . *Int. J. Sci. Eng Res., vol. 7, no. 12, ,* pp 82–84,.

Kaushal, N. a. (2019). A Review on Big Data: Applications and Challenges. *Journal of
Emerging Technologies and Innovative Research ,* 3 - 5.

Kim, Y. P. (2018). Analyzing social media data with interactive visual analytics: A
survey. . *Journal of Information Science,* 44(5), 553-575.

Klipfolio Inc. (n.d.). Retrieved from Klipfolio Inc. Website:
https://www.klipfolio.com/resources/articles/what-is-ecommerce-data-and-why-
do-you-need-it

Kshetri, N. (2014). Big Data's impact on privacy, security and consumer welfare.
Telecommun. Policy 2014, 38,. *Telecommun,* 1134–1145.

L. Li, T. C. (2018.). Customer demand analysis of the electronic commerce supply
chain using big data. *Ann. Oper. Res., vol. 268,nos. 1–2, ,* pp. 113–128, .

Laudon, K. C. (2018). E-commerce: business, technology, society. Pearson Education
Limited. *Pearson Education Limited.*

Lee, I. &. (2019). The internet of things (IoT): applications, investments, and challenges for enterprises. *Business Horizons*, 62(4), 441-450. doi:10.1016/j.bushor.2019.03.011.

Lee, S. L. (2017). Mining online customer reviews for predictive modeling: A case study in the women's clothing industry. . *Journal of Business Research*, 70, 1-10.

Lejoyeux, M., & A., W. (2013). Shopping Addiction; Academic Press: Cambridge, MA, USA, 2013. *Academic Press: Cambridge, MA, USA,*.

Li, K. &. (2012). Building a targeted mobile advertising system for location-based services. . *Elsevier Science Direct, 54(1),*, pp.1-8.

Liaw, T. M.-Y. (2017). Effects of Pros and Cons of Applying Big Data Analytics to Consumers' Responses in an E-Commerce Context. *mpi*, 4 -8.

Liu, B. (2012). Sentiment analysis and opinion mining. *Synthesis Lectures on Human Language Technologies*, 5(1), 1-167.

Liu, B. (2017,). A study on the innovation of E-commerce service mode under the background of big data,. *Proc. 2nd Int. Conf. Educ., Sports, Arts Manage. Eng. (ICESAME),* , pp. 989–992.

Lo, H., & Harvey, N. E.-m.-b. (2012, 1,). Effects of shopping addiction on consumer decision-making: Web-based studies in real time. . *J. Behav. Addict.*, 162–170.

Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C., . . . McKinsey Global Institute: Washington, D. U. (2011). *ig Data: The Next Frontier for Innovation, Competition, and Productivity.* Washington, DC, USA: McKinsey Global Institute.

MarketingCharts. (2021, May). *MarketingCharts.* Retrieved from https://www.marketingcharts.com/digital/social-media-117074

Mayer-Schönberger, V. &. (2013). *Big Data: A revolution that will transform how we live, work, and think. .* New York: Houghton Mifflin Harcourt.

McAfee, A., & Brynjolfsson, E. (2012). Big Data: The management revolution. In T. Davenport, D. Patil, & D. Barton. Harvard Business Rev.

McKinsey & Company. (2019). *McKinsey Insights.* Retrieved from https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/personalization-at-scale-the-retail-imperative

Media, H. A. (2021, May 10). *MarketingCharts.* Retrieved from MarketingCharts: https://www.marketingcharts.com/digital/social-media-117074

MEHRA, G. (2013 , MAY 22). *Practical Ecommerce®.* Retrieved from Practical Ecommerce®: https://www.practicalecommerce.com/Using-Big-Data-to-Prevent-Ecommerce-Fraud

Milly. (2021, January 21). *Octopus Data Inc.* Retrieved from Octopus Data website: https://www.octoparse.com/blog/benefits-of-big-data-analytics-for-e-commerce#

Mosavi, A. &. (2013). Developing Effective Tools for Predictive Analytics and Informed Decisions. *Technical Report. University of Tallin.*

Nawaz, A., Vveinhardt, J., & Ahmed, R. (2014). Impact of Word of Mouth on Consumer Buying Decision. *Eur. J .Bus. Manag. 2014, 6, 394–403.*, 6, 394–403.

Newman, M. E. (2010). Networks: An introduction. *Oxford University Press.*

Ofcom. (2009, September 16). *Mostly Mobile. .* Retrieved from https://www.ofcom.org.uk/consultations-and-statements/category-1/msa

P. Maroufkhani, R. W. (2019). Big data analytics and firm performance: A systematic review. *Information, vol. 10, no. 7,* , p. 226,.

PwC . (2019). How voice assistants are shaping the future of commerce.

Russom, P. (2011, S). The three Vs of big data analytics. *TDWI.*

Schroeck, M. S.-M. (2012). *Analytics: The real-world use of big data.* NY, USA: IBM: Institute for Business Value.

Shad., A. A. (n.d.). Retrieved from Crazy Egg: https://www.crazyegg.com/blog/ecommerce-customer-journey-mapping/

Shmueli, G. &. (2011). Predictive analytics in information systems research. *MIS Quartely*, 35(3), pp.553-72.

Shopify. (n.d.). Retrieved from https://www.shopify.com/payment-gateways

Shopify . (2021). Retrieved from Shopify website: https://www.shopify.com/enterprise/the-future-of-ecommerce

Shopify. (2021, September 27). *Shopify eCommerce Market Credibility Study: Data Review, a commissioned Forrester Consulting study conducted on behalf of Shopify.* Retrieved from https://www.shopify.com/research/future-of-commerce/future-of-ecommerce#:~:text=The%20ecommerce%20industry%20is%20expected,reopen%2C%20ecommerce%20growth%20keeps%20climbing.

Singh, D. S. (2020, July 20). *Entrepreneur Media, Inc. .* Retrieved from Entrepreneur Media, Inc. : https://www.entrepreneur.com/en-in/technology/the-pivotal-role-of-big-data-in-e-commerce/353507

Stephen, M. (2013, August 28). *Big Data Brewing Value in Human Capital Management.* Retrieved from Ventana Research Community: https://blog.ventanaresearch.com/2013/08/28/big-data-brewing-value-in-human-capital-management

T. M. Le, a. S.-Y. (2017.). Effects of pros and cons of applying big data analytics to consumers' responses in an E-commerce context. *Sustainability, vol. 9, no. 5,* p. 798.

Talend. (2022). Retrieved from https://www.talend.com/resources/big-data-ecommerce/

Tao, S. M. (2012). Real-Time Urban Traffic State Estimation with A-GPS Mobile Phones as Probes. *Journal of Transportation Technologies, 2(1),* , pp.22-31.

Taylor, C. (2019, March 19). Retrieved from CNBC Website: https://www.cnbc.com/2019/03/13/e-commerce-is-the-future-for-a-lot-of-markets-adidas-ceo-says.html

Techtarget . (2021). Retrieved from https://searchbusinessanalytics.techtarget.com/definition/big-data-analytics

Ververidis, C. &. (2002). Mobile marketing using a location based service. . *In Proceedings of the First International Conferenceon Mobile Business. Prentice-Hall.*, pp.1-8.

W. Huang, Y. L. (2018). C2C electronic commerce tax management based on big data, . *Proc. 3rd Int. Conf. Econ. Bus. Manage. (FEBM),*, pp. 83–86.

Wamba, S. A. (2016). Big data analytics in E-commerce: a systematic review and agenda for future research. *SpringerLink*, 182 - 184.

Watson, J. W. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *University of Minnesota Management Information Systems Research Center*, Vol. 26 pp. xiii-xxiii (11 pages).

Weforum. (2019). Retrieved from Weforum website: https://www.weforum.org/agenda/2019/10/how-e-commerce-is-changing-the-world/

Wyzowl. (2021). "The State of Video Marketing.

Y. Chen. (2017). Application and research of big data in E-commerce enterprises. *Amazon as the case," in Proc. 7th Int. Conf. Educ., Manage., Comput. Med. (EMCM),* , pp. 481–487.

Y. Sutisnawati and W. K. Maulani. (2019,). ''Big data impact in development Ecommerce,'' , . *in Proc. IOP Conf. Mater. Sci. Eng., vol. 662*, pp. 1–6.

Appendix 1. Material Management Plan

During the thesis process, having a well-defined plan for saving and processing research data is crucial to ensuring data security and protection. The author primarily relied on digital platforms to securely manage and store research data. The data has been stored on a dedicated research laptop and backed up to a secure, password-protected external hard drive (C). Cloud storage solutions like Google or Dropbox may also be employed, but access will be limited and secured through solid and unique passwords. The thesis will be stored in attached storage for one year after the completion of the project.

Regular data backups are vital to prevent data loss due to hardware failure, corruption, or other unforeseen events. The author of the thesis will schedule automated backups for the research laptop, external hard drive, and cloud storage to ensure redundancy. To protect the research data throughout the project, ensuring its integrity, confidentiality, and availability while complying with all relevant regulations. This strategy will help safeguard the data and facilitate a successful thesis process.