International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 10 Issue 1, Jan-Feb 2026 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Big Data Marketing

Matthew N. O. Sadiku[1], Samuel A. Ajayi[2], Janet O. Sadiku[3]

[1]Roy G. Perry College of Engineering, Prairie View A&M University, Prairie View, TX, USA
[2]Texas Southern University, Houston, TX, USA
[3]Juliana King University, Houston, TX, USA

ABSTRACT

Big data refers to the large volume of data generated every second from digital interactions, devices, and systems. It encompasses both structured and unstructured data and includes text, images, video, and more. In marketing, big data refers to large volumes of customer information collected from various sources, such as digital platforms, websites, and apps, about customer behavior, interactions, and preferences. For marketing organizations, big data is the fundamental consequence of the new marketing landscape, born from the digital world we now live in. The more data a marketer has, the greater their ability to make precise predictions, create personalized marketing strategies, and drive more customer engagement. With predictive analytics, advanced analytics tools, and data-driven decisions, marketers can use big data to stay ahead of their competition. Big data can improve the profitability and competitiveness of organizations by extending market knowledge and strategic marketing insight. This paper explores what big data is and how it can improve marketing activities.

KEYWORDS: *big data, big data analytics, big data applications, marketing, marketers.*

How to cite this paper: Matthew N. O. Sadiku | Samuel A. Ajayi | Janet O. Sadiku "Big Data Marketing" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-10 | Issue-1, February 2026, pp.408-417, URL: www.ijtsrd.com/papers/ijtsrd100058.pdf

IJTSRD100058

INTRODUCTION

Large volumes of structured and unstructured data are generated every second from various marketing sources including mobile devices, customer feedback, customer interactions, the Internet of things, and website analytics. With this data, marketers make data-driven insights to understand and anticipate their customers' needs, preferences, and behaviors on an unprecedented scale [1].

In the world of digital marketing, data is everything. Big data is a cornerstone of data-driven decision-making in digital marketing. It has reshaped the landscape of market research, offering unprecedented insights and opportunities. By leveraging insights from big data, companies can create more effective and targeted marketing strategies.

Big data refers to the ever-increasing volume, velocity, variety, variability, and complexity of information. It includes structured data like demographic information and purchase histories, and unstructured data like social media interactions and customer service transcripts. Big data in marketing refers to the vast and complex sets of information generated by various sources, such as social media platforms, websites, and customer interactions. Marketers can analyze these extensive datasets to gain insights into customer demographics, behaviors, and preferences. Big data marketing uses massive amounts of customer information from digital interactions (social media, web, mobile) to gain deep insights into customer behavior. Businesses can harness big data to monitor emerging trends in real time [2].

Big data plays a crucial role in modern marketing strategies by providing businesses with valuable insights about their customers. Now, with big data, artificial intelligence (AI), and machine learning, marketing has been transformed. We can analyze data in real time, run personalized marketing campaigns, and more. The concept of big data in marketing has evolved over the years with the advancements in technology and the exponential growth of digital information.

WHAT IS BIG DATA?

Big data applies to data sets of extreme size (e.g. exabytes, zettabytes) which are beyond the capability of the commonly used software tools. It involves

situation where very large data sets are big in volume, velocity, veracity, and variability [3]. The data is too big, too fast, or does not fit the regular database architecture. It may require different strategies and tools for profiling, measurement, assessment, and processing. Different components of big data are shown in Figure 1 [4]. The cloud word for big data is shown in Figure 2 [5].

Big Data is essentially classified into three types [6]:

- *Structured Data:* This is highly organized and is the easiest to work with. Any data that can be stored, accessed, and processed in the form of fixed format is known as a structured data. It may be stored in tabular format. Due to their nature, it is easy for programs to sort through and collect data. Structured data has quantitative data such as age, contact, address, billing, expenses, credit card numbers, etc. Data that is stored in a relational database management system is an example of structured data.
- *Unstructured Data:* This refers to unorganized data such as video files, log files, audio files, and image files. Any data with unknown form or the structure is classified as unstructured data. Almost everything generated by a computer is unstructured data. It takes a lot of time and effort required to make unstructured data readable. Examples of unstructured data include Metadata, Twitter tweets, and other social media posts.
- *Semi-structured Data:* This falls somewhere between structured data and unstructured data, i.e., both forms of data are present. Semi-structured data can be inherited such as location, time, email address, or device ID stamp.

The different types of big data are depicted in Figure 3 [7].

The process of examining big data is often referred to big data analytics. It is an emerging field since massive computing capabilities have been made available by e-infrastructures [8]. Big data analytics is the application of advanced analytic techniques to large, heterogeneous data sets that comprise structured, semi-structured, and unstructured data from many sources with sizes ranging from terabytes to zettabytes.

It enables predictive analytics, which involves using historical data to forecast future outcomes. Analytics include statistical models and other methods that are aimed at creating empirical predictions. Data-driven organizations use analytics to guide decisions at all levels. Several techniques have been proposed for analyzing big data. These include the HACE theorem, cloud computing, Hadoop, and MapReduce [9]. Figure 4 shows big data analytics [10].

CHARACTERISTICS OF BIG DATA

Big data is growing rapidly and expanding in all science and engineering, including physical, biological, and medical services. Different companies use different means to maintain their big data. As shown in Figure 5 [11], big data is characterized by 42 Vs. The first five Vs are volume, velocity, variety, veracity, and value.

- *Volume*: This refers to the size of the data being generated both inside and outside organizations and is increasing annually. Some regard big data as data over one petabyte in volume.
- *Velocity*: This depicts the unprecedented speed at which data are generated by Internet users, mobile users, social media, etc. Data are generated and processed in a fast way to extract useful, relevant information. Big data could be analyzed in real time, and it has movement and velocity.
- *Variety*: This refers to the data types since big data may originate from heterogeneous sources and is in different formats (e.g., videos, images, audio, text, logs). BD comprises of structured, semi-structured or unstructured data.
- *Veracity*: By this, we mean the truthfulness of data, i.e. weather the data comes from a reputable, trustworthy, authentic, and accountable source. It suggests the inconsistency in the quality of different sources of big data. The data may not be 100% correct.
- *Value*: This is the most important aspect of the big data. It is the desired outcome of big data processing. It refers to the process of discovering hidden values from large datasets. It denotes the value derived from the analysis of the existing data. If one cannot extract some business value from the data, there is no use managing and storing it.

On this basis, small data can be regarded as having low volume, low velocity, low variety, low veracity, and low value. Additional five Vs has been added [11]:

- *Validity:* This refers to the accuracy and correctness of data. It also indicates how up to date it is.
- *Viability:* This identifies the relevancy of data for each use case. Relevancy of data is required to maintain the desired and accurate outcome through analytical and predictive measures.
- *Volatility:* Since data are generated and change at a rapid rate, volatility determines how quickly data change.

- *Vulnerability:* The vulnerability of data is essential because privacy and security are of utmost importance for personal data.
- *Visualization:* Data needs to be presented unambiguously and attractively to the user. Proper visualization of large and complex clinical reports helps in finding valuable insights.

Instead of the 10V's above, some suggest the following 5V's: Venue, Variability, Vocabulary, Vagueness, and Validity) [12].

Industries that benefit from big data include the healthcare, financial, airline, travel, restaurants, automobile, sports, agriculture, and hospitality industries. Big data technologies are playing an essential role in farming: machines are equipped with sensors that measure data in their environment. The analysis of both structured and unstructured data is crucial in the shipping industry to gain insights into customer behavior, improve operational efficiency, and make informed business decisions.

BIG DATA MARKETING

Big data drives modern marketing. Big data in marketing can be regarded as the massive amount of information that is generated, collected, and stored by businesses and organizations. It is characterized by its volume, velocity, and variety, requiring advanced tools and techniques for analysis. It enables marketers to analyze large amounts of customer information like trends, purchasing behaviors, and customer feedback, and uncover behavior patterns. It provides marketing teams with a rich and detailed understanding of consumer behavior and market dynamics. You can harness this information to refine and transform your marketing strategies. Figure 6 shows a representation of big data marketing [13], while Figure 7 shows some digital marketers [14].

Marketing lives in the customer data era. Big data has revolutionized the digital marketing landscape, empowering businesses to make data-driven decisions and create highly targeted campaigns. Because of accelerated digitalization, data is more accurate and timely than ever before. There are three types of big data that are a big deal for marketing: customer, operational, and financial. By harnessing the power of big data analytics, marketers can gain valuable insights into consumer behavior, preferences, and trends. In marketing, big data is not just customer analytics gathered in the same data dashboard, but pure business intelligence which must be managed by experienced, digital-savvy marketers. As a consequence, now many business decisions are based on big data marketing tools [15].

APPLICATIONS OF BIG DATA MARKETING

Big data plays diverse and significant roles in marketing. From enabling increased customer engagement to equipping marketers to discover new opportunities, these datasets provide access to insights that can significantly influence business outcomes. Big data can play many roles in digital marketing. Common applications of big data marketing include the following [16,17]:

- *Customer Segmentation*: Customer centricity has become a key tactic for marketers and, in turn, an expectation for audiences. Today, customer segmentation and personalization are at the heart of many of the most effective marketing strategies. Big data allows marketers to compile, explore, and analyze various aspects of behavioral criteria, such as how people use their products and services. It also provides a window into social and demographic factors. The findings can help companies more efficiently determine consumer personas and preferences, making it easier to enhance and optimize marketing messages accordingly.
- *Predictive Analytics:* Using data, statistical algorithms, and machine learning techniques, companies can use predictive analysis to forecast future consumer behaviors and trends. Prescriptive analysis takes this a step further to suggest actionable strategies based on these predictions. It involves using historical and current data to forecast future outcomes. You can use big data in predictive analytics, which enables marketers to more accurately anticipate customer behavior and market trends. Historical data can show marketing teams patterns that can help you predict future events and outcomes. Drawing on the power of past interactions or purchases to reveal how consumers might respond to future campaigns, predictive analytics plays an increasingly central role in today's digital marketing initiatives. Figure 8 shows uses of data in predictive analytics [18].
- *Data Analytics:* Big data analytics uses advanced techniques, such as machine learning and NLP. These technologies can obtain information and knowledge from large and complex data types. Data analytics involves analyzing and interpreting large data sets to uncover valuable insights and trends. It is a crucial component of big data in marketing. By using it, marketers can better understand their target audience, which can help them develop more effective marketing strategies. Data analytics allows marketing teams to make better, data-driven decisions. This increases in

leads, sales, and revenue. Big data analytics will continue to force marketers to modify and develop their skillsets.

- *Advanced Analytics:* Advanced analytics entails a comprehensive examination of data using sophisticated techniques. This form of marketing analytics goes beyond traditional business intelligence, tackling complex scenarios like market prediction, customer segmentation, and risk analysis. Advanced analytics and visualization tools are transforming complex datasets into visually compelling, actionable narratives that anyone can understand and act on.
- *Sentiment Analysis*: By analyzing hordes of data culled from social media posts, reviews, and search queries, marketers can better understand how consumers feel about their brand and products. Social media sentiment analysis helps businesses understand public opinion and consumer attitudes by analyzing social media conversations, often in real time. Armed with these insights, brands can gauge sentiment around products, industry trends, major events and the impact of their own campaigns.
- *Targeted Marketing:* Big data analytics can be used to deliver more relevant content to consumers, for example by informing product recommendations, social media advertisements, and email drip campaigns.
- *Social Media Marketing:* Social media is one of the leading platforms for retargeting. Social media marketing company enables brands to deliver personalized content that resonates with individuals on a profound level, driving higher engagement and conversion rates. One of the most significant impacts of big data on social media marketing is the ability to create hyper-targeted campaigns. By leveraging demographic, geographic, and psychographic data, agencies can pinpoint niche audience segments with surgical precision. Figure 9 shows how to use big data in social media [19].

BENEFITS

Big data is a powerful marketing tool for data-driven marketing strategies. It enables improved market segmentation. Big data allows marketers to predict future trends and consumer behavior based on historical data and real-time analysis. It opens the opportunity for predictive modeling that can help marketers forecast future trends and potential consumer behaviors. Other benefits include [20,21]:

- *Customer Engagement:* Modern customers are digitally savvy and have higher expectations for how they engage with brands. Big data can deliver insight into not just who your customers are, but where they are, what they want, how they want to be contacted and when. The predictive power and personalization that big data analytics allows can boost customer engagement over the long term.
- *Customer Loyalty:* Big data can help you discover what influences customer loyalty and what keeps them coming back again and again. When you meet customers' expectations, customer satisfaction and long-term loyalty increase. Big data can provide deep insights into what customers want, how they behave, and what drives their decisions, which is essential for designing effective loyalty programs.
- *Improved Customer Experience*: If you want your business to be successful, you need to include consumer experience in your marketing priorities. By analyzing customer behavior and preferences, marketing teams can identify improvement areas related to customer experience. Companies can improve customer experience and loyalty by making changes based on this information.
- *Better Decision Making:* Big data drives modern marketing. Big data is analyzed to support a level of decision making that is more accurate and timely than anything previously attempted – big-data-driven decision making. It is not the data itself that is so important. Rather, it is the insights derived from big data, the decisions you make, and the actions you take that make all the difference. When you analyze big data effectively, you have solid information for decision-making that reduces guesswork and enhances precision in marketing. Although data drives decision-making, low quality data leads to false findings.
- *Personalization:* Big data powers personalization in marketing. You can gain a deep understanding of customer preferences and behaviors to create unique buyer personas and tailored customer journeys. Today's demanding consumers desire personalized messaging and services that reflect their unique needs and preferences. Big data makes it possible to bring this personalized approach to a broader population of consumers. Kroger (shown in Figure 10) uses big data to personalize direct mail coupons to customers [22]. In order to do this correctly, they need data to determine which customers should get which coupons and on which days/times.

CHALLENGES

Big data marketing faces many challenges, and one of the most significant involves the integration of offline and online data. The challenges related to the effective use of big data can be especially daunting for marketing. That is because most analytics systems are not aligned to the marketing organization's data, processes, and decisions. Handling large amounts of customer data raises privacy and security concerns. Other challenges include the following [1,2]:

- *Data Security:* Ensuring data stays safe and secure is a major challenge with using big data in marketing. With the vast volumes of customer information that businesses collect, store, and analyze, protecting it against data leaks is crucial, both for maintaining customer trust and for regulatory compliance.
- *Data Privacy:* The collection and analysis of big data in marketing raise concerns about privacy. Handling large volumes of customer data requires stringent measures to protect sensitive information and comply with data protection regulations. Businesses must prioritize data security to build trust among customers and mitigate the risks associated with data breaches.
- *Data Quality*: Ensuring the quality of big data is another challenge faced by businesses. Ensuring the accuracy and reliability of data is crucial for making informed decisions. With the vast amount of information available, there is a risk of inaccuracies, incompleteness, or inconsistency in the data. Inaccurate or outdated data can lead to incorrect insights and poor marketing outcomes. Dirty or bad data can disrupt the entire revenue flow of an organization.
- *Data Integration:* Integrating big data with real-world analytics can present challenges such as the complexity of data integration from diverse sources, the need for advanced analytics skills, and the requirement for robust data management systems. This is especially the case when dealing with unstructured data. Marketers need advanced tools and technologies to analyze data effectively.
- *Skill Shortage:* The complexity of big data analytics requires skilled professionals who can interpret data and derive meaningful insights. Implementing big data analytics requires specialized skills and knowledge in data science, which marketing teams might lack. Hiring and training the right talent can be a significant hurdle, but a significant benefit in the long run.
- *Regulation:* Accurate and reliable data is crucial for generating meaningful insights, and maintaining these standards is a regulatory requirement under many privacy laws. With the impact of regulations like GDPR and CCPA — and rising consumer empowerment in data awareness and data rights — businesses have no option but to build solid foundations for transparent, ethical data practices into the future.

FUTURE OF BIG DATA MARKETING

Data has always played an essential role in sales and marketing. The age of data-driven marketing has arrived. Some marketing companies and professionals are yet to catch up. The future of marketing depends on effective, compliant data strategies. Meanwhile, advancements in AI, ML, IoT, and mobile technology are increasing the speed and accuracy at which data is collected, which can lead to more precise digital marketing strategies. Despite some challenges, the future of big data marketing seems bright.

The future of big data in marketing holds exciting possibilities. There are two areas to watch. First, one of the most transformative areas to watch is the rise of AI models and machine learning, which are revolutionizing the way businesses harness big data. These technologies are shifting data-driven marketing by enabling businesses to uncover patterns and trends more easily. It will be no surprise that AI is set to dominate the future of big data in market research. Second, the ability to analyze big data in real-time opens up vast opportunities for marketers. This allows for agile decision-making, personalized campaigns, and immediate actions, resulting in enhanced customer satisfaction and competitive advantage [23].

Technology will play a key role in the future of marketing. Emerging technologies like blockchain have the potential to revolutionize data security, offering immutable records and ensuring data integrity, while AI will play a crucial role in real-time compliance monitoring and identifying vulnerabilities.

CONCLUSION

Big data is the collection of data that is also growing exponentially with time. In marketing, big data refers to large volumes of customer information collected from various sources, such as digital platforms, websites, and apps, about customer behavior, interactions, and preferences. When it comes to marketing, big data helps organizations by offering valuable insight into their customers and future customers. Understanding big data in marketing is essential for businesses to thrive in today's digital landscape. Having big data does not automatically lead to better marketing, but the potential is there. The ability to thoroughly analyze big data is the main difference between companies who are efficient and

companies who fail. Marketers who commit to utilizing big data are bound to see more success in all their different projects and campaigns.

Marketing is entering a new era where data is a powerful tool, but only when handled responsibly. Big data has become a powerful marketing tool for data-driven marketing strategies. Although big data's role in digital marketing is still growing, big data marketing is probably here to stay. As privacy regulations evolve and new technologies emerge, the future of marketing depends on effective, compliant data strategies. More information about big data in marketing can be found in the books in [24-30] and the following related journals:

- Journal of Big Data
- Big Data and Cognitive Computing

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Figure 1 Different components of big data [4].

Figure 2 The cloud word for big data [5].

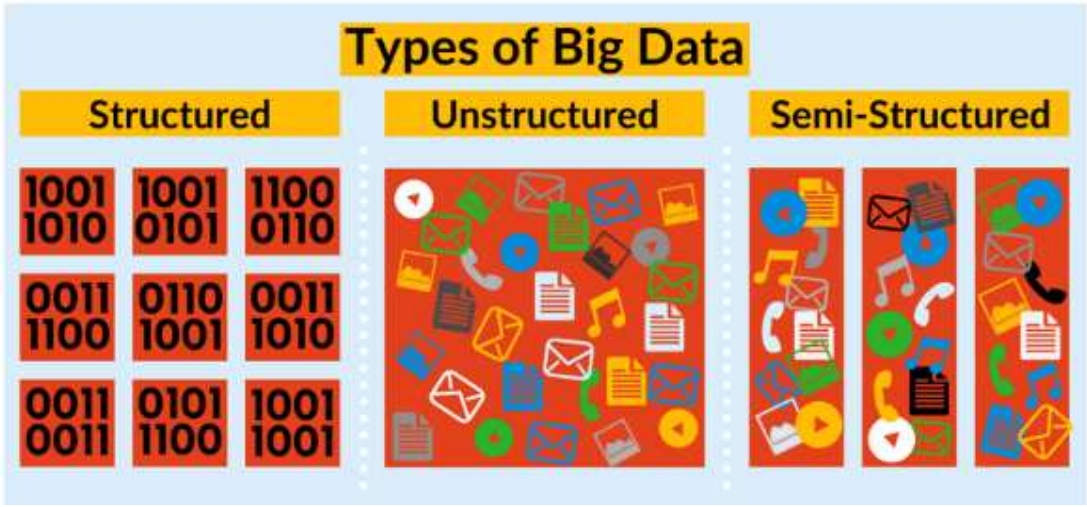

Figure 3 Types of big data [7].

Figure 4 Big data analytics [10].

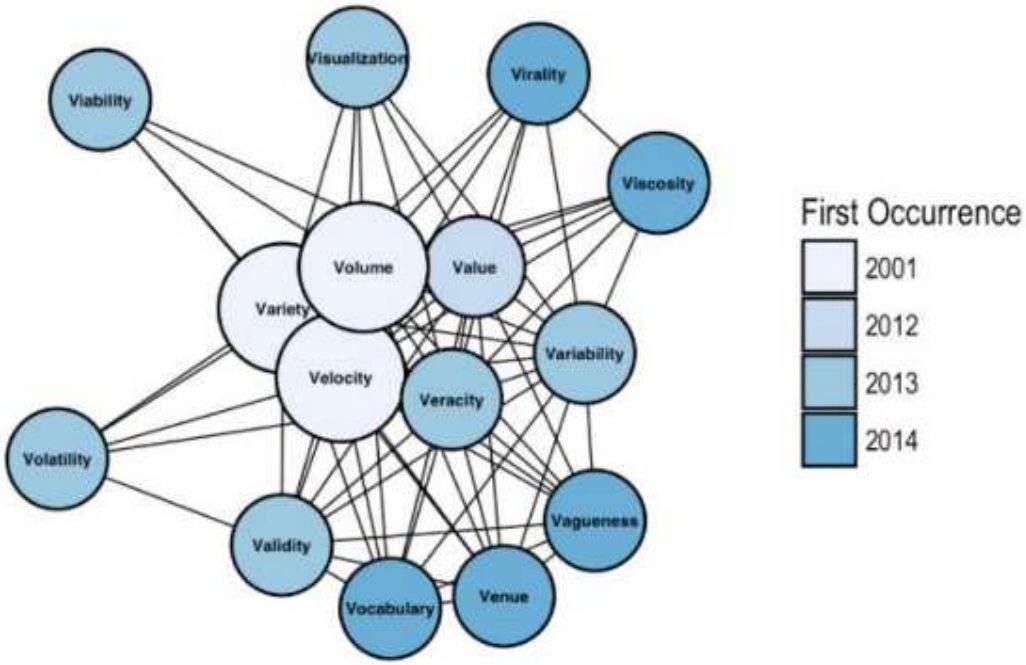

Figure 5 The 42 V's of big data [11].

Figure 6 A representation of big data marketing [13].

Figure 7 Some digital marketers [14].

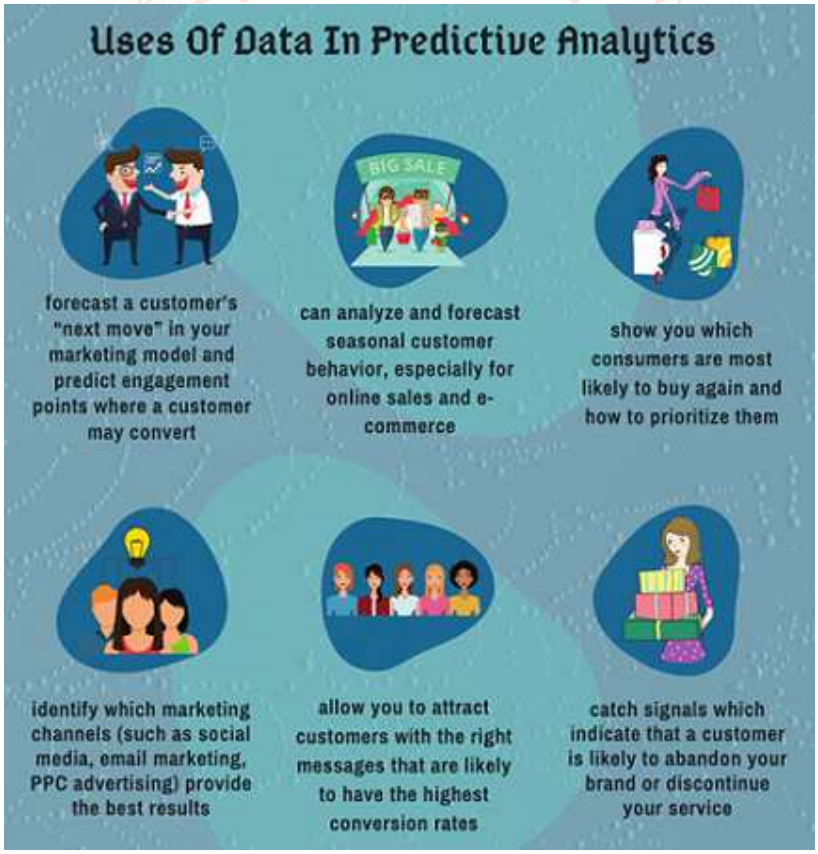

Figure 8 Uses of data in predictive analytics [18].

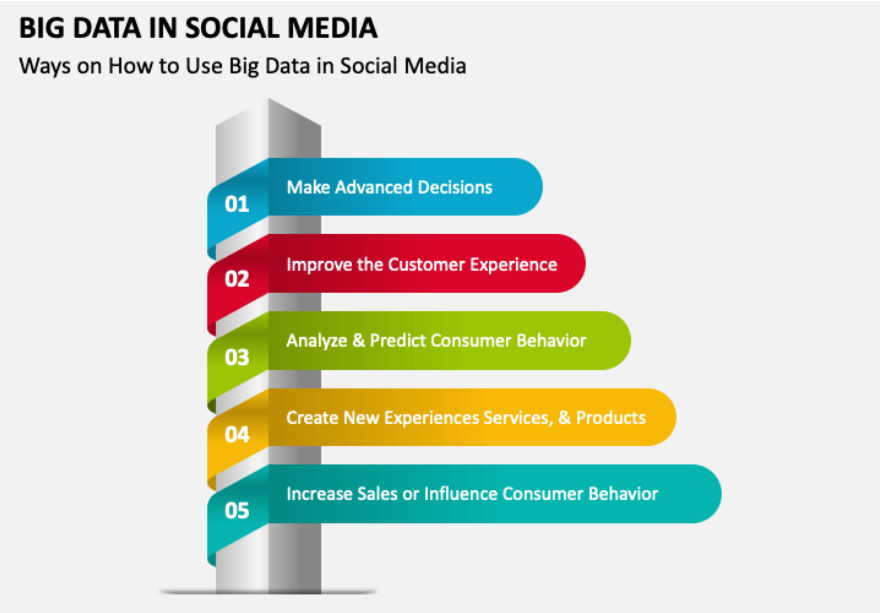

Figure 9 How to use big data in social media [19].

Figure 10 Kroger uses big data to personalize direct mail coupons to customers [22].