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The Current Use of Data Analysis and Future Anticipations of the Big Box Industry

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ABSTRACT
This study explores the possibilities of data analytics in the retail industry by examining it from different aspects and therefore leading to some hypothesis of possible future applications of data analytics. This work starts with exploring the industry's history, providing background information. It then moves onto discussing various sectors of its value chain, breaking each sector down into details and understanding how the industry operates. Following, this study shifts the focus back onto the main topic, providing successful examples of current applications of data analytics in the industry, therefore showing the benefit that it can bring. Finally, the paper concludes with a conclusion of understanding and applying data analytics is a crucial field that the industry should develop and invest in. The purpose of this paper is to highlight the importance of understanding the potential of data analytics, emphasize what it is capable of, and to show how it could be the key of solving long lasting problems in the industry.

***Keywords**: value chain, data analytics, deep learning, future anticipations*

1. INTRODUCTION

The significance of data analytics has been increasing rapidly over the past few years. Numerous industries have already invested and put this technology to use. The aim of this paper is to understand how firms in the retail industry operates and to explore how they could be using data analytics, therefore maximizing the potential of the industry. In this work, this paper weighs in favour in looking at the past for answers to the present and the future, so this work will first introduce the history of retail industry, analysing what makes them so successful, and what they are doing to improve the value chain. According to what the retailers have done and the reasons why they have done it, this paper introduces information and obstacles in the use of the most wide-used methods to improve value chain, data analysis, and made assumptions about the future. However, the future is unknown, the world is bombastically developing faster than ever before. We can only make assumptions based on current needs. Although the establishment of retailers such as Walmart, Kmart and Target in 1962 is usually marked as the beginning of the big box retailing industry. In fact, some of the earliest retailers were built as small stores in the 1940s-1950s, which was the true origin of the big box industry.

2. HISTORY AND PRESENT OF THE BIG BOX INDUSTRY

The idea of the big box retailing industry has its origins with Walmart, Kmart, and Meijer in the 1960s, when they were more commonly known as the "discount stores.

Table 1, displays basic history of the retail industry

1940s-50s	Some earliest big-box stores founded
1962	Walmart, Target, and Kmart opened
1970s	The Fierce Market Competition start
1990s	Global Expansion for the giants
1994	Amazon founded
2000	Emerging market developed their own big-box store

2.1. The Fierce Market Competition

In the early 70's, there were only around 10,000 shopping centers in the United States, but over the next two decades, that number grew to 36,500. During the rapid expansion of the industry, Walmart, Target expanded their discount mall format. Under such increasing competition, some big-box stores develop new management models to improve their work efficiency.

To better fund the expansion, the leading firms were seeking access to capital markets.

During this period, some retailers began to lose profits due to mismanagement. For example, Sears and Roebuck, a former industry leader, had been losing customers to Wal-Mart because of its high supply chain costs. Its business was crippled by severe internal management friction.

In the mid-1990s, the giants that survived the fierce competition began to seek new territories, such as new logo ranges and online stores. During the same period,

Amazon also started to move from online bookstores into audiovisual products, toys, and electronic software. Since then, it has continued to expand its business and become the world's largest online retailer in terms of product range.

To further explore the dynamics, challenges and opportunities of the hypermarket industry, this paper focuses on a comparative analysis of Walmart and Amazon, who both have an unassailable position in the between Walmart and Amazon. The former is the world's largest general retailer, while the latter is the world's largest online store. When Wal-Mart was establishing itself during fierce competition, Amazon was still just a book retailer. However, as e-commerce continues to grow, Walmart has fallen behind Amazon in online sales and is at risk of shifting to online sales. Table 3 shows the 2020 revenue of 4 major retailers in the world.

2.2. Challenges retailers are facing today

Digital disruption With the development of e-commerce, more and more people shop online. It is estimated that roughly 85 percent of network users across the globe have an online shopping experience using online platforms, people can receive the goods that they want within a day. More and more people have started to shop online because it saves time and money simultaneously [1]. This is no doubt a huge impact on the brick-and-mortar industry, for not only people are looking for simpler shopping process, and for the lockdown during the pandemic.

2.3. Customer loyalty

Customer retention has been a major problem within the retailing industry for a long time. Retailers such as Walmart and Target offer similar products, so customers do not selectively visit the same supermarket as the products are available in every store. Therefore, excluding geographic factors, the shopping experience has a direct impact on the situation. The importance of retailers creating brand loyalty is self-evident and one way to achieve this is to provide customers with a personalized experience, and that is where data analytics can come in.

Through learning of the history, the retailers have developed a variety of strategies to achieve success. From this point on, this work will look at how value is created and delivered with a focus on the two biggest companies in the industry, Walmart and Amazon.

Table 3 displays the revenue of the top four major players in the retail industry.

Retailer	2020 Revenue in Billion
Walmart	$543.17
Amazon	$263.16
Costco	$162.48
Target	$92.40
Alibaba	$71.99

Data from nfr.com

3. VALUE CHAIN

Efficiency has always been a major area of optimization in the retail industry. When it comes to improving efficiency, supply chain optimization is the best way to achieve this goal. Retailers have a variety of ways to improve their supply chain through data analytics.

3.1. Procurement

After a revolution in supply methods, Amazon now does not typically have long-term contracts with suppliers and transferred into helping businesses

Table 2, shows comparison between the operation of Amazon and Walmart

Amazon vs. Walmart

Retail company	Nature of Store	Locations	Competitive Advantage
Amazon	Ecommerce store with limited physical outlets	Online purchases in more than 180 countries	Low-cost leadership Fast delivery service Customer differentiation
Walmart	Mainly Physical stores	Over 11000 stores in 27 countries	Low price Market saturation Efficient supply chain management

purchase goods without lengthy processes or contracts with every individual. With Amazon Business, hundreds of categories are integrated and reviewed to provide a comprehensive, business-relevant selection. Therefore, Amazon Business helps companies transform their procurement in a digital way, contributing to better business results such as, reduction of business costs, timesaving, improving payment efficiencies, getting greater visibility and control [2].

On the contrary to Amazon, Walmart usually has fixed import (relationship and vendor) sources to keep their collaboration stable. Retailers like Walmart receive goods from different suppliers. Because of its large size, Walmart is usually able to gain products at a low price. Walmart focuses on maintaining long-term relationships with its suppliers. Furthermore, to help its suppliers to increase sales, Walmart offers them a scorecard that includes sales, profitability, and asset efficiency of the products.

3.2. Logistics

In today's competitive environment, the need for a powerful logistics system is increasingly important. Faster packing and delivery have a direct impact on customer satisfaction and economic efficiency. In the value chain, retailers would want to reduce the shipping time between suppliers and customers as much as possible.

Due to Amazon's almost perfect integrated logistics system, they can select, pack, and ship goods in a short time, which is not available to other suppliers, specifically for their own goods to create a set of such a system requires a lot of labor and financial resources. In cooperation with Amazon, they have no need to do so, even a large proportion of goods ordered from their own official website will be shipped through Amazon's logistics [3].

Walmart strives to optimize its outbound routing and loading operations in a systematic way to improve the overall efficiency of these operations and achieve cost reductions. The use of cross-docking - receiving products from suppliers at distribution centers and forwarding them to stores - eliminates inefficiencies by keeping inventory and shipping costs low and reducing the time required for shipping. In this way, Walmart stores can be replenished immediately without long waits. This reduces Walmart's costs and allows the benefits to be passed on to customers.

3.3. Infrastructure

The Amazon Management System by Ram Charan mentions that management systems like command-and-control are outdated and will be obsolete soon, so companies need to turn to new systems like Amazon's management model. Amazon wants its business model to be 100% focused on consumers rather than competitions. Like mentioned previously, Amazon has no long-term contracts or arrangements with its suppliers to guarantee the availability of goods, specific payment terms, or extended lines of credit. Economies of scale are a key source of value creation in Amazon's inbound logistics.

Contrastingly, Walmart's organizational structure is hierarchical. At Walmart, each employee has a direct supervisor. Instructions from the top are implemented through middle management to each Walmart store employee. By using a hierarchical organization structure, decisions from headquarters are passed directly to each region and each store, but the disadvantage is that this

lacks flexibility. It takes a long time for the lower levels to communicate with the upper levels, so they are not able to adjust in time.

3.4. Value Chain Summary

Amazon has used technology throughout its business and has developed a competitive advantage through it. With all the unique systems combined, Amazon can therefore form a virtuous circle of getting a better reputation, more corporation, more import capital saving, and eventually become too big to fall.

Walmart's information management runs through the entire value chain, by using advanced information technology and with information flow, driving the flow of logistics and capital to achieve the goals of zero inventory, zero working capital, and zero distance for users. Following, this work will explore how these are achieved with the help of data analytics.

4. CURRENT APPLICATIONS OF DATA ANALYTICS

4.1. Sales and marketing

The current application of data analytics plays an important role in the value chain. For Walmart and Amazon, predictive analytics is crucial. They can use big data to predict where customers can convert, which customers are most likely to repurchase, which marketing channels provide the best results, and to capture signals that customers may abandon your brand. Predictive analytics enables them to response immediately and to retain their customers back. In addition, by analyzing customer preferences and shopping patterns, Walmart can optimize shelf and product display methods [4]. Big data also provides insights into new products, discontinued products, and brands, and gives customers personalized experiences [5].

Retailers can develop a more consistent and tailored shopping experience by analyzing the preferences of shoppers. For example, if customers are to buy baby products, they can use data analytics to predict their needs. Also, they can provide customers with a good online experience, for instance, they can send targeted advertisements, personalized emails, targeted notifications, etc. Thus, Amazon can improve customer experience and gain a strong competitive advantage.

4.2. Supply chain and logistics

Current data analytics applications can not only help companies create more value in sales, but also play a significant role in the supply chain. At Walmart and Amazon, data analytics methods are being actively applied in various supply chain areas, including delivery commitments, sales tracking, transparency, and transportation.

The back-end algorithm is executed based on estimated data including distance between the customer and the Fulfilment Center (FC), inventory levels of products in the FC, available transportation methods and capacities (transportation costs are considered to a certain extent). All these data and descriptive analysis of the retailers are available to the suppliers (sales tracking). For example, Walmart purchases products from more than 60,000 suppliers in 80 countries/regions, and each supplier can use its Retail Link system to track the movement of its products. With these data provided, suppliers can improve their products, thereby increasing sales of Walmart and their own companies. Thus, companies can reduce costs and create more value for its stakeholders.

In addition, retailers often collect data about consumers and use this data to ensure that consumers get the purchased products in expected time and quantities (logistics guarantee, providing customers with real-time estimated delivery dates and compensate in the event of inaccuracies). This allows them to replenish inventory at the lowest cost, reduce transportation costs, warehousing costs, and operating costs, and ultimately provide low prices to customers on daily basis. When a customer places an order, retailers now use real-time, large-scale optimization technology to optimize the choice of shipping locations and integrates multiple orders so that customers can receive goods with the lowest possible transportation cost and the shortest delivery time. Therefore, companies can create more value for customers and stakeholders.

4.3. Human resources

Human resource management in the retail industry often analyzes employee productivity through big data. Retail companies obtain data from performance management (a system that provides employees with feedback on their performance levels). These companies also give feedback to employees on how to improve their performance.

The companies' analytics of employee overtime data can track the workload of employees with more details, showing their professionalism and work process defects. However, long-term high workload can also reduce employee satisfaction and increase absenteeism. This indicator also directly affects the absence rate. Companies analyze the absence rate to get insight of the employee's enthusiasm and participation in the work and the company. In addition, companies analyze data on past training costs for new hires and calculate the investments made to recruit new employees and improve employee skill levels. Over time, analyzing absenteeism and training costs can help employees improve their

productivity, and companies create more value to customers and stakeholders [6].

4.4. Product design

The retailing industry benefits from data analytics as it can help them develop products that are more effective and less intrusive to the customers. Social media platforms like Facebook, Instagram, and Twitter can be used to gather valuable customer sentiments and provide useful information for a company. Thus, being liked or re-shared by other users can help a business validate a specific opinion or sentiment. Furthermore, by obtaining valuable insights into a customer's online behavior, the product development team can present a complete view of their target customers. This is a huge advantage for small retailers as they can use this data as their advantage against their larger competitors.

Walmart is using social media data to find out reasons for a trending product design. For instance, Walmart analyzed social data to see how many people were more interested in the color 'blue' than 'purple', or how many people were interested in the shape 'cube' than 'sphere'. By gathering all these results, Walmart can predict which type of product design is most likely to trend. They could then share this information with their suppliers, helping to increase both the sales of themselves and the suppliers.

4.5. Finance and accounting

Machine learning (A branch of artificial intelligence, in which computer-generated rules based on raw data that has been inputted, can be used to learn and improve the efficiency of the model) can be used for predicting the future value of customers based on their past behavior. The retail industry obtains large amounts of data from social media and large number of transactions; the industry can then utilize machine learning to generate insights about the customers and extract business intelligence. Furthermore, this method has enabled the retail companies to automate daily reporting, help IT departments gain productivity, and allows business users to access and analyze critical insights easily. To be more specific, data analytics can help the industry to improve its financial management by identifying the risk and increase the efficiency of acquisition. Data such as customer information, financial transaction, and institution train can optimize the risk scoring model and their cost. Also, by using data analysis can help target the right set of audience. Based on the targeted audience, the industry can determine the best approach to the marketing campaign.

Walmart has created a dynamic Casualty Allocation System (CAS) that allows Walmart to allocate the ultimate costs of accidents to the stores faster. "CAS is now utilized in the more than 5,000 Walmart, Sam's Club and supply chain locations in the U.S. and Puerto Rico. In its first year, CAS has resulted in an over $90 million favorable and sustained actuarial adjustment."

4.6. Service

Good services make customers feel involved and increase their impulse for purchasing. In the era of big data, retailers can provide an even more delicate and personalized service. Big data analytics allows the retail industry to get a comprehensive view of their customers' history, including their family details, past transactions, and so much more. This saves them time and helps them target offers more effectively. Amazon and Walmart are two typical examples.

Amazon has patented a system called "anticipatory shipping" that automatically delivers goods to consumers before they have decided to buy them. This hints their graveness towards data analytics and especially predictive analytics. With the application of such an advanced system, this will undoubtedly save a lot of manpower and resources, allowing Amazon to put them where they are needed more.

Walmart is using data analytics to develop a mobile app that can predict customers behavior. This app generates a shopping list by data analytics on customers' weekly purchases. When a customer enters the store, the app sends a customized list to the customer, informing the customers the position of their wants.

While the accomplishments of using data analytics in the retail industry has been significant in the past and today, data analytics will be applied in more aspects in the future.

5. DIRECTIONS OF THE INDUSTRY GROWTH & CHANGE

Based on all the research, the direction of the retail industry growth and change is roughly as follows.

In the future, online shopping will become even more popular due to the following reasons. First, online shopping is constantly improving. Companies need to focus on offering more personalized and efficient experiences to customers to better compete with other companies. For example, now retailers like Amazon and Ikea have developed AR technology which enables customers to view products at homes before buying them [7]. AR and other technologies are developing to be more advanced in the future, and algorithms could be able to predict what the customers would like to buy in almost 100% sure by using the information collected from different sources. Second, with the fact that people are shopping online because of the pandemic, they are likely to maintain this habit even after the pandemic. According to a survey done by Mckinsey, the intention to purchase online increased by up to 40% since the pandemic [1]. Even retailers that were famous for offline shopping,

such as Walmart, are starting to offer online shopping now.

Also, companies will serve their stakeholders better in the future. If a company wants to survive and expand in the market, they need to deliver value to their stakeholders. The use of data analytics can help them achieve this goal. Data analytics can help them to offer a more personalized shopping experience to customers. On the other hand, data analytics can be better used within the business in the future to monitor the performance of the employees [8]. For the society, the infrastructure and technology in the retailing industry can be used in other fields, for example, the logistics system in Amazon can also be used to deliver other things like letters and packages. Following, this work has provided some examples of the ways that data analytics can help an industry.

6. POSSIBLE FUTURE APPLICATIONS OF DATA AN*ALYTICS*

6.1. Customer Sentiment Analysis

Sometimes strategies can be learned across industries. For instance, social medias like Twitter have already developed algorithms that can analyze the users' feelings underlie social media conversations about certain brands, and the retailers can further develop and apply this technology to benefit themselves. In the future, online retailers like Amazon can apply customer sentiment analysis to their website, The underlying logic of customer sentiment analysis is that the companies use the unstructured data collected from the cameras and microphones of the customers to analyze their emotions and relate the unstructured data to the structured data such as how much do the customers buy. Machine learning can be used to recognize the emotions of the customers from their faces and daily conversations [9]. For example, if the ML model finds out that when the customers are sad, they usually spend more money than usual, then they can conclude that when people are sad, their chances of making impulse spending increases, so the ML model can then send the customers some coupons to prompt the customers to even spend more when the machine recognize they are sad.

6.2. CCTV Level Analysis

Image analysis can be used to extract features from images. Retail can adopt this CCTV level technology to locate problems faster than manual efficiency. Offline retails can use the images and videos collected from stores to identify where they can make improvements. For example, if a camera capture customer falling around the same area of the store, the machine learning model can analyze the images and compare with previous images to identify where the problem exists. If the model concludes that the root cause is untreated polling water on the floor, by using reinforcement learning, the model can promptly inform the workers to get them to address the problem in a timely manner. This reinforcement learning models can identify problems and help fix them quicker than humans can.

6.3. Further Anticipatory Shipping

This work is inspired by Amazon's anticipatory shipping model, a model that predicts items of great interest to consumers by using their personal data such as locations and search history, and subsequently shipping those products to the nearest warehouses before they are ordered. This study decided to take this another step further and to develop an algorithm that keeps the dates and times of each purchase of each consumer and the algorithm will attempt to search for a repetitive pattern out of them. Once a similar pattern is found, the company can directly mail the products to them at the time they are estimated to be bought, reducing storage costs. This work mentioned that one of the ways to improve the value chain is to squeeze the logistics time between suppliers and customers in this new transportation model, which allows almost complete elimination of redistribution, therefore saving significant time and labor resources. However, the inaccuracies inherent in this guesswork are the biggest hurdle to overcome for predictive shipping, and it is impossible for algorithms or data-driven systems to predict with 100 percent accuracy what customers want. Where these inaccuracies are concerned it is likely to be a logistical nightmare.

7. CONCLUSION AND DISCUSSION

In conclusion, the retail industry is an indispensable part of society since they provide commodities to people. In the previous parts of this paper, we have explored how the retail industry has changed throughout history, how it is operating now and how it might operate in the future. The future of the retail industry is promising for a period, but what would happen when more forces are being gathered in online areas, and if people are no longer willing or need to go out in the future? Will they choose to hold on to their current balance or start a revolution within the industry against this formidable adversary. It is obvious that data analytics will become the key to push this industry's capability even further. Just as the paper has mentioned, some companies have already started using data analytics for some portions of their work, however it is very likely that this portion will expand rapidly soon as technologies develops. It is imperative for the firms in this industry to acknowledge the potential of data analysis and invest in this technology as this will eventually allow them to achieve things that were thought to be impossible in the past.

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