MSBA 305 Final Team Project

Business Intelligence and Decision Support Systems

Retail Industry

Team Member

Jing (DJ) Ding

Xiaoting (Theresa) Liu

Hanqing (Jamie) Huang

Xiangwen (Jessica) Meng

Introduction

The retail industry continues to accelerate rapidly. In order to maintain a competitive edge in such an accelerating marketplace, Business Intelligence is becoming increasingly significant of seeking proactive methods of harnessing new and extensive data sources in innovative ways. Retail companies are able to achieve a more comprehensive understanding of customer behavior and preferences , reveal hidden pattern on pricing trend and market trend, as well as other valuable business insights.

On the other hand, retail companies are capable of leveraging effective marketing campaigns and discovering potential opportunities to generate better profits. Also, BI helps companies effectively improve operational performance, such as supply chain management and inventory management. In sum, Business Intelligence enables retail companies strengthen the competitive advantages in an expanding industry space.

In this project, we are going to analyze retail industry from four sectors: department store, grocery, wholesale and e-commerce. To be more specific, we will explain how Business Intelligence assist them to achieve their goals based on their unique characteristics. Finally, there will be a conclusion made by taking all the benefits and advantages into consideration.

Retail Analytics Application on Department Store (Jessica)

In-store analytics is defined as, the discovery, interpretation, and communication of meaningful patterns in data. In-store retail analytics simply takes the collection of processes and applies them to retail store operations. With such technology, retailers can get more business insights on both micro and macro scales. One of the biggest reasons why we use

in-store analytics is that it can guide the management to make better decisions which are based on statistical analysis instead on gut-feeling.
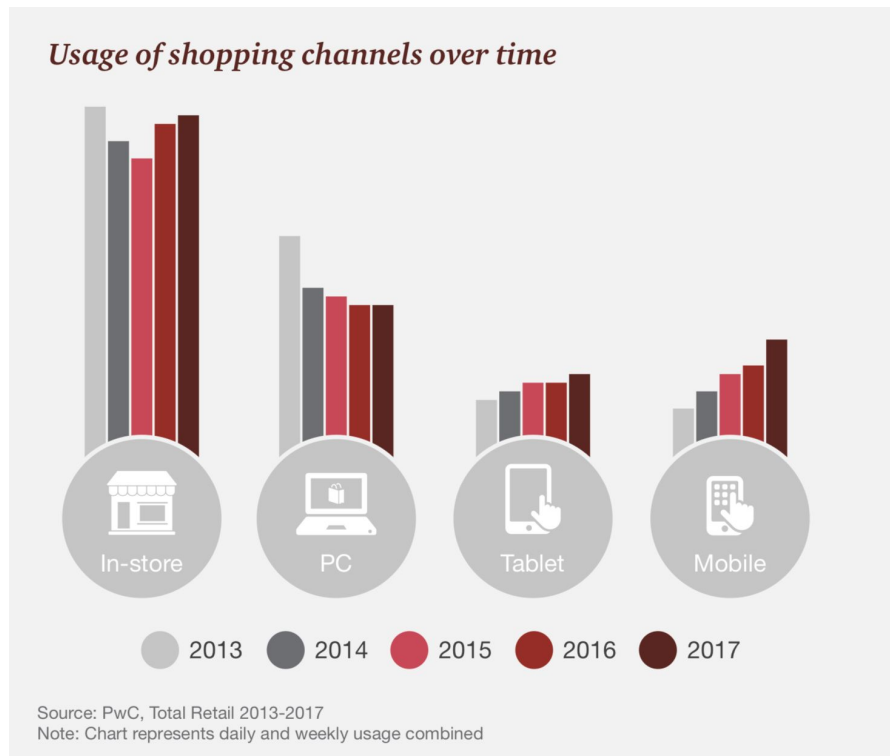
Shopping Pattern Analysis

Shopping pattern analysis is a method to provide effective business decision based on customer's preferences. Customer shopping pattern analysis tool can analyze a customer's shopping pattern based on flow line data which is tracked from customer's movement through the shop and their purchasing transaction. According to the research of Darus, Ibrahim, Othman and Affendey (2011), in order to determine the customer purchase pattern over time, we need to ensure the data is structured, organized and located centrally so that we can access the correct details of the customer's purchase habits over a period of time. Secondly, we need to ensure that the right questions are asked over a period of time because we can use it to identify customer segmentation. We can then understand which customer is most interested in purchasing which particular items in the period of time. Third, analyzing the purchasing trend by looking at the purchase transaction over a period of time is also significant to shopping pattern analysis. Shopping pattern analytics help the company to determine what the customers are buying or what their purchase habits are. By understanding customer needs, we need to have better product replacement; improving store design to guide footfall to desired areas or products; improving the street capture rate from people who pass the store (Sung, 2002).

In-Store Customer Journey

In-store customer journey map is the process of identifying key customer with the product interactions. Deloitte and PwC (2017) introduce the importance of business

intelligence and analytics technology use for store operators. Big data has been successfully used by some traditional retailers. They use BI to analyze customer transactions in order to gain insights to increase sales and profitability. More importantly, people use tracking technologies to generate information for in-store optimization and understand customer behaviors. For instance, Ronny (2019) explained that "location analytics provides a comprehensive tracking solutions by forecasting the demand for the physical location, provide competitive benchmarks, and count people entering and exiting". Also, there are some other similar technologies such as facial recognition, vision (most known in driverless car), sensor-based, device-based, and embedded with Advanced Analytics (Andriluka, Roth and Schiele 2008). Based on PwC/SAP survey of primarily multichannel retailers, it shows that the two main channels for generating sales were "Stores" at 79% and "Website" at 73%. Furthermore, according to Mckinsey & Company, Boudet and Gregg suggests that "journey analytics is the solution that helps you understand and transform your journeys, at scale", so business can create better products and provide better user-experiences. Adobe states that "customer journey analytics provides a toolkit to business intelligence and data science teams that help them collect and analyze cross-channel data. Data improves customer experience by aggregating structured and unstructured data is invaluable for learning about your customers. Its capabilities deliver context and precision to the complex multichannel customer journey". However, it requires the right data, from all channels, working together to make an all-inclusive picture of the customer journey, as well as the right tools (such as SQL or analytics platforms) to analyze the journey and quickly activate discovered insights (CJA, IBM).
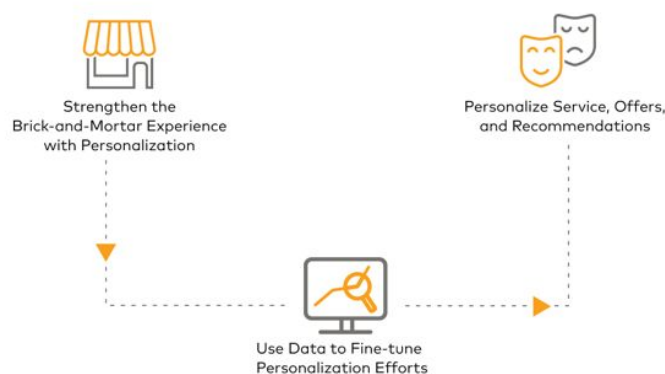
Usage of shopping channels over time

Source: PwC, Total Retail 2013-2017
Note: Chart represents daily and weekly usage combined

In-Store Customer Behavior Analytics with BI Solution

Behavior analytics is good method to combine elements of behavioral economics, customer engagement, friction prevention, and CRO techniques to optimize in-store conversions and profits. Using behavior analytics method has successfully increased revenues and drive more product category purchases in store. Company should focus on understanding their customer's needs to maintain or even increase revenues. As Finsterwalde (2018) mentioned that they strive to have a "360-degree view of customer behavior and were looking to quickly integrate new and disparate sources of structured and semi-structured data, including ad hoc correlation of private collection data with public, industry standard product category codes and other information." With in-store analytics software, retailers can measure the marketing attribution with the following KPI's: number of visits and time per day; number of new and old visitors; different advertising methods and their effect on visits;

different ad displaying and their effect on visits; advertising effect on the click rate and average purchases. Retailers should also consider tracking and measuring some of these analytics as well such as In-store hot spot mapping system or demographics of store visitors. Depending on the goals of the department store, there are a number of programs, apps, and sensors that eager merchants can seek out to help them stay on top of these important numbers.

Improvement of Personalized In-Store Experience

Personalization in retail is the process of using personalized shopping experience to provide custom-made experiences to shoppers in your retail store. Every path to purchase is different, and personalization in retail aims to serve each individual based on their needs and behaviors. Mobile phone usage contributes the most to in-store personalized experience. Understanding the shopping behavior, the department store is able to send out notifications

Strengthen the
Brick-and-Mortar Experience
with Personalization

Personalize Service, Offers,
and Recommendations

Use Data to Fine-tune
Personalization Efforts

when they are walking close by the stores that they have been eyeing on. Communications that effortlessly include both online and offline experiences and provide real value which can make a customer feel a retailer really knows them. Customer offers are an important way to build customer loyalty and prevent churn. For example, retailers can select certain particular

items for loyalty customers to buy within a given period of time (Julien, B., Brian, G. 2017).

For example, the cross-channel clienteling, McKinsey research found that communications

with brands when they're in shopping mode is one of the most welcome practices of

personalized marketing. Clienteling is a common practice in retail stores. Sales associates

make connections with their customers and become their sales associates and add customers

to their own client books, which record transactions and other necessary information: her/his

sizes and preferred styles, whether she's a sale shopper. It creates a sense of in-store

personalization (Julien, B., Brian, G. 2017). Moreover, retailers focus more on offering

end-to-end multi-channel experiences nowadays, it will become even better for them to

collect more information on customer preferences across a variety of sources. In-store

shopping is still more attractive than online shopping. For example, face-to-face interaction

from in-store sales staff can always bring a better shopping experience to the customers.

Department stores should utilize the BI tools to analyze the store data, so they can better

understand customer behavior and preference.

Retail Analytics Application on Grocery (Jamie)

According to Mckinsey perspectives on retail and consumer goods report (Kuijpers,

Simmons, & Wamelen, 2018), more than 50 percent of the economic profit of large publicly

traded grocery retailers evaporated from 2012-2017. The article points out that the major

forces cause the disruption of grocery industry are changes in purchasing behavior and

preferences, new technologies and intensifying competition. In order to avoid being

eliminated by fierce market competition in recent years, some grocery stores have introduced

BI applications into brick and mortar space to enhance the in-store customer experience, track food retention and optimize shelf management.

Behavior Analytics - In-Store Customer Tracking

Understanding consumer preferences with behavior analysis is one of the solutions for the grocery store. In order to have a better understanding with in-store customer habits, the grocery store should apply a quantified tracking map named In-Store Customer Journey to capture customer in-store action. The mapping system is aimed to help business owner gain insights by measuring in-store customer motions. The store is using technologies such as facial recognition, infrared beams or 2D monocular, and fisheye video analytics to collect in-store customer shopping time and shopping location data. Location and time data usually include store foot traffic, demand trends, and occupancy. For example, the grocery store can adjust their yogurt stocks by analyzing weekly foot traffic around dairy department. In-Store Customer Journey Analytics provide grocer a data-driven map of customer behaviors to optimize in-store customer experience and store operation performance (Max, 2019).

1. Purchase points is the first element for in-store optimization (ISO). In grocery store, purchase points appended when customers pick a product from the shelf and put it to their shopping cart. Purchase points helps retailers increase sales by identifying when and where their customers decide to spend their money (Max, 2019).

2. Customer flow feeds in-store path analytics model, which provide data-driven insights to optimize store layout. By collecting and analyzing the data form store entry, exit, and time frequency that each customer spends or pass in specific area, grocer could adjust their shelf pattern based on path analytics results.

3. After identifying customer flow and touch point, product positioning could help retailers close more deals and increase sales. Unlike online store there is no quick check out buttons or pop-up recommend items for in-store customer to confirm their final decision, because most of the deals were closed when shopper check out. Results generated by In-Store Customer Journey Analytics helps grocery store optimize their product location to fill the gap (Max, 2019). For example, by tracking customer flow and touch point grocers usually putting extra lime and mint next to their liquor aisle.

The rapid development of big data technology provides a strong support for the grocery stores so that they can obtain useful information from huge amount of business data they have. Unlike e-commerce data, the data for brick-and-mortar store is hard to be collected. We believed that with the help from BI tools such as In-Store Customer Mapping system, grocery stores can find more actionable insights to maximize their profit.

Optimum Shelf Life Management

Grocery retailers provide perishable projects such as meat, dairy and seafood, and these products require proper inventory management to avoid any waste of unsold products. The article from Manthan points out "a closer understanding of shopper behavior and demand patterns through the use of advanced customer analytics and forecasting tools grocery store maintain optimized stocks, achieve faster turn-rates and reduce wastage on their perishables" (Nayar, n.d.).

According to SOLVOYO (Solvoyo, n.d.), SOK Market have reduced 8% of short shelf-life products with automated replenishment system. The system will generate sales forecasting of each Stock Keeping Unit (SKU) weekly at every store and calculate ideal inventory range for each SKU at store and at the distribution center. It also extracts daily

inventory information, open orders, in-transit orders from SOK's ERP system, and thus provides a reasonable store replenishment plan for each store. Moreover, the automated replenishment system can generate purchase orders recommendation for each distribution center, and create an exception list for planners to focus on. The ERP system provides lots of benefits to the grocery stores so that they can easily track and analyze the demand of perishables products.

Customer Experience Improvement

Retail giant Walmart applies BI tools to explore the best shopping experience for its customers not only for online purchases but also for in-store shopping. With more than 240 million customer flow per week, Walmart collects these customers' data to feed into its BI tools. Based on these big data, WalMart has developed a mobile app to optimize the consumer in-store shopping experience. (SAS.com, n.d.)
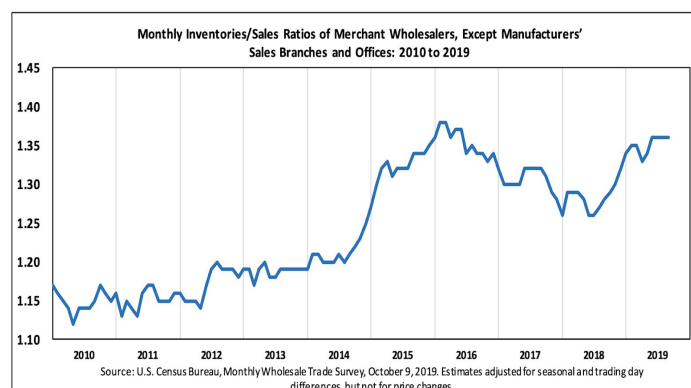
According to Walmart Senior Vice President Daniel Eckert's that 80% of the chain's customers create a list when they go shopping (Eckert, 2018). The application improves list-building which enables customers to enter a conventional term like "milk" instead of a particular brand. The system will automatically check what is available at its nearby stores. The Walmart app also provides in-store maps with product locations to help customers finding products effectively. According to Deena (Amato, 2017), to improve store checkout process, Walmart is using predictive analysis to anticipate store demand and determine how many associates are needed to help customers in registration counter. To provide personalized customer experience, Walmart analyzes customer purchase history and shopping habits in order to create personalized mobile rollback deals for customers (5 Ways Walmart Uses Big Data to Help Customers, 2017).

Retail Analytics Application on Wholesale (Theresa)

With the continuous popularization of Internet and information technology, the amount of data generated by human beings and machines is growing exponentially. The invention of cloud computing brings us into the era of big data. "Big data", as the most fashionable word in information technology field, has started to permeate and radiate into various industries, and wholesale, as a typical example for retail industry, is influenced by this trend.

According to the "Latest Monthly Wholesale Trade Report" from Census Bureau, merchant wholesalers reached $499.1 billions in August 2019. There was 0.7% decline compared to August 2018. Monthly wholesale inventories reached $680.7 billions in August 2019. The inventories went up by 6.2% compared to August 2018. The inventories/sales ratio for merchant wholesalers was 1.36 in August 2019 and 1.28 in August 2018. Inventories/sales ratio is an important factor that shows company's product turnover. The smaller the ratio, the better the efficiency of product turnover.

From the graph below, we can see the wholesale trade had very high ratio from 2015 to 2016 and slowly dropping after 2016; however, it started rising again after 2017. Wholesales is facing the difficulties to better manage its operation and performance.

Monthly Inventories/Sales Ratios of Merchant Wholesalers, Except Manufacturers' Sales Branches and Offices: 2010 to 2019

Source: U.S. Census Bureau, Monthly Wholesale Trade Survey, October 9, 2019. Estimates adjusted for seasonal and trading day differences, but not for price changes.

Operational Performance Management

Being a wholesaler requires a proper understanding of the driving forces of the new economy. In the past few years, the following changes have promoted the development of the new economy.

The first change is the highly interconnected nature of products. The internet of things allows different products equipped with sensors, wireless connections and software to communicate with each other. Data can be collected, stored and sent between products through communication.

The second change is the rise of supercomputing and cloud computing. The rise of these technologies is a leading role of the Internet of things. Cloud computing allows companies to store huge amounts of data at low cost and to build a collaborative platform for wholesales.

The third change is big data. Big data analysis software and platforms are gradually showing their value to the enterprises. These tools make it easier to store, access, report and analyze massive amounts of data, especially in a real time analysis.

The massive amount of data the wholesalers have allows them to gain insights into their customers profitability, so then they can predict and analyze future customer demand models. The supply order with suppliers thus can run smoothly.

IBM provides more details about operations analysis. We can see that empirical data are loaded into the tunnel and thus produces insights from analytics using BI technologies. The results include empowering the C-Suite, improving reliability, speeding operations, and providing monitor and react.
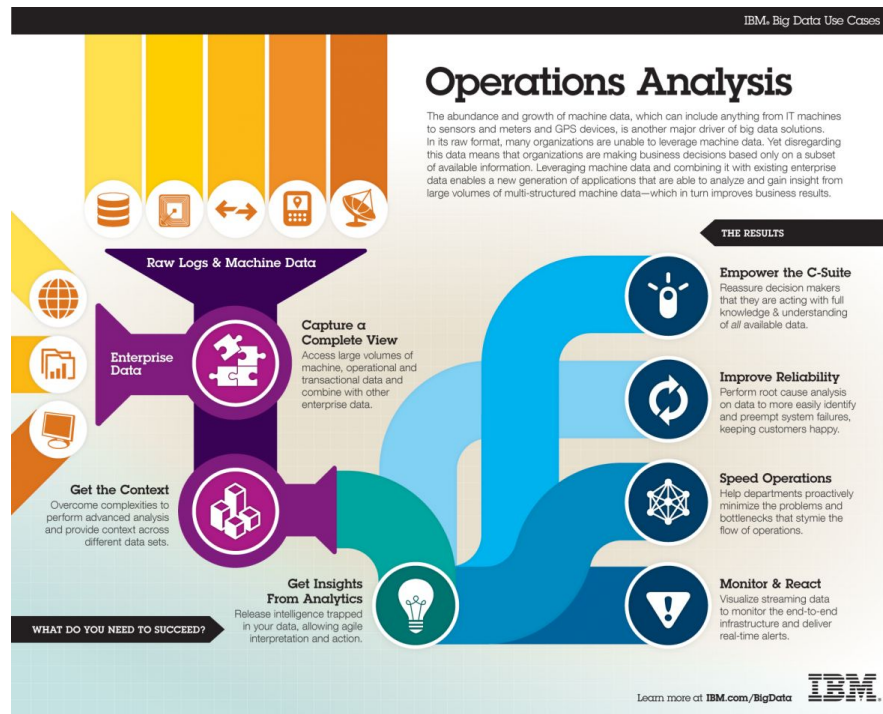
To make this happen, a Business Intelligence software is indispensable. Taking Costco as an example, its operational management focus on 10 decision areas: design of goods and services, quality management, process and capacity design, location strategy, layout design and strategy, job design and human resources, supply chain management, inventory management, scheduling and maintenance (Kissinger, 2017). Costco faced the challenge that to the Costco marketer has to wait 90-120 days to gain insight into campaign performance (VeraCentra). Robert Csonaki, the director strategic marketing identified the challenge, and struggled to find a solution to change the inability to make fast decisions. Thus, Costco chose VeraCentra to implement an on-demand marketing intelligence solution. VeraCentra was able to provide a real-time reporting to help the management to drive smarter and faster decisions for Costco operation. By implementing VeraCentra into the system, Costco is able to slice and dice data in different combinations to discover insight for further customer acquisition, retention and up sell initiatives.

Supply Chain Management

Supply chain management plays a significant role in the wholesale operation. In order to minimize the cost of the whole supply chain system, the management often takes product manufacturing, transshipment, distribution sales under consideration so that it can effectively organizes suppliers, manufacturers, warehouses, distribution centers and distributors together. Mckinsey (2016) believed that the data generated by supply chain can bring insights to the management. This meant a lot to the wholesales operation as it relies heavily on efficient supply chain management.

In an article written by Mckinsey & Company operations (2016), there are two major challenges that restrain the full impact of big data in supply chain management. The first one is that the management or employee often lack the knowledge or experience with the data analysis techniques, and the second one is that the company lacks a structured process to apply data analytics in supply chain management. In other words, with the help from data scientist, the wholesales could transform the way they define and manage their supply chains.

Mckinsey (2016) also provides an overview of the supply chain analytics opportunities from a KLU research report. There are six key components in supply chain design are identified in below figures. Especially for sales, inventory and operations planning, Mckinsey gives three outstanding points while applying data analytics in supply chain system: supply risk management and incoming goods projection, inventory projection and scenario planning, and forecasting accuracy evaluation and optimization. When we take a close look of wholesale's operation, these three points play a key role to determine its efficiency. Supply chain management shows the optimization of enterprise's whole operation flow in strategy and tactics. This technology definitely provides an excellent integration and optimization to the business efficiency of suppliers, manufacturers and retailers to make and

sell goods in the right quantity and quality, in the right place, at the right time and at the best cost.

The landscape of supply chain analytics opportunities

NOT EXHAUSTIVE

Product design					
Supply chain design					
A. Sales, inventory, and operations planning					
• Supplier risk management and incoming goods projection		• Inventory projection and scenario planning		• Forecasting accuracy evaluation and optimization	
B. Sourcing	C. Production	D. Warehousing	E. Transportation	F. Point-of-sale	G. Consumer
• Cost modeling to identify cost drivers • Quantification of benefits from spend pooling • Automatic analysis of contract compliance • Aggregate demand/supply balancing	• Scheduling of energy-intensive production • Statistical quality control and tolerance optimization capabilities • Lot sizing and scheduling considering cost, inventories, and capacities	• Picking zone/ warehouse space allocation • Worker to picking zone allocation based on efficiency • Automatic stock relocation in high bay storage areas • Cleansheet cost modeling • Workload optimization	• Real-time routing and ramp allocation at warehouses • Delivery scheduling in line with consumer patterns • Cleansheet cost modeling • Dynamic routing	• Out-of-stock detection and prevention • Shelf space optimization • Channel/store allocation of goods maximizing service • Retail employee scheduling	• Credit rating to define payment terms offered • Return projection to calculate outstanding inventory • Product recommendations based on purchase history • Fraud detection

McKinsey&Company | Source: KLU research report "Supply Chain Analytics—Gaining value from data-based decision making"

Inventory Management

Inventory management can be a part of supply chain management, but it can also stand as a key part by itself as it seizes a big portion of the supply chain management implementation purpose. As mentioned earlier, inventory/sales ratio is important to identify a company's efficiency of product turnover. Wholesales as a major party in retail industry, its competitiveness lies in its low price and large quantity it can offer. An efficient inventory management system is an indispensable component to a company. This system is critical to both decision makers and managers. Julia (2018), as the Customer and Partner Success Manager of EazyStock, mentioned four ways that big data is changing inventory management:

1. Improved Operational Efficiency: With big data, operations managers may have an overview of real-time operations and better access to metrics, which helps to remove

bottlenecks and improve efficiency. Big data enables supply chains to proactively enhance performance compared to traditional models.

2. Maximized Sales & Profits: In the wholesale distribution industry, access to real-time data helps finance directors to manage tight profit margins with greater insights. This ensures that maximum profits can be achieved from investments in.

3. Increased Customer Service Levels: Having access to real-time customer demand pattern data helps service managers match inventory and inventory levels with customer orders accurately, which will contribute to increased customer service levels. Data can be analyzed to predict seasonal trends, spikes or depressions in customer demand to ensure the right levels of inventory are maintained at all times.

4. Reduced Costs by Migrating to the Cloud: A Software-as-a-Service (SaaS) approach for IT management means that the cloud-based nature of big data reduces hardware and maintenance costs. It can also be seamlessly integrated into existing systems at low costs.

The inventory management in wholesales can display the inventory information according to the minimum inventory and the maximum inventory of each kind of goods, and thus indicate which goods need to be purchased and which goods have exceeded the inventory quantity. Management can use the inventory information to determine the purchase or sales plan. In this way, it can not only ensure the daily sales will not be stopped due to the shortage of inventory, but also prevent the company from overstocking the working capital due to the excessive inventory of the products.

Retail Analytics Application on E-Commerce (Jing Ding)

There is a huge transformation in retail industry by combining technology with BI tools, especially for predictive analytics and prescriptive analysis. With the widespread impact from social media, retail companies are paying more attention on digital marketing campaigns to implement high performance by applying multiple BI approaches such as text mining and sentiment analysis. In this part, we are going to specifically focus on five perspectives: conversion rate performance, price optimization system, online recommendation system, fraud detection as well as real-time analysis system.

Conversion Rate Performance

Nowadays, online shopping plays a key role in the retail industry. In order to gain customer acquisition and expand market share, how to increase conversion rate, which is one of the most vital KPIs for E-commerce, becomes a top priority for retail companies.

According to Erin Hitchcock (2018), retail companies are used to collect limited customers' demographic information during sales transactions. However, the interaction between retail companies and customers is actively involved through multiple channels, especially on social media. The interaction reveals various valuable information such as customer preferences, demographic information, and most popular brands or products we are seeking. By comprehensively understanding customer behaviors, retail companies are capable of building more accurate predictive models to create effective marketing campaigns through omni-channel, and thus ultimately achieve their business goals.

Therefore, analyzing customer behavior on social media is the key to correlate and reveal underlying insights between customers and conversions. By monitoring customer purchasing power and social media activities, retail companies are able to timely catching up

with the current trends and accurately offer proper promotions that meet customers' needs and, which is an effective approach of increasing conversion rate.

Target's Guest Marketing Analytics Department is a practical example of predictive analysis. Target assigns each shopper a unique code - known as the Guest ID tied with demographics, preference and shopping behavior into a trackable entity. By tracking the entity, Target is capable of deducing whether an individual shopper possesses characteristics that make them particularly good targets for a specific marketing effort. According to Dina Gerdeman (Dec 4, 2018), the company's third-quarter sales increased by more than 5% over last year, and in August, online revenue showed especially high growth of a whopping 41% — the firm's highest gain on record.

Pricing Optimization System

There is no doubt that online market is extremely competitive for retail industry. In order to ensure sales and maintain customer satisfaction, pricing strategy becomes really significant for retail companies. Using timely pricing optimization enables retail companies seize the opportunity to retain market attention, attract potential customers and realize pricing schemes.

Not only do retail companies apply BI tools to adjust price based on the prediction based on evaluating internal factors such as inventory or KPIs, or simulate price trend based by capturing high traffic periods such as events or festivals, they are also assess external factors - competitors' price in the same period to automated generate the optimized price for competitiveness and profit maximum.

Back in 2013, price intelligence firm Profitero revealed that Amazon made more than 2.5 million price changes daily. Walmart and Best Buy were making 54,633 and 52,956 daily price changes respectively during November that year (n.d., Apr 24, 2019).

Online Recommendation System

Similar to sales representative makes personalized recommendations based on the face-to-face conversation, online recommendation system with Machine Learning provides personalized services based on prescriptive analytics. By analyzing the past purchase history and browsing patterns, Machine Learning are capable of recommending relevant products within an affordable price range or special promotions to particular customer segments who are likely to purchase, which highly encourages them to complete the order or even to retrieve the purchase from an abandoned shopping cart. In sum, improved recommendation system strongly increases the probabilities of generating successful conversions.

Judging by Amazon's success (JP Mangalindan, July 2012), the recommendation system works. The company reported a 29% sales increase to $12.83 billion during its second fiscal quarter, up from $9.9 billion during the same time last year.

E-commerce Fraud Detection

Online fraud leads to serious consequences in retail industry. It is highly possible to hinder online shoppers from completing purchases, even abandoning the shopping cart. According to Experian, an information service company, e-commerce fraud attacks in the United States were up more than 30% in 2017, which nearly twice as fast as the growth rate of e-commerce sales by consumers in 2017 (Glen Goldstein, 2018). E-commerce lost nearly

$7 billion to chargebacks caused by fraud in 2016 — and that number is expected to reach $31 billion by 2020 (Glen Goldstein, 2018).

The combination of predictive analytics with Machine Learning becomes one of the sophisticated weapons against fraud. Essentially, predictive analytics analyzes customers' browsing patterns, payment methods and historical purchases to identify most susceptible transactions and improve the learning model to prevent potential fraud before customers complete the transaction, which is effectively reduce credit card fraud or payment failure, and escort successful conversions. In sum, predictive analytics ensures a secure online purchase environment and better customer shopping experience.

Real-Time Analysis System

According to Louis Columbus (2018), scaling real-time analysis cross-functionally is the leading growth driver with enterprises creating real-time marketing technologies stacks to scale. Retail companies are concentrating on providing personalization at scale by continually fine-tuning various aspects of marketing mix for customer segments in real-time. By translating data into actionable insights at the optimal time, Machine Learning develops timely marketing strategies we've mentioned before, such as personalized recommendation system and dynamic pricing optimization system, to enhance competitiveness.

Walmart's Shopycat is an awesome recommendation system to provide suitable products to Facebook Users based on real-time analysis on the interests and hobbies of their friends (EKN, 2013). Its Social Genome Technology combines with public data from the web, social media data and proprietary data such as contact information, email address and customer purchasing data, which greatly helps Walmart understand its customers.

However, there are just 22% enterprises having success on real-time customer analysis. According to Louis Columbus, the biggest gap we have to solve in real-time customer analysis capabilities are customer information access, data analytical performance, and business decision based on the insights. In sum, we are strongly believed that real-time customer analysis will be the future trend for retail industry.

Conclusion

The future is the era of big data. Three factors becomes tightly correlated: the Internet as the infrastructure, big data as a strategic resource and cloud computing as the core competitiveness. Retailers should take full advantage of big data analytics to understand consumer behavior, improve performance and develop innovation. By analyzing four main sectors in the retail industry, we can see that big data successfully helps retailers realize the value by perfecting shopping experience, improving performance among operation, supply chain and inventory, as well as achieving better profit. In sum, "customer" is always the core value of retail analytics. With big data analytics, data is not just records of purchasing transactions, but one of the most valuable treasures for retailers to explore. By analyzing it, we are capable of maximally exploiting customers' purchasing power. Taking all these into consideration, we are reasonably believe that big data analytics is an optimal solution to make effective business decisions in retail industry.

Reference

Adobe (n.d.). Creative, marketing and document management solutions. Adobe Analytics | Customer Journey Analytics. Retrieved from
http://www.adobe.com/dk/analytics/customer-journey-analytics.html

Altexsoft. (2019, April 24). Dynamic Pricing Explained: Machine Learning in Revenue Management and Pricing Optimization. Retrieved from
https://www.altexsoft.com/blog/datascience/dynamic-pricing-explained-use-in-revenue-management-and-pricing-optimization/

Amato, D. M. (2017, September 08). Five ways Walmart uses big data. Retrieved from CSA: https://chainstoreage.com/operations/five-ways-walmart-uses-big-data

Columbus, L. (2018, July 8). How To Improve Customer Experiences with Real-Time Analytics. Retrieved from
https://www.forbes.com/sites/louiscolumbus/2018/07/08/how-to-improve-customer-experiences-with-real-time-analytics/#4fe1f97a6e82

DeZyre. (2017, November 10) How Big Data Analysis Helped increase Walmarts Sales Turnover? Retrieved from
https://www.dezyre.com/article/how-big-data-analysis-helped-increase-walmarts-sales-turnover/109

Eckert, D. (2018, February 8). Your Shopping Trip Just Got Easier with This New Store Assistant. Retrieved from
https://corporate.walmart.com/newsroom/innovation/20180208/your-shopping-trip-just-got-easier-with-this-new-store-assistant

Eivaz, R. (2019, November 4). IBM Watson Customer Experience Analytics. Retrieved from
https://www.ibm.com/us-en/marketplace/customer-experience-analytics

EKN. (2013). State of the Industry Research Series: The Future of Retail Analytics. Retrieved from
https://www.sas.com/content/dam/SAS/en_us/doc/research2/ekn-report-future-retail-analytics-106717.pdf

Finsterwalder, J. (2018). A 360-degree view of actor engagement in service co-creation. Journal of Retailing and Consumer Services, 40, 276-278.
doi:10.1016/j.jretconser.2016.08.005. Retrieved from
https://www.sciencedirect.com/science/article/pii/S0969698916303514

Gerdeman, D. (2018, December 4). On Target: Rethinking The Retail Website. Retrieved from
https://www.forbes.com/sites/hbsworkingknowledge/2018/12/04/on-target-rethinking-the-retail-website/#214253e316fb

Germann, F., Lilien, G. L., Fiedler, L., & Kraus, M. (2014). Do Retailers Benefit from Deploying Customer Analytics? Journal of Retailing, 90(4), 587–593. doi: 10.1016/j.jretai.2014.08.002. Retrieved from https://www.sciencedirect.com/science/article/pii/S0022435914000554

Goldstein, G. (March 30, 2018). Trends in Retail Fraud: What You Need to Know. Retrieved from https://www.transunion.com/blog/trends-in-retail-fraud-what-you-need-to-know

Ha, S. H., Bae, S. M., & Park, S. C. (2002). Customers time-variant purchase behavior and corresponding marketing strategies: an online retailers case. Computers & Industrial Engineering, 43(4), 801–820. doi: 10.1016/s0360-8352(02)00141-9. Retrieved from https://www.sciencedirect.com/science/article/pii/S0360835202001419

Hitchcock, E. (2018, February 27). Five Big Data Use Cases for Retail. Retrieved from https://www.datameer.com/blog/five-big-data-use-cases-retail/

Harvard Business Review. ((2017, October 3). Is Your Company Adapting Fast Enough to Thrive in an Increasingly Digital World? Retrieved from https://hbr.org/sponsored/2017/10/is-your-company-adapting-fast-enough-to-thrive-in-an-increasingly-digital-world

IQLECT. (2018, November 14). The Importance of Predictive Analytics for E-commerce Stores. Retrieved from https://medium.com/swlh/the-importance-of-predictive-analytics-for-e-commerce-stores-d7ef0ce2d32e

Julien, B., Brian, G. (2017). What shoppers really want from personalized marketing. Retrieved from https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/what-shoppers-really-want-from-personalized-marketing?cid=soc-web

Kissinger, D. (2017, February 6). Costco's Operations Management, 10 Decisions, Productivity. Retrieved from http://panmore.com/costco-wholesale-operations-management-10-decisions-areas-productivity

Kuijpers, D., Simmons, V., & Wamelen, J. v. (2018). Reviving grocery retail: Six imperatives. Retrieved from mckinsey.com: https://www.mckinsey.com/~/media/McKinsey/Industries/Retail/Our%20Insights/Reviving%20grocery%20retail%20Six%20imperatives/Reviving-grocery-retail-Six-imperatives-vF.ashx

Max, R. (2019, May 1). 7 Actionable Analytics for In-Store Customer Journey. Retrieved from https://behavioranalyticsretail.com/in-store-customer-journey/

Mckinsey & Company Operations (2016, February). Big data and the supply chain: The big-supply-chain analytics landscape (Part 1). Retrieved from https://www.mckinsey.com/business-functions/operations/our-insights/big-data-and-the-supply-chain-the-big-supply-chain-analytics-landscape-part-1#

Melton, J. (2018, April 24). E-commerce fraud rose nearly twice as fast as e-commerce sales in 2017. Retrieved from https://www.digitalcommerce360.com/2018/04/24/e-commerce-fraud-rose-nearly-twice-as-fast-as-e-commerce-sales/

Montgomery, J. (2018, October 10). 4 Ways Big Data is Changing Inventory Management [Blog post]. Retrieved from https://www.eazystock.com/blog/4-ways-big-data-is-changing-how-companies-manage-inventory/

Nayar, A. (n.d.). Top 3 Grocery Retail Strategies using Better Shopper Insights. Retrieved from https://www.manthan.com/blogs/vl-top-3-grocery-retail-strategies-using-better-shopper-insights/

Roziyah, D., Hamidah, I., Mohamed, O. and Lilly, S. A., "User interestingness for prefetching in mobile environment", Information Technology and Multimedia (ICIM) 2011 International Conference on, pp. 1-6, 2011. Retrieved from https://ieeexplore.ieee.org/abstract/document/4421816

SAS.com. (n.d.). How Walmart makes data work for its customers. Retrieved from https://www.sas.com/en_us/insights/articles/analytics/how-walmart-makes-data-work-for-its-customers.html

Solvoyo. (n.d.). Automated Replenishment with Big Data Analytics. Retrieved from https://www.solvoyo.com/resources/casestudy/automated-replenishment-big-data-analytics/

U.S. Census Bureau. (2019, October 9). Latest Monthly Wholesale Trade Report (Report No. CB19-156). Retrieved from https://www.census.gov/wholesale/pdf/mwts/currentwhl.pdf

VeraCentra. (n.d.). Success Story: Costco Wholesale. Retrieved from http://www.veracentra.com/resources/case-studies/VIP-Provides-Costco-Insight-for-Improved-Marketing-Outcomes.pdf

Walmart. (2017, August 8). 5 Ways Walmart Uses Big Data to Help Customers. Retrieved from https://corporate.walmart.com/newsroom/innovation/20170807/5-ways-walmart-uses-big-data-to-help-customers