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**BIG DATA ANALYTICS**

**How Big Data Analytics are used in the Fast-Food industry?**

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**Introduction**

Overall, the food industry represents one of the most vital industry segments in the world. Indeed, we, as humans, need to be fed to live. Consequently, the fast-food industry has a considerable weigh on local economies all across the globe as it responds to human beings’ fundamental needs. To give a market overview, in 2019, the fast-food market industry was worth $647.7 billion globally and was projected to be valued at $931.7 billion by 2027[[1]](#footnote-2). In the US, the fast-food market was valued at $240 billion and is estimated to reach a market size of $281.7 billion in 2021[[2]](#footnote-3). Also, in 2020, 199549 franchised fast-food establishments were reported in the US, with around 3.88 million people employed. In 2019, the key players were Chick-fil-A which led in terms of sales per unit, McDonald’s which is the top fast-food chain by “systemwide” sales and Subway which had the most units sold[[3]](#footnote-4).

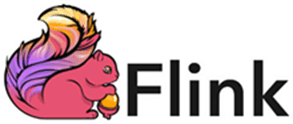
This enormous market is subject to fierce competition among its players and consumers volatility. Nowadays, consumers want their meals to be healthy, fresh, tasty, etc.… Thusly, they need the best product panels possible alongside a high level of service. Undeniably, companies are to find a breakthrough solution that will grant them the edge over competitors. With the wealth of data generated by customers available and the right big data implementation, fast-food restaurants could perform advanced analytics and so, improve customer experience, services, and products, which ultimately leads to increased revenues and profits.

How is big data used in the fast-food industry? What advantages does it bring? What are the limits? What the improvement perspectives? In this development, these questions will be answered, and 2 use cases will be analyzed.

**Big Data**

Before starting off this study development, let us define Big Data: it “*refers to the large, diverse sets of information that grow at ever-increasing rates. It encompasses the volume of information, the velocity or speed at which it is created and collected, and the variety or scope of the data points being covered (known as the “three v’s” of big data)*.”[[4]](#footnote-5) What is important is what organizations do with data: “*Big data can be analyzed for insights that lead to better decisions and strategic business moves*.”[[5]](#footnote-6).

With the aim to perform the best analytics, a multitude of tools and softwares are used depending on the companies’ sizes, business, data analytics goals, financial capabilities, etc.… Following is a snapshot of the top big data tools:

Moreover, many platforms have been developed to ease data analytics processes over a scalable platform. They usually gather and offer, in a single outlet, features specific to one or numerous big data tools and softwares. Some of the most renown platforms are Cloudera , Microsoft Azure , SAP HANA , to name a few.

**General applications of big data in the fast-food industry**

Data had always been available, throughout simple transactions such as buying an item at a grocery store to buying a menu at a fast-food restaurant.

Nowadays, with most companies using cloud computing and shifting almost every part of their businesses online, a very large volume of data, ranging from customer habits to product lists and prices for instance, is available and awaits to be analyzed.

The fast-food industry is the perfect application for big data analytics as various amount of data involving customer habits, products, services must be analyzed. Indeed, the use of big data gives an edge to companies within a sector, but also permits competition to exist and customers to reap many benefits in terms of pricing, products, and services. It is a fact, the competition is fierce, and consumers are more volatile, thus, using big data analytics comes as a natural solution for growth, competitiveness, and the global betterment of the industry. To give some examples, big data can help improve customer/user experience (i.e., online food ordering platform layout), products (i.e., quality) and services, prices, optimized supply chain …

The general restaurant industry has transitioned, for the most part, from only face-to-face activities to abounding online services ranging from food ordering and delivery, online food delivery platforms, restaurant reservation websites, to social network presence and advertising. Hence, a lot is at stake for fast-food structures. Fortunately, this also means that considerable data would be accessible and would need proper use to spot trends, patterns, discrepancies, disruptive elements and thusly act accordingly to gain competitive advantage. Fast-food outlets rely on advanced analytics platforms and machine learning to perform “granular data analysis” and apply, the valuable gained insights, to the outlet’s operations improvement, product promotion, product and service development, better pricing, or demand forecasting. In terms of food delivery, big data brings efficient monitoring and analyzing of different impactful elements as distance, weather, route changes. In terms of pure marketing, big data offers valuable insights regarding at what moment and where should the brand or product marketing be relevant. By collecting data on people’s habits for a product and the traffic of a place, it is possible to target a place and moment to direct marketing activities. In 2012, Uber launched an on-demand barbecue delivery campaign in collaboration with Iron Works BBQ for the SXSW attendees.

For customers with fidelity programs, a fast-food company collects data about their consuming behavior (via the different products they purchase under a fidelity card) and produces personalized offers. This is another application of big data to leverage analytics through a direct marketing initiative. Moreover, with the advent of IoT and sensors installed in multiple transportation cars and devices, for instance, either for telematics or other valuable information, big data helps processing and analyzing the high volume veloce stream of data coming from the sensors. With big data, companies can perform sentiment analysis, which implies measuring customers’ emotions and feelings regarding a brand, a product or service. This technique is employed to garner knowledge about customers’ opinions regarding a brand. Also, big data analytics are progressively applied to generate original recipes through specific computer programs. These computer programs can create various meals for various purposes (healthy, real fast-food styles…) thanks to a giant data collection of recipes, ingredients, human flavor preferences, and so forth.

The overall goal is to grant restaurants very good decision-making elements to boost their business in any way possible.

**Benefits**

Now that we have tackled what were the general applications of big data in the fast-food industry, let us know examine the different benefits. Of course, the benefits from making right use of analytics throughout big data are the consequences of using the general applications studied before. Because infinite possibilities can be brought up via big data, only the most broadly advantages will be assessed:

* Enhanced and improved efficiency: this advantage relates to overall restaurants improvements through big data. by adopting a data-driven, it results easy to better understand what is happening in individual restaurants and what to improve: thrive-thru experience is optimized via reaping data on info provided on menus as well as the type of customers coming through. Also, looming for trends for increased consumer demand for one or more product can help the restaurant be prepared for the spike in demand ahead of time. In terms of pricing, analyzing the products with the highest demands and the ones with the lowest demands and comparing them against their respective prices, help fast-food to adjust prices.
* Speedy deliveries: in nowadays fast-food business nomenclature, food delivery has become a crucial element in customer outreach and so in turnover augmentation. Whether the restaurant organizes the delivery and do it through online platforms. In this industry, timing is everything, and thus facilitating swift deliveries though big data analytics by traffic, weather, routes, food preparation time and so forth, is indeed a revolution, especially in a ferocious competition environment. Generally, after all elements cited before are analyzed through advanced analytics platforms, artificial intelligence is applied to anticipating and predicting time needed for traveling from spot to another. The rate of delivery is then improved which can lead to more orders processing and even new clients. On the customers’ side, big data allowing the development of powerful mobile and web application, have the possibility to know when their order are arriving and even track them.
* Supply chain transparency: tackling the swift deliveries advantage bore by big data leads to studying the food provisioning process. “*Big data is powering the optimization of such transparency, allowing companies and providers to better track their sourced and transported goods*.”[[6]](#footnote-7). This is possible with the advent of IoT and connected sensors embed in transportation vehicles, food storage, etc…. now, it is possible to monitor in real-time the shipment and delivery process for both suppliers and fast-food companies. Big data also allows to supervise food storing (temperature, etc…) to avoid stocks losses and so money loss. The instance FreshDirect, an online platform for prepared food and grocery, uses sensors to process and analyze data for monitoring product status and understand environmental conditions during transportation.
* Product quality: this aspect completes the improved efficiency brought by big data. Indeed, fast-food restaurants want to preserve the quality and taste of their reference/cash cow meals to meet consumers’ expectation of a steady across their beloved chain restaurants. Because the food taste and quality are dependent of many factors (i.e. seasoning, measurement of ingredients, season, etc….), big data analytics studies, analyzes and interpret these elements and make prediction of their repercussion on food taste and quality. In parallel, the acquired insights from the big data analyses are used to improve food quality overall.
* Quality control: addressing product quality leads naturally to study the raw materials quality. Of course, assuring consistent quality of food relies heavily on quality of elements making up the food. Quality control is usually correlated to the supply chain (making sure the products arrive in “good form”) during the shipping process by making sure the sensitive products are in the right environmental conditions and not subject to defect due to uncontrollable variations. As explained in the supply chain transparency part, IoT sensors and big data help in processing, transferring, and analyzing the data in real-time. Thus, it is possible to replace damaged products ahead of time, carrying out prevention measures and overall assess the product quality before being delivered to restaurants. This is crucial, as it allows time gain, delivery of reliable products to fast-food restaurants, etc.….
* Custom customer service: due to intense competition, being customer-centric and focused is primordial. Big data allows a complete customer analysis regarding their favorite meals, reviews written, what they like and shared on social media, how much they are ready to pay across fast-food websites and applications and multiple social network channels. With advanced analytics platforms easing tracking, collecting, analyzing all this data, it is possible to provide a personalized experience to every buyer.
* Sentiment analysis: today’s business world is highly oriented towards the customer sentiment. Customer sentiment is a considerable factor in determining whether a product or service is going to sell. As its denomination suggests, it implies emotions and feelings regarding a brand and its products/services. Big data providing the tools to gather information about knowledge regarding customers and opinions about a brand, product or service, this analysis technique is engaged in the fast-food industry to grasp the latest trends in terms of meals, preference (i.e., healthy) as well as the most popular items.
* Fluctuation in trends: this fold collapses with ‘sentiment analysis’. Indeed, fast-food companies have to deal with fluctuating trends that affect their businesses. Nowadays, food consumption trends are pushed forward by millennials: they generally look for healthier meals and have a preference for online ordering. To survive in this complex and competitive landscape that is the fast-food industry, fast-food restaurants have to be creative by leveraging technology (big data analytics) to answer volatile customer base needs and changing market trends. Product innovations are fostered and result with plant-based options for cash cow meals for instance. Mixing up sentiment analysis and trend fluctuations analytics permit extracting “*the most value fe most value from their customers, increase loyalty to the brand and understand which products are most profitabl*e.”[[7]](#footnote-8).

**Limits/improvements**

Nonetheless, although its applications in the fast-food industry allow companies to compete between each other and respond to new customer needs, many areas of improvements exist. Of course, because it is not an old established discipline, there are no rooted rules about its limits and how it should be improved. The most important limit and improvement does not lie in big data itself, but on the interpretation that we make of it: big data should be used to drive strategy not just tactics to answer short and midterm issues. Indeed, many marketers for restaurant and fast-food still tend to leverage analytics for mostly improving store operations, justifying promotional program sell-in, etc. unfortunately, many users tend to ignore it as a strategical tool but instead utilize it for tactics improving short term outlook (i.e. increase in quarterly sales). Sophisticated analytic tools enabled by big data should be employed to build custom strategies and programs with respect of the fast-food segment, needs, and so on, and with regard of its ultimate goal (i.e., grow market share).

Difficulty in answering why (data taken from different users): indeed, there are 2 techniques utilized to analyze data taken from different users (or user-level data), which are either aggregating (and then applying statistical analysis methods) or directly relying on algorithmic methods. Even though both methodologies result in prescriptions and predictions, the “why” question response tend to be very difficult to interpret for an average marketer. Thus, systems that are more “user friendly” must be implemented.

As said at the beginning of this part, big data is still evolving and so finding a pattern in terms of limitations and improvements is very difficult. Only a few years ago, improvements of algorithms were implemented to optimize memory space and computation power while processing large datasets.

**Application of big data within fast food industry (use cases)**

To better understand how big data analytics are applied in the fast-food industry, let us consider 2 use cases articulated on a startup (DoorDash) and a well-established structure (McDonald’s).

DoorDash is an online food delivery platform launched 7 years ago. This platform succeeded in securing a predominant spot in the highly competitive delivery platforms business. The recipe for this success is mostly due to DoorDash’s data driven approach. Indeed, the latter uses big data for every purpose: from stock inventory, delivery time to predicting demand and estimating food preparation time. Let us explore some practical examples to get an optimal overview of DoorDash’s big data use:

* Capacity planning algorithm: this algorithm was developed with the aim to predict the number of drivers required for a particular day.
* Self-learning dispatch system: as its name suggests, this system adapts itself with the changing demand as its principal variable. It relies on a mix of machine learning and big data analytics.
* Logistics software: the different softwares utilized at DoorDash are the combination of big data analytics and machine learning in order to provide the on-demand deliveries characterizing DoorDash and that made efficient for the restaurants and affordable for the customers.
* Data driven approach: apart from using big data analytics for dispatching, capacity planning or logistics, DoorDash relies heavily on food preparation time analysis. With this approach, the goal is to determine the perfect for the driver to come pick up and food so that when the meal is delivered, it is neither too cold nor too hot for the consumer.

Now, let us evaluate how McDonald’s planned (in 2017) on having the edge over its competitor for the coming years by using big data analytics, artificial intelligence, and robotics. Indeed, the largest fast-food company was far behind its competitors as far as integrating big data, AI,… to enhance operations is concerned. In 2017, McDonald’s announced a growth plan focused on improving customer experience throughout the use of technology. In parallel, big data allows reducing costs, which is very important in the fast-food industry. Through its many stores all around, McDonald’s has a high volume of data that awaits to be processed and analyzed. Mc Donald’s’ use of big data falls into 4 categories:

* Digital menus: what needs to be understood is the fact that the digital menus are not fancier version of old menus. The menus roll out changes depending on the current weather or the time of the day (morning, afternoon, evening). For instance, during a record heat day, cold and refreshing beverages might be enhanced.

This technique was used in Canada with 3% to 3.5% sales increase.

* Enhanced customer experience: with the launch of the Mc Donald’s application, it is even easier to collect customer information. Throughout their utilization of the application, it is possible to know where and when they go to premises to pick up the food or if they use the drive thru, and more importantly what consumers purchase. Thus, Mc Donald’s can place promotions, recommend meals and complementary items, and so forth. To give an example, it was found in Japan that customers ordering through the app spent on average 35% or more (compared to orders placed in restaurants) due to ordering easiness, suggestions, and recommendations[[8]](#footnote-9).
* Trend analytics: with every restaurant (branches or franchises) functioning in a data-driven environment, they share their information with Mc Donald’s, which will process them to uncover what works and what does not, and afterwards share the best practices to other chain restaurants. This step is crucial as the customer experience (service, food taste) should be consistent across the channel, no matter the locations or owners.
* Interactive terminals: to reduce its overall operation costs but also alleviate in case of high traffic within a restaurant, Mc Donald’s slowly introduced digital screens where customers can place orders. Once the order is placed, the customer takes a connected card to his/her table. Once the order is ready, a staff member locates the customer via the card and delivers the meal. This is a good solution to in store traffic and order management.

This use case shared a glimpse of what big data analytics and AI is utilized in traditional fast-food chains such as the world renown Mc Donald’s.

**Conclusion**

Throughout this paper, it was possible to give a concise list of big data applications within the fast-food industry. Indeed, big data analytics are mainly utilized to gain valuable insights about the restaurant’ activities, to optimize the outlet’s operations, to promote products and services, to efficiently establish prices, for transportation purposes and customers’ habits analysis, to give the main applications. In terms of benefits, big data allows competition to strive for better customer service, pricing and optimum products through enhanced and improved efficiency for restaurants general functioning; speedy deliveries; transparent supply chain; quality control; optimized customer service; sentiment analysis for advanced study and comprehension of customers’ feelings towards products and services; and helping to cope with many fluctuations in trends. All these advantages permit fast foods to answer their market needs and come up with new concepts, menus, promotion to gain edge over their respective competitors. Nonetheless, as big data is a discipline, not accessible to everybody in terms of understanding, with many improvements to carry out, especially related to its utilization within the fast-food industry, it results difficult to interpret the analysis results and even use the right mining techniques to solve for specific problems. With the study of use cases, it was possible to understand the different stakes from the point of view of a start up company and from the viewpoint of a well-established banner. The stakes that they have to deal with are different and incumbent of their market, and thus lead to divergent ways of disrupting the market.

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