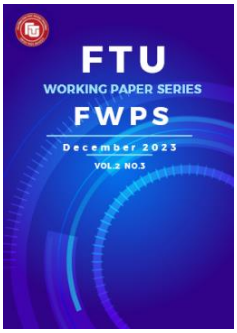

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ỨNG DỤNG PHÂN TÍCH DỮ LIỆU LỚN: NGHIÊN CỨU TRƯỜNG HỢP CỦA STARBUCKS VÀ HÀM Ý CHO DOANH NGHIỆP F&B TẠI VIỆT NAM

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Tóm tắt

Phân tích dữ liệu lớn (BDA) với khả năng ứng dụng linh hoạt trong mọi hoạt động của doanh nghiệp đã cho thấy vai trò thiết yếu của nó trong thời đại chuyển đổi số. Nắm bắt những cơ hội của phân tích dữ liệu lớn để cải tiến hoạt động quản lý chuỗi cung ứng, hay tiếp thị và quảng cáo,... các tập đoàn lớn trên thế giới, như Amazon hay Walmart, đã thành công nâng cao hiệu quả và năng suất hoạt động, gia tăng trải nghiệm khách hàng, từ đó khẳng định vị thế của doanh nghiệp trên thị trường. Trong bối cảnh của ngành dịch vụ thực phẩm (F&B Industry), Starbucks có thể coi là người đi đầu trong khả

năng ứng dụng phân tích dữ liệu lớn vào các hoạt động của doanh nghiệp và nâng cao chất lượng dịch vụ. Trong bài nghiên cứu này, nhóm tác giả sẽ tập trung vào phân tích và đánh giá việc ứng dụng phân tích dữ liệu lớn của Starbuck trong các hoạt động kinh doanh của doanh nghiệp. Từ đó, bài nghiên cứu đưa ra một số đề xuất cho doanh nghiệp trong lĩnh vực F&B tại Việt Nam để khuyến khích họ ứng dụng tiến bộ công nghệ này trong hoạt động kinh doanh.

Từ khóa: Starbucks, Phân tích dữ liệu lớn, Ngành F&B, Việt Nam

APPLICATION OF BIG DATA ANALYTICS: A CASE STUDY OF STARBUCKS AND IMPLICATIONS FOR VIETNAMESE F&B INDUSTRY

Abstract

Big data analytics (BDA) plays a vital role in the era of digital transformation thanks to its flexible application in parts of a business's value creation activities. Taking advantage of big data analytics to innovate supply chain management, marketing and promotion, ect. big corporations, such as Amazon or Walmart, have improved the productivity and efficiency of its operations, enhanced customers' experiences, and thus enlarging their pies in the market. Within the context of the F&B industry, Strabucks could be considered as a pioneer in the application of big data analytics, and this data-driven strategy has helped them to strengthen its core competitive advantages and constantly improve the service performance. In this paper, the authors will focus on analyzing and evaluating Starbucks' adoption of big data analytics in its business performance to satisfy the growing demand of its customers and compete against potential competitors. Then, based on the investigation, this paper aims to propose several recommendations for Vietnamese enterprises in the F&B industry in order to encourage them to adopt Big data analytics in their business operations.

Key words: Starbucks, Big data analytics, F&B industry, Vietnam

1. Introduction

Given the fast transformation of digitalization, people are dealing with the data explosion of the 21st century, with an average of 120 zettabytes being generated per year (Petroc Taylor, 2023). Much of this is attributable to frequent human-being's usage of smartphones, electronic sensors, and other digital devices in any parts of their daily life (Saha, 2020). The boom of digital data, which is, in large volume, high speed of processing, and extracted from diverse sources, have led to a new era of big data analytics, and this concept has emerged as a driving force for the digital transformation process.

The important trait of big data comes from the fact it is gathered from a wide variety of sources in very large volumes, which enables corporations to discover knowledge in different aspects of a business operation, given that these data are analyzed properly (Shabbir and Gardezi, 2020). Many business case studies have demonstrated the vital role of big data analytics in enhancing the efficiency of firms' performance in diverse industry sectors. For example, e-commerce platforms like Amazon, Tencent, Alibaba have truly taken the advantage of big data analytics to customize marketing campaigns, optimize their pricing strategies, and improve their supply chain operations and reduce costs (Zhuang, 2021). Within the context of F&B Industry, Starbucks stands out as a successful adoption of big data analytics into core business (Hovsepyan, 2023). It has truly leveraged big data analytics to offer exceptional service to existing and potential customers, as well as improve their predictive capacity in the future strategies (Shen, 2022).

Basically, Starbucks gathers customers' information via its reward program and mobile app, from which they currently create a mound of data that would be a perfect reflection of customers' purchasing habits. The ultimate purpose of Starbucks' massive collection of data is not only for quantitative purposes, but it would also lie in the capability to provide new insights for better business performance (Saha, 2020). Starbucks stands out as a successful case of effective big data analytics adoption in the attempt to improve the customers experience, service performance and marketing and promotion decisions. However, there has been a limited number of papers that thoroughly investigate how Starbucks have been truly taking advantage of big data, big data analytics in their business operation. Therefore, in order to fill this research gap, our papers make a descriptive approach to a case study of Starbucks' application of big data analytics in improving business performance. The paper begins with an overview of Big Data (BD) and Big Data Analytics (BDA), then conducts an in-depth analysis of the successful adoption of big data analytics in Starbucks' business operation. The conclusion reviews the current state of big data use in the Vietnamese F&B industry, and proposes recommendations for potential business practitioners to manage the adoption of big data analytics.

2. Theoretical framework

2.1. Overview of Big Data and Big data analytics

2.1.1. Overview of Big Data

Big Data (BD) can be defined as "structured and unstructured data generated from diverse sources in real time, in volumes too large for traditional technologies to capture, manage, and process in a timely manner" (Errity and Lucker, 2013). Likewise, Manyika et al. (2011) and Zikopoulos (2012) deemed it to exceed the capacity of conventional database software tools to process and analyze.

Alternatively, certain scholars characterize big data by its attributes. Correspondingly, big data is widely defined as "a new generation of technologies and architectures, designed to economically extract value from very large volumes of a wide variety of data, by enabling high velocity capture, discovery and/or analysis" (Mikalef et al., 2018). Accordingly, a dataset is initially considered as big data when it encompasses four key attributes namely volume, velocity, variety, and veracity. However, as information complexity increases, the fifth V - Value has been additionally proposed later on to enhance value creation, culminating in **5V's characteristics of Big Data** (IBM, 2021). Value refers to the ability to turn the processed and analyzed data into valuable insights that can drive informed decision-making. The ultimate goal of working with big data is to extract meaningful insights and value (Deloitte, 2012).

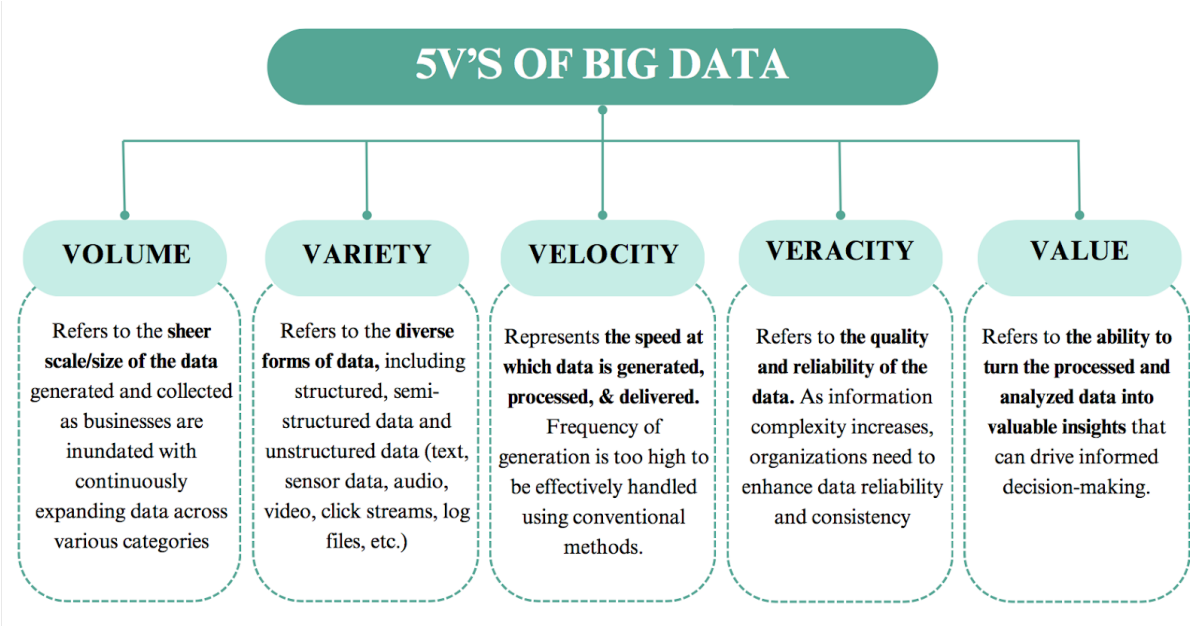

Figure 1: Five V's characteristics of Big Data

Source: *Authors' adaptation from IBM (2014), Davenport & Dyché (2013)*

The importance of each of these attributes depends on the specific goals, industry, and use cases of a company. For example, a company dealing with real-time analytics may prioritize velocity, while a company working with diverse data sources may prioritize variety. Understanding the unique needs and objectives of the organization is essential in determining which aspects of big data are most relevant and critical for their success.

2.1.2. Overview of Big data analytics

According to Tableau, a leading interactive data visualization software company, big data analytics (BDA) describes the intricate process of analyzing substantial datasets to uncover and extract valuable insights such as hidden trends, patterns and correlations and subsequently drive data-informed decisions. Essentially, the sequence of gathering, analyzing and visualizing big data presents organizations with significant possibilities to make informed business decisions, enhance efficiency and optimize operations (Kościelniak & Puto, 2015; Mikalef et al., 2019).

While traditional data analytics focuses on smaller, structured data collected over a period of time and often involves batch processing, BDA is characterized by the need to process massive volumes of diverse, often unstructured data in real or near-real time, using scalable and distributed computing frameworks (Shahid and Sheikh, 2021). Key differences between these kinds of data analytics are delineated as follows.

Characteristics	Traditional Data Analytics	Big Data Analytics
Key data characteristics	• Structured data • Data volume measured with megabytes and gigabytes	• Diverse types: Structured, semi-structured & unstructured data • Data volume measured with terabytes and petabytes
Featured types of analytics	Diagnostic and Descriptive Analytics	Predictive and Prescriptive Analytics
Object of analysis	The sample from known population	Entire population
Analytical domain	Answers on already defined questions: What happened and why?	New and unexpected findings: Hidden insights, trends/ patterns & correlations
Necessary knowledge	Knowledge of analytical techniques & tools, basic grasp of reporting	Advanced analytical, mathematical, statistical and computer knowledge

Figure 2: Comparison between Traditional Data Analytics and Big data analytics

Source: *Authors' compilation from Rajendran et al. (2016) and Bajaj et al. (2017)*

2.2. Big data analytics Application in F&B Industry

Big data analytics (BDA) has become a game-changer in various industries, and the Food and Beverage (F&B) industry is no exception. Leading F&B giants like Starbucks, McDonald's, Domino's Pizza, and Coca-Cola are tapping into the power of BDA. Essentially, BDA empowers F&B businesses by opening doors to various opportunities, such as enhancing customer satisfaction, streamlining supply chains, making data-driven decisions and boosting operational efficiency. Yet, the ever-elevating customer experience is considered the most critical recipe for success in the F&B Industry. Wherefore, companies are now using BDA to understand individual preferences and tailor offerings. As the F&B industry continues to evolve, the integration of BDA not only helps to build customer loyalty but also encourages repeat visits, thereby paving the way for sustained long-term growth.

2.2.1. Benefits of Big data analytics Application in F&B Industry

The advantages of employing big data analytics (BDA) in the F&B industry are varied depending on the purpose of application. Key advantages can be categorized as follows.

Enhance customer understanding and experience

Leveraging big data analytics in the F&B industry enhances customer understanding and experience with the provision of valuable insights into preferences and behaviors. Through the analysis of vast datasets, businesses can identify trends, personalize recommendations, and optimize menu offerings to meet specific tastes (Roy et al., 2023). This heightened understanding enables targeted marketing strategies, fostering customer loyalty and satisfaction. Additionally, real-time analytics allow for quick adjustments to meet changing preferences and improve operational efficiency .

Optimized operations and supply chain management

Effective operations and supply chain management are essential for F&B businesses to ensure timely delivery of fresh products, minimize costs, and maintain product quality (Mast, 2020). Big data analytics provides valuable insights into demand patterns, inventory levels, and potential supply chain disruptions, enabling businesses to optimize operations, reduce risks, and improve efficiency (Sadiku et al., 2020; Margaritis et al., 2022). This data-driven approach eventually leads to cost savings and increased profitability.

Data-driven decision making and innovation

Big data analytics provides a wealth of information about consumer preferences, market trends, and emerging food technologies, empowering businesses to identify new product opportunities, develop innovative offerings, and adapt to changing market dynamics (Sadiku et al., 2020). By harnessing these vast datasets, F&B businesses can make more informed and data-driven decisions on optimizing inventory management, pricing strategies, and product development. They can also respond faster to changing market conditions and make strategic choices based on real-time data.

Enhanced traceability and food safety efficiency

Ensuring food safety is paramount for F&B businesses to maintain consumer trust and protect public health (Logan, 2021). Big data analytics enhances traceability by tracking the movement of goods from farm to table, enabling businesses to identify potential contamination risks, take corrective actions promptly, and ensure the safety and quality of their products (Mast, 2020). This data-driven approach to food safety protects consumer health, maintains brand reputation, and reduces the risk of costly returns.

2.2.2. Challenges of Big data analytics Application in F&B Industry

Despite immense benefits, there remain significant challenges in implementing big data analytics applications within the Food and Beverage (F&B) industry. Key challenges associated with applying BDA in the F&B sector are categorized as follows.

Data integration and storage

The F&B industry faces challenges in managing the vast amounts of data generated daily from various sources, spanning point-of-sales transactions, sensor data, to social media interactions. Diverse data formats hinder the creation of a unified view of the data to effectively interpret complex data patterns and draw meaningful conclusions (Deloitte, 2013). Dealing with this data deluge requires F&B companies to develop expertise in sophisticated data analysis techniques for diverse data formats. Besides, the complexity of big data necessitates F&B companies' investments in IT infrastructure and data management solutions to ensure efficient storage-management systems and long-term accessibility (Sadiku et al., 2020).

Data quality and accuracy

Ensuring the accuracy and reliability of data is crucial for effective analytics since incomplete or inaccurate data can lead to faulty insights and decisions. The sheer volume and variety of data may compromise the data quality as its integration process can be a complex and time-consuming task (Deloitte, 2013). Especially when dealing with large volumes of data, maintaining data quality requires robust data cleansing and validation processes.

Data privacy and security

Data privacy and security is a critical challenge for F&B companies implementing big data analytics (BDA) due to the sensitive nature of the data they collect and handle (Deloitte, 2013). This data includes personal information, such as names, addresses, and purchasing habits, which can be misused for identity theft, targeted advertising, or other nefarious purposes. Therefore, protecting this data from unauthorized access, breaches, and misuse is paramount to maintaining customer trust and complying with data privacy regulations.

Cost and resource allocation

Cost and resource allocation can be a challenge for F&B companies implementing BDA due to the significant financial and personnel investments required (Sadiku et al., 2020). Implementing BDA requires a substantial upfront investment in hardware, software, and data storage solutions to accommodate the vast amounts of data being collected and analyzed. Additionally, hiring and retaining skilled data scientists with expertise in BDA may pose a challenge due to the high demand for these professionals and their salaries and benefits can be significant expenses. For some companies applying BDA for the first time, costs for integrating and migrating data from disparate sources into a new BDA platform can incur significant costs (Deloitte, 2013).

3. Analysis of Starbucks' Big data analytics Application

3.1. Overview *of Starbucks*

3.1.1. General information of Starbucks

Starbucks Corporation, founded in 1971, is an American multinational chain of coffeehouses and roastery reserves headquartered in Seattle, Washington. With a global presence in more than 80 markets and over 35,000 stores, Starbucks has become synonymous with premium coffee experiences and one of the most recognizable brands in the world.

Starbucks opened its first store in 1971 on the site of Seattle's historic Pike Place Market. In the early days, Starbucks simply provided fresh-roasted coffee beans, tea and spices from around the world to its customers. By 1983, Starbucks' decisions to change into a coffee house marked a huge success for this company. The introduction of Starbucks to the global coffee market in 1996 is seen as a memorable milestone. In that year, Starbucks launched its first location in Japan, and soon after that it penetrated the European and the Chinese market in 1998 and 1999, respectively.

Today, Starbucks is the largest coffeehouse chain in the world. As of December 2022, Starbucks had 35,711 locations around the globe and it reached a tremendous revenue of roughly 35.97 billion US dollars. Starbucks' growth over time indicates how powerful they are in the coffee industry. In the next decade, Starbucks is targeting 55,000 locations worldwide, which is believed to be feasible.

3.1.2. Vision - Mission

During the 1970s, as a coffee bean roaster, Starbucks initially identified its vision as becoming "the premier purveyor of the finest coffee in the world". However, after Howard Schultz bought the company in 1987, Starbucks changed into a coffee shop as today. Since then, the company has focused on making Starbucks be the "third place" where customers can visit on the way to work or back home. Starbucks aimed to make itself a "third place" where people can come to savor the best coffee and temporarily forget their work and life pressures. It was the idea of "third place" that created

a new mission statement for Starbucks today: “to inspire and nurture the human spirit – one person, one cup and one neighborhood at a time.”

Starbucks’ mission does not lie solely on providing a cup of exceptional drink but creating a warm atmosphere and high-quality service for the customers. The company's mission statement echoes its vision, emphasizing the importance of human connection and community building through its products and spaces. Through practical experience and careful market research, Starbucks believes that constantly improving the quality of customer service will be the right way to fulfill their mission.

3.1.3. Business model and business performances

Starbucks' business model revolves around creating an unparalleled coffee experience for its customers. At the heart of this model is the emphasis on sourcing top-quality coffee beans from diverse regions worldwide. This commitment to quality extends to their extensive menu, offering a wide array of beverages and food items tailored to varying tastes and preferences. Moreover, Starbucks places a strong focus on customization, allowing customers to personalize their drinks to their liking.

In addition to the quality of their offerings, Starbucks places significant importance on the ambiance and experience within their stores. Each location is carefully designed to create a welcoming environment that encourages community engagement while also ensuring convenience for their patrons. Their strategic store placements, coupled with the incorporation of mobile ordering options, further enhance accessibility and convenience for customers.

Moreover, Starbucks prioritizes social responsibility by implementing ethical sourcing practices and actively engaging in initiatives that support communities. This commitment aligns with their broader mission and resonates strongly with socially conscious consumers.

Lastly, Starbucks' global expansion strategy is marked by its ability to adapt to diverse markets while maintaining a consistent brand identity and robust loyalty programs. This strategy ensures that customers worldwide experience the same level of excellence and engagement that defines the Starbucks brand.

3.2. Starbucks Adoption of Big Data Analytics

3.2.1. Overview of Starbucks’ adoption of Big Data Analytics

Being a coffee giant in the world, Starbucks records a huge number of transactions in its network of stores worldwide with the assistance of cutting edge technology of big data collection and analytics. Starbucks' utilization of data analytics and transformation strategies can be seen through the lens of an insight-driven approach, which involves gathering and generating data and translating into actionable strategies (Ogombo, 2023). By doing so, Starbucks can leverage its success in many ways to improve its customer experience, help direct marketing and optimize business decisions.

Starbucks is renowned for its relentless commitment to delivering an exceptional customer experience thanks to data analytics. Upon introducing its rewards program and mobile app, Starbucks significantly expanded its data collection, offering insights into customer behavior and purchasing habits. It can offer a more personalized customer experience by identifying the customers through their smartphones and give the barista their preferred drinks or allow customers to customize their drinks with their names on the cup and recommend suitable products to their customers. This mobile app includes two data-driven programs namely Digital Flywheel and Unified Commerce Platform.

Analytics of big data supports many important decisions, including determining a potential location for a new store, which is enabled by the platform Atlas. This data-driven approach, powered by the analysis of massive amounts of data, ensures choosing the strategic and right location for the new store (Ogombo, 2023). Moreover, this system also forecasts the potential effect on nearby Starbucks stores if a new branch were to open in the area (Sharaf, 2022). Besides assisting in the choice of locations, it relies on data to determine the optimal product offerings, merging store-specific customer ordering patterns with data from diverse industries regarding at-home consumption to develop its grocery store product range. This data also informs the creation of exclusive limited-time menu items, tailored to prevailing circumstances (Shen, 2022).

3.2.2. Digital Flywheel program

The Digital Flywheel program is the central part of a five-year innovation strategy launched by Starbucks in late 2016. This program is a strategic approach aimed at seamlessly integrating physical customer interactions with digital platforms to leverage big data analysis and drive important business decisions. Its main pillars are four key elements which are rewards, customization, payment, and ordering all based on its mobile app (Figure 3). The objective was not just to generate a large data volume, boost sales, enhance customer experience but also to outperform other digital enterprises in the physical setting.

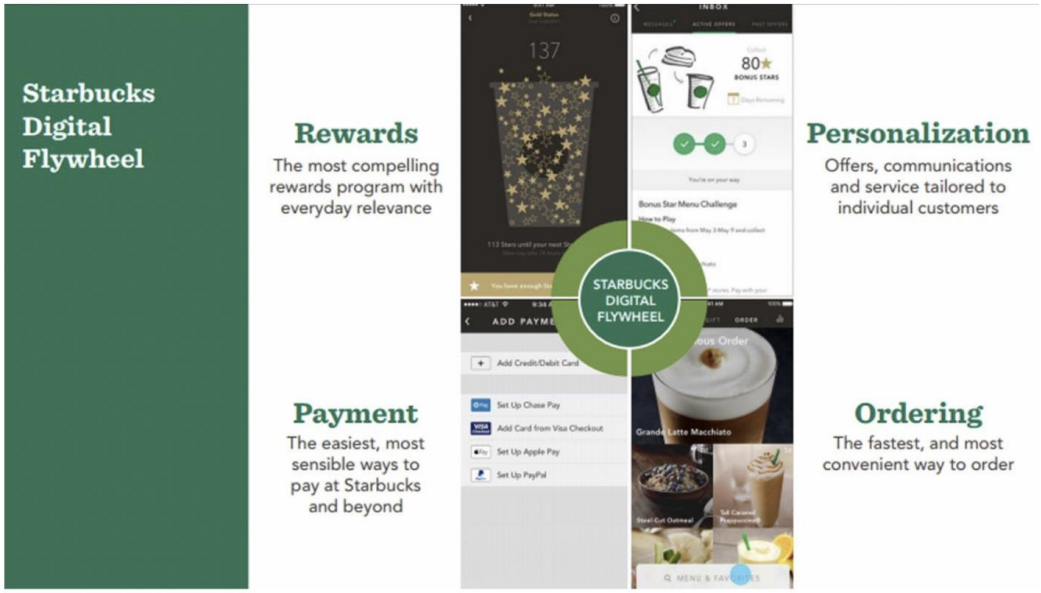

Figure 3: Starbucks' Digital Flywheel

Source: *Authors' adaptation from (Shen, 2022)*

In detail, Starbucks implements an attractive reward policy by allowing any member with an account having spent $1 receive 2 reward points, often known as stars. The accumulated stars can be redeemed for free drinks and food items, even for non-Starbucks products (Ani, 2023). Users can accumulate points to advance their membership, which encourages more customers to use their digital app. These users collectively generate extensive data regarding their typical coffee orders—details on when, where, and what they usually purchase—along with complementary products that might interest customers. Additionally, weather patterns, holidays, and promotional events are also examined to drive important insights based on this diverse data pool. With such a colossal amount of data regarding customers' behavior, Starbucks can offer a high level of personalization based on

insights extracted from Big Data Analysis, and therefore suggesting stores nearby, suggest suitable products or offering highly appealing communications, offers and promotions to boost purchases. This personalized approach significantly enriches the customer experience and cultivates deeper customer loyalty (Ani, 2023).

Starbucks has achieved success by acquiring a substantial amount of big data for analysis. To illustrate, in 2018, the mobile app boasts over 75 million users, while the Rewards program engaged over 18%, equal to more than 13 million active users in the US only (Marr, 2018). In 2019, the membership surged by 25%, surpassing 16 million members. (Chickowski, 2019). The application in Big Data helps Starbucks achieve a robust annual and quarterly financial growth although only approaching the midpoint of its five-year digital flywheel innovation strategy. In fiscal 2018, they experienced substantial double-digit revenue growth of $24.7 billion. Similarly, in fiscal Q1 2019, the company recorded a 9% growth rate, fueling a steady rise in Starbucks shares throughout the year (Chickowski, 2019).

3.2.3. Unified commerce platform

Furthermore, leveraging the gathered data, Starbucks implemented a unified commerce platform equipped with personalized tools to foster digital customer connections while integrating inventory and point-of-sale systems, as illustrated in figure 4. The company's mobile app stands as a testament to its unified commerce approach.

This platform will not only enhance the organization of customer data but also integrate more seamlessly with in-store operational systems, such as inventory and production management. The introduction of this platform empowers Starbucks to dynamically modify rewards programs and target specific customer segments.

Looking ahead, this technology platform is envisioned to seamlessly integrate with inventory and point-of-sale systems. A tool known as the Digital Order Manager will streamline inventory control, particularly in the company's busiest mobile order and pay-enabled stores.

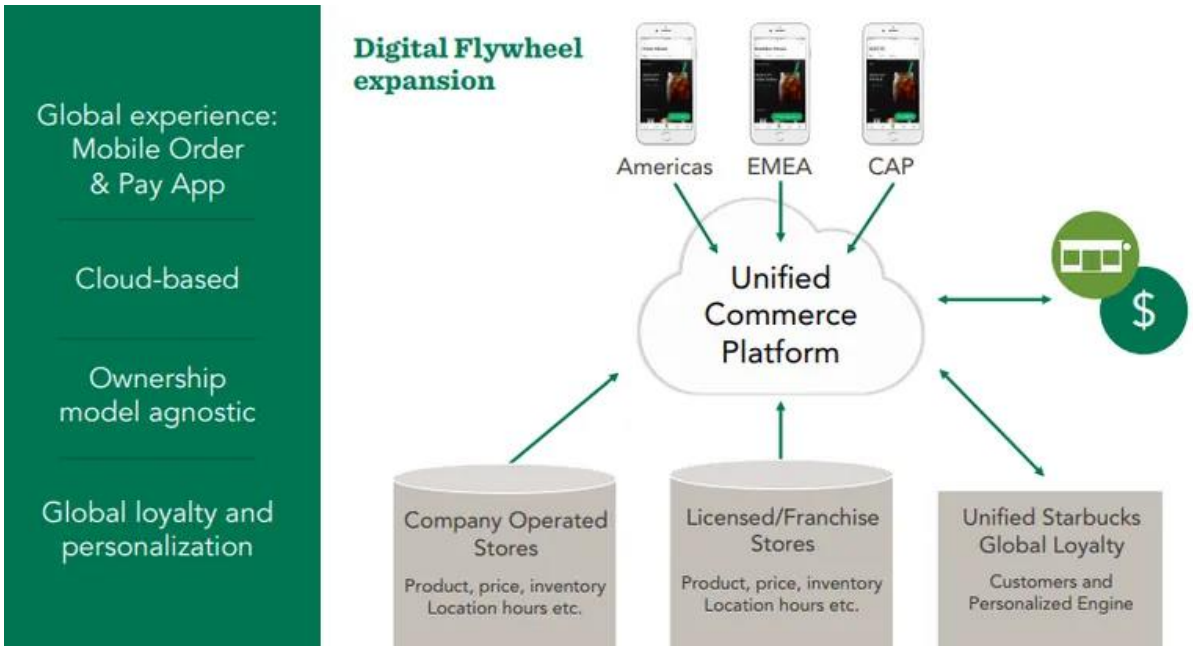

Figure 4: Starbucks' Unified Commerce Platform

Source: *Authors' adaptation from (Shen, 2022)*

3.2.4. Atlas

Starbucks utilizes data intelligence through Atlas, a mapping and business intelligence platform to aid in various aspects including identification of new store locations. That analysis is done in Atlas, the company's market planning and store development application, which is powered by Esri ArcGIS. The system processes extensive data and a visual representation related to key factors such as population, income levels, traffic, competitor presence, and proximity to existing Starbucks stores (Figure 5). It even highlights upcoming transportation nodes and areas with new office constructions or increased customer traffic to suggest an optimal location for a new store strategically.

This system even forecasts the potential effect on neighboring Starbucks stores in the vicinity if a new store were to be established. Despite the abundance of Starbucks stores, even in close proximity, where one might anticipate sales overlap, the data analysis assures the decision to build a new store is justified (Sharaf, 2022). Upon selecting a potential site and its impact, Atlas streamlines the approval, permitting, and construction stages, leading to the store's eventual opening. Additionally, Starbucks leverages ArcGIS to analyze customer spending habits and determine suitable locations for the high-end Clover Brewing System. This system meticulously brews individual cups of coffee, ensuring an exceptionally flavorful and aromatic experience. ArcGIS is also employed to generate various informational resources, including a comprehensive overview of safety and security at global store locations. This illustrates how Starbucks begins with the concept of a new store location and sees it through to the grand opening ceremony (Esri.com, 2014).

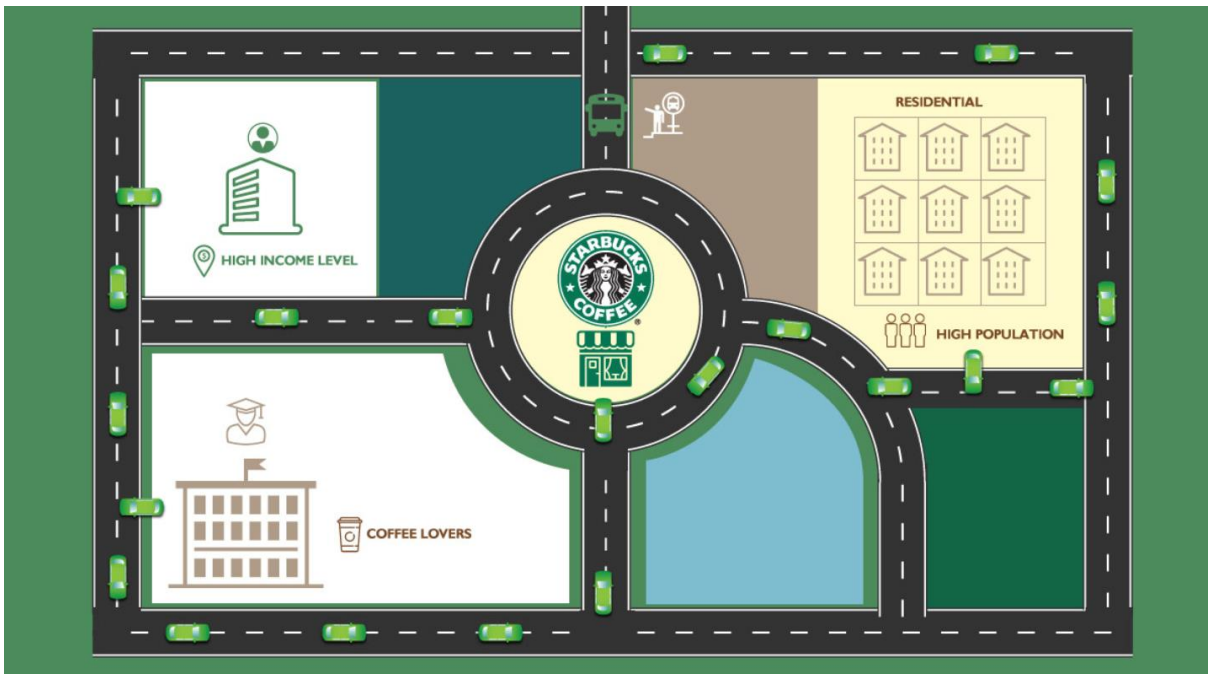

Figure 5: A visual example of the data local consumer data Starbucks analyses, when selecting a store location.

Source: *Authors' adaptation from (Shen, 2022)* and Kayla (2017)

3.3. Evaluation of Starbucks' adoption of Big Data Analytics

Starbucks' adoption of big data analytics has played a crucial role in enhancing personalized customer experiences and operational efficiency. Leveraging data analytics, Starbucks can gain

valuable insights of customer preferences, gathering extensive behavioral data through their mobile app and rewards program. This wealth of data enables them to offer tailored recommendations, promotions, and unique experiences to customers. Additionally, they utilize data to predict demand, manage inventory, and optimize processes, thereby minimizing waste and enhancing supply chain efficiency. Moreover, in product development, big data analytics scrutinize trends and customer feedback, aiding Starbucks in introducing new flavors, beverages, and merchandise that resonate with their target audience. Furthermore, the company relies on data analytics to make informed decisions regarding the establishment of new stores or expansion strategies, providing valuable insights for projecting the success and performance of new coffee shops to bolster profitability.

Several empirical lessons can be drawn from the case of big data application in Starbucks. Starbucks serves as a prime example of leveraging data for decision-making and discovering insights from various sources to drive strategies, enhance customer experiences, and refine operations. Firstly, the transition from a traditional approach to a data-driven one must be a step-by-step process, gradually integrating data-centric practices into their core operations. By implementing various campaigns, Starbucks has increased customer engagement with the business, ensuring that each interaction generates data-driven insights. Secondly, their utilization of the app to support Business Data Analytics (BDA) operations is a smart strategy. Constructing an app ecosystem that aligns with the majority of businesses is necessary as it allows tailoring based on the available resources of the enterprise. Therefore, businesses can use a mobile app as a data source and integrate BDA operations to optimize their activities. Thirdly, Starbucks shows a high level of adaptability in their Big Data Analytics approach by employing both internal and external resources like Atlas by Esri ArcGIS. This flexibility allows them to leverage diverse tools for comprehensive insights. However, while Starbucks faces challenges in human resource management to align with their data-driven culture, they still strive to adapt human resource practices to suit the evolving data-centric environment. This involves aligning recruitment, training, and retention strategies with the company's data-driven ethos.

4. Recommendations for Big data analytics in Vietnam’s businesses in F&B Industry

4.1. Overview of Vietnam's F&B Industry

The food and beverage (F&B) industry is a broad scope that includes raw materials, semi-finished, and finished products ready for sale to the consumers (Demir and Istanbullu Dincer, 2020). It is divided into two main segments: production and distribution. The manufacturing segment includes the creation and processing of foods and beverages, while the distribution segment in the F&B industry involves transportation activities or methods related to providing products to users.

In Vietnam, the F&B industry has for many years been one of the important economic sectors with much development potential. Beside large businesses and international restaurant chains, it also thrives in the areas of small restaurants, independent cafes, and small and medium-sized enterprises (SMEs). In the context of the whole economy facing many challenges, consumers tend to tighten their wallets, but F&B industry revenue in Vietnam still reaches a high growth rate of nearly 610 trillion, forecast to grow by 18% in 2023 and reach a value of nearly 1 million billion VND in 2026. However, it also faces many challenges which come from a massively growing business model leading to fierce competition among companies in the industry, increasing raw materials costs and lack of human resources, especially in the field of management.

Currently, F&B business trends focus on youth-oriented businesses, using healthy ingredients, non-cash payments and applying technology in the business process. The high level of market competition and the growing demand for both quantity and quality mean that Vietnamese F&B manufacturers need to implement technological systems to increase productivity. However, the Vietnamese F&B industry is considered to be lacking in terms of introducing new technologies and has not yet maintained and controlled the quality of products professionally (Wang et al., 2020), one of which is Big Data Analytics. Big Data Analytics plays a vital role in various aspects of Vietnam's F&B businesses, including marketing, customer experience, operations, delivery optimization, compliance, and collaboration. By harnessing the power of data, F&B businesses can gain a competitive edge, make data-driven decisions, and thrive in the ever-evolving F&B industry.

4.2. Application of BDA in Vietnam's F&B Enterprises

4.2.1. Current situation of BDA application in Vietnam F&B's Enterprises

Big Data and artificial intelligence have been mentioned a lot in recent times. Big Data and AI applications have also been used in some F&B businesses in Vietnam such as the VinMart Scan & Go application with super-fast payment capabilities, helping to save up to 90% of waiting time or the widespread use of Robots in Vinamilk's processing, handling and operation stages (Vietnam Report JSC, 2019; Ha, 2019). However, according to industry experts in a Vietnam Report survey, the most potential trend that Big Data brings to the F&B industry is the ability to personalize from collected data, share data and support automation, and thus the product will be able to meet the different nutritional needs and preferences of each individual. Consequently, F&B enterprises in Vietnam are increasingly adopting big data analysis to gain insights and improve their operations. While the adoption levels may vary across businesses, there is a growing recognition of the value that Big Data Analytics can bring to the F&B industry.

Large enterprises

Large chain restaurants and international F&B brands operating in Vietnam often have more resources and capabilities to implement big data analytics solutions. These businesses have the infrastructure and expertise to collect, process, and analyze large volumes of data from various sources, such as point-of-sale systems, customer databases, online platforms, and social media. For example, the Coffee House - a famous coffee shop chain in Vietnam- used big data analytics to understand customer behavior and preferences, thereby creating personalized marketing and serving strategies. This helps the brand grow sales and build customer loyalty.

A case of successful application of big data in Vietnam that cannot be ignored is the case of Heineken Vietnam. Heineken's data drive company strategy is based on three main pillars: first, standardize data so it can be retrieved; Second, distill valuable data (data product) to support departments in promptly making weekly/monthly/yearly decisions; Finally, apply AI and Machine Learning (data analytics) - a method commonly used within big data analytics - to solve complex business problems. The third pillar will be where data creates the most value.

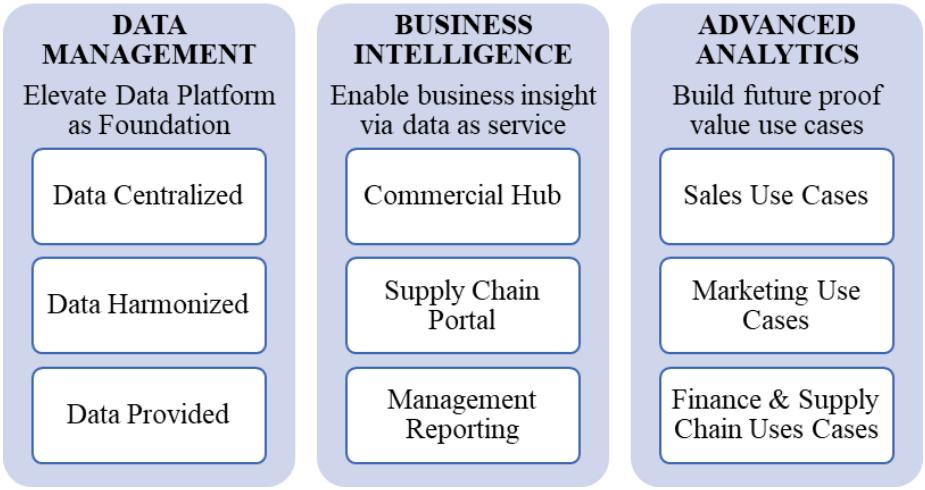

Figure 6: Data Driven of Heineken Group
Three Pillars from Data Foundation, enabling Business Insights to apply High Value Use Cases.

Source: Vietnam Artificial Intelligence Festival 2023

A specific example of data-driven strategy is that through analyzing customer data combined with AI and Machine Learning, Heineken Vietnam will bring marketing messages to consumers at the right time and with the right frequency; or recommend products that suit their current needs. This helps optimize marketing and PR costs, and also helps employees personalize sales activities. New data and technology also help the production department - the factory predicts the number of machines that will have problems in the future so that Heineken can intervene in advance; forecast demand for fermented beers or apple juice in the near future. According to Heineken's calculations, in 4 years - from 2022 to 2025, data can generate around 40 million euros for the Group: 3.1 million euros in 2022, 7.4 million euros in 2023, 2024 estimated amount of 15.8 million euros.

In addition, the biggest dairy company in Vietnam, Vinamilk, has increased efficiency and productivity by 20% by using SAP ERP - software systems that can incorporate and utilize big data analytics, to manage every aspect of its supply chain, from the procurement of raw milk to the delivery of finished goods; alternatively, SABECO, the biggest beer producer in Vietnam, saw a 5% increase in revenue and a 10% cost reduction when it used SAP ERP to handle sales, distribution, inventory management, and production planning (ABeam Consulting Vietnam, 2023). By automating manual labor, SAP ERP can reduce costs, improve productivity, and streamline business operations for Vietnamese F&B manufacturers. It provides a single integrated platform for managing the F&B supply chain, improving visibility and control. The system also enhances quality and safety by tracking raw material and finished product flow, identifying damaged or expired products, and ensuring compliance with complex food safety and quality regulations.

Small and medium enterprises

Some SMEs in Vietnam's F&B industry have begun to apply Big Data Analytics in some particular areas through personalizing services, increasing interactivity, and improving product quality to provide better experiences. Specifically, big data analytics can be applied in market research, demand forecasting, production process optimization and supply chain management, quality management, advertising and marketing, and improve customer experience.

In recent years, there has been a growth of companies and providers of data analytics solutions and services to help SMEs in Vietnam promote their development. These companies offer services

such as data collection, analysis, and visualization, helping F&B businesses leverage data-driven insights to make informed decisions. A remarkable example is the appearance of GOnJOY chatbot application using Big Data and AI that provides accurate suggestions on places to eat, necessary services, and predicts the user's needs even if they change to another location such as when traveling or working. Launched on the market in August 2018, Chatbot GonJOy is a smart artificial intelligence application that supports users in choosing suitable dining and entertainment locations through online chat. Applying natural language analysis technology (NLP - Natural Language Processing) and personalized recommendations (Personalized Recommendation), the Chatbot has received a lot of positive feedback in proactively suggesting places to eat, bringing to increasingly accurate and diverse recommendations for more than 30,000 active users in the Da Nang market alone.

With the advancement of technology and growing awareness of the value of data, it is expected that the application of big data analytics in the F&B industry will continue to grow and become an important factor. However, the application of BDA is still limited to SMEs in the F&B industry in Vietnam as there are still some challenges and constraints that need to be worked on.

4.2.2. Challenges of BDA application in Vietnam's F&B Enterprises

The F&B industry in Vietnam, like its counterparts worldwide, has recognized the potential of Big Data Analytics in enhancing operational efficiency, refining customer experiences, and optimizing resource allocation. Generally, the application of big data analytics in Vietnam's F&B businesses offers significant opportunities for improving customer satisfaction, operational efficiency, and profitability. Large F&B enterprises in Vietnam have been at the forefront of harnessing Big Data Analytics for these transformative gains. Some have successfully streamlined complex operations, optimizing supply chain management and production processes. Some SMEs have also successfully adopted Big Data Analytics albeit on a smaller scale, the adoption of Big Data Analytics is still relatively limited among Vietnam's F&B SMEs due to their size and resource constraints.

Implementing big data analytics requires robust technical infrastructure, including storage, processing, and analytics capabilities (Sivarajah et al., 2017). Many Vietnamese F&B SMEs are lacking the necessary resources & infrastructure required to implement sophisticated BDA systems or struggle to upgrade their systems to handle large volumes of data effectively (Thu Ha, 2022). Currently, most businesses' data often gets scattered across different platforms (POS systems, online orders, inventory management) making it difficult to consolidate and analyze. Moreover, embracing a data-driven culture and integrating big data analytics into existing organizational processes and decision-making frameworks can be challenging for F&B SMEs businesses. The resistance to change at the management level, lack of awareness can impede the integration of BDA into strategic decision-making processes (Song Ha, 2022). According to a survey on 1,000 SMEs by the SME Support Center of VCCI, financial constraints indeed emerge as one of the most crucial challenges, with about 85.2% enterprises lacking financial resources for digital technology application. The integration of BDA systems involves substantial financial investments in acquiring advanced technologies related to Big Data, implementing infrastructure upgrades to support data storage and processing, and hiring skilled professionals capable of managing and analyzing the collected data. Applying this to the inherent characteristics of the F&B industry, it is apparent that Vietnamese F&B SMEs operate with tight margins, making it difficult to justify investments in big data initiatives whose return on investment might not be immediate.

According to EY experts, Vietnam's F&B industry is still in its infancy in terms of Data Analysis. However, as technology continues to advance and become more accessible, it is expected that BDA adoption will become more widespread across the F&B industry in Vietnam, including both large and small enterprises. Moreover, the government is also implementing initiatives to foster technology innovation, such as providing funding for research and development, encouraging collaboration between academia and industry, and developing talent pool in STEM fields. These efforts will directly benefit the growth of the BDA sector in years to come.

5. Recommendations for Vietnamese F&B businesses in applying Big Data Analytics

Building upon the insights gained from Starbucks' successful big data analytics (BDA) implementation, actionable recommendations are consolidated for Vietnamese F&B businesses attempting to materialize their BDA application. However, recognizing the diverse landscape of the industry, we categorize our recommendations into 02 distinct groups: one catering to well-resourced large enterprises and another offering practical solutions for smaller and medium-sized businesses.

5.1. For large F&B enterprises

Define clear objectives, use cases and data strategy

Large Vietnamese F&B businesses should establish clear objectives and identify specific use cases where BDA can make a significant impact. This entails defining business goals such as optimizing supply chain management, enhancing customer satisfaction, or reducing operational costs. With clear objectives in place, identifying corresponding use cases for BDA (eg. demand prediction, inventory optimization, or customer personalization) allows businesses to focus their resources on areas with the greatest potential for improvement.

Furthermore, establishing a comprehensive data strategy that aligns with the business's overall objectives is crucial. In the Vietnamese context, large F&B businesses should tailor the data strategy to not only fit local market dynamics and consumer behaviors but also to align with Vietnamese regulations to ensure legal compliance, thereby minimizing the risk of legal issues and protecting the company's reputation. This involves several activities from defining data sources, implementing data governance, investing in data storage and management infrastructure, identifying analytics tools for extracting to turning data into actionable insights.

Invest in information technology infrastructure

For effective BDA implementation, large Vietnamese F&B businesses must invest wisely in IT infrastructure, tailoring choices to their needs and budget. The BDA process involves establishing data storage (cloud or physical server), identifying data sources (sales, social networks), and strategically utilizing the derived analysis to enhance business operations. Accordingly, IT infrastructure includes the hardware, software, and services needed to collect, store, process, and analyze data.

Specifically, businesses need to invest in hardware such as servers, computers, data storage devices, etc. to be able to store and process large amounts of data. Additionally, investing in specialized data analytics software and leveraging cloud services is imperative for optimizing data analysis capabilities. This targeted approach ensures that the chosen IT infrastructure is not only aligned with the business requirements but also supports the successful integration of BDA.

Build a data-driven culture

Data-driven culture refers to an organizational environment where data is readily accessible and used consistently to drive decision-making processes within the organization. While embracing data, Starbucks grapples with adapting HR practices for its data-driven culture. This could potentially be a point of investigation and adaptation for large Vietnamese F&B enterprises. A data-driven organizational culture should be established for the successful adoption of Big Data Analytics.

Transition of culture must come first with leaders' commitment to embracing data in any aspect of business perspectives, and promoting its use with a clear roadmap guiding towards data-oriented operations. Every member should also have a foundation of data, its application and functionality, which could only be achieved through extensive training and educational programs. C-suite executives must champion data-driven decision-making, investing in infrastructure, training, and data-literacy programs for all employees. Accordingly, tailored training programs should equip employees at all levels with the skills and knowledge to understand, analyze, and leverage data for their specific roles. In the long term, data-driven culture should be continuously fostered within the organization by promoting cross-department data sharing and collaboration to break down silos and enhance overall decision-making.

Iterate and improve continuously

For large Vietnamese F&B enterprises to thrive in the digital age, Big Data Analytics is not a one-time investment, but an ongoing journey. Regular adaptation, based on real-world results and strategic considerations, is key to staying ahead of the curve and meeting ever-changing consumer demands. Given the case of Starbucks, customer behavior has fundamentally shifted due to the outbreak of Covid 19, yet Starbucks continued to leverage on the mound of customer digital information it possessed to create innovative solutions and perform its business exceptionally. Starbucks was, although not born in the digital era, it managed to integrate Big Data Analytics into its core business, and successfully spread the application of it from the upstream to downstream of the business operation.

5.2. For small and medium F&B enterprises

Given the context of Vietnamese SMEs, implementing lessons from the Starbucks case might be impractical due to its limited financial and non-financial resources as discussed above. Nevertheless, successful implementation of big data analysis, both in general and specifically within Starbucks, have highlighted the importance of top management commitment and the essential of an ongoing, gradual process. Hence, two practical lessons are proposed for Vietnamese SMEs as follows.

First, a transition from traditional to data-driven models within Vietnamese SMEs should start with the long-term commitment of top managers to the ongoing BDA implementation. Specifically, their endeavors should focus on fostering an environment in which employees are motivated to adopt data and integrate it to every facet of their work.

Second, drawing from Starbucks' BDA success, Vietnamese SMEs should "*Start Small and Scale Gradually",* which involves focusing on specific and manageable projects, simplifying and customizing the adoption process according to current needs and budgets in the initial stage. Essentially, BDA implementation is an ongoing process and starting small allows businesses to focus on specific and manageable projects, simplifies the learning process and minimizes potential disruptions. For small and medium enterprises opening with limited resources, opting for appropriate

infrastructure or a well-devised strategy from the outset are essential for preparing the organization for the transitions and ensuring optimal work efficiency in the long-run.

6. Conclusion

With the successful integration of big data analytics (BDA) in its core business, Starbucks has fulfilled its relentless commitments to deliver customers with exceptional experience. Upon launching mobile application and reward programs based on data-driven platforms namely Digital Flywheel, Unified Commerce Platform, Starbucks has truly leveraged on the massive amount of data collected to offer tailored recommendations, promotions, and unique experiences to customers. Additionally, the introduction of Atlas for location optimization enables the company to predict demand, manage inventory, and optimize processes, thus minimizing waste and enhancing supply chain efficiency. Big data analytics is also employed to scrutinize ever-changing trends and customer feedback, aiding Starbuck to innovate new goods and services that could resonate with their target audience.

Given the context of the F&B industry in Vietnam, big data analytics applications bring generous opportunities for business improvement, from optimizing operational efficiency and profitability to enhancing customer experience and customer relationships. However, the adoption of this technological advance is also a challenge for Vietnam simultaneously. Hence, for a successful adoption of big data analytics, it is recommended for Vietnamese F&B businesses to first start gradually with a clear vision and goals, then they should prepare for technological readiness, both in infrastructure and organizational culture. Lastly, in the ongoing process of implementation, successful adoption of big data analytics demands constant revisit and improvement with strategic considerations from the company themselves.

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