Leveraging Data Analytics to Enhance Customer Experience in the Food and Beverage (F&B) Industry: A Review of Practices and Strategies

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ABSTRACT

The rapid digital transformation in the food and beverage (F&B) industry requires businesses to continuously adapt to evolving customer expectations, technology integration, and competitive pressures. This review examines how data analytics enhances customer experience in F&B small and medium enterprises (SMEs), particularly within the urban context of Kuala Lumpur. By analysing consumer purchasing behaviour, payment methods, frequently ordered food categories, and customer feedback from delivery applications and social media platforms, data analytics enable businesses to identify emerging patterns, personalise services, and design more effective promotional strategies. Furthermore, data-driven insights improve operational efficiency, strengthen customer relationships, and enhance profitability. This study also proposes a strategic framework for adopting data analytics in the F&B sector, with emphasis on digital transformation, personalised services, and decision-making efficiency. Ultimately, the findings highlight that data analytics is not only a competitive advantage but also a necessity for achieving sustainable customer satisfaction in today's digital economy.

Keywords: Customer Behaviour, Customer Experience, Data Analytics, Digital Transformation, Food and Beverage Industry, Small and Medium Enterprises (SMEs), Personalised Services.

INTRODUCTION

The food and beverage (F&B) industry is undergoing rapid transformation in response to the digital revolution and rising customer expectations. In today's competitive environment, businesses are required to not only offer quality products but also provide seamless and personalised customer experiences (Fang et al., 2023). To achieve this goal, many are turning to data analytics as a strategic tool to gain deeper insights into customer behaviour and improve service delivery.

Data analytics allows businesses to collect, analyse, and interpret large volumes of data using techniques such as descriptive, diagnostic, predictive, and prescriptive analytics (Provost & Fawcett, 2013). When combined with technologies such as artificial intelligence (AI), analytics can uncover purchasing trends and help businesses make more effective decisions (Mahmud et al., 2021; Ali & Harrison, 2022). Despite widespread adoption in sectors such as e-commerce and retail, the use of data analytics in the F&B industry is still growing.

In Malaysia, the rise of digital platforms like GrabFood and Foodpanda, along with the growing adoption of point-of-sale (POS) systems and online reviews, has created new opportunities for F&B businesses to utilise data more effectively (Hasan, Ibrahim & Koh, 2025). However, small and medium enterprises (SMEs) often struggle to harness this data because of limited resources, expertise, and awareness of their strategic value.

This paper aims to examine how data analytics can be used to improve customer experience in the F&B industry, especially among SMEs operating in urban areas. This study also provides insights into consumer patterns and proposes a practical framework for data-driven decision-making in the F&B sector.

Background of Study

In the digital era, the food and beverage (F&B) industry is experiencing rapid growth due to technological advancements and the increasing adoption of data-driven strategies (Fang et al., 2023). Businesses are not only competing in product quality or price, but also in delivering meaningful and personalised experiences. With changing customer expectations and the importance of customer satisfaction, F&B businesses are changing by finding innovative ways to attract and retain loyal customers.

Data Analytics

Data analytics refers to the systematic process of collecting, processing, and interpreting large datasets through statistical techniques, machine learning algorithms, and data visualisation (Provost & Fawcett, 2013). It aims to extract valuable information to support organisations in making more accurate and strategic decisions. Among the types of data analytics commonly used are descriptive analysis (what is happening), diagnostic analysis (why it is happening), predictive analysis (what might happen), and prescriptive analysis (what appropriate action should be taken). According to Mahmud et al. (2021), the use of data analytics in the retail industry allows businesses to offer more personalised services, retain customers and improve operational efficiency (Mahmud et al., 2021). Meanwhile, Ali and Harrison (2022) emphasised that the combination of Big Data and artificial intelligence (AI) allows companies to identify purchasing patterns, customer needs and make strategic decisions more effectively (Ali & Harrison, 2022). Although the context of this study focuses on e-commerce, the approach used is relevant and can be applied in the F&B industry to optimise the customer experience.

In the F&B industry, data obtained through food delivery applications, online ordering systems, point-of-sale (POS) systems, customer feedback, as well as Internet of Things (IoT) devices, such as temperature sensors and inventory monitoring, are important sources for analysis. These data analytics help businesses identify peak purchasing times, best-selling products, location-based customer needs, and consumer behaviour in more detail. Furthermore, this supports the overall digital transformation of F&B by saving costs, time, and increasing competitive advantage (Fosso Wamba et al., 2015).

Enhancing Customer

Customer experience encompasses all touchpoints between customers and businesses, from awareness, purchase process, product usage, to after-sales support (Shaw & Ivens, 2005). In the context of F&B, this experience includes the taste of food, speed of preparation, ease of ordering, digital interaction, and accuracy and efficiency of delivery.

According to Lukita et al. (2023), implementing a digital e-menu system can speed up the ordering process and reduce food delivery errors, thus increasing customer satisfaction (Lukita et al., 2023). The use of AI to analyse customer reviews and social media data also allows businesses to understand customer perceptions in real time, as well as identify issues or needs that require immediate action.

With the help of data analytics, businesses can identify customer preferences, organise targeted promotions based on location or purchase history, and introduce intelligent recommendation systems that suggest menus based on past orders. All of this results in a more personalised and seamless experience, thus fostering customer loyalty and increasing long-term value to the business (Fosso Wamba et al., 2015).

F&B Industry

The food and beverage (F&B) industry in Malaysia is one of the most active and dynamic sectors, supported by consumer demand for convenience and digital interaction. The development of food delivery applications such as GrabFood and Foodpanda, as well as the emergence of virtual restaurants and smart ordering systems, have revolutionised the way food is offered and delivered to consumers (Hasan, Ibrahim & Koh, 2025).

Today's F&B businesses are not just selling food but also selling experiences. Therefore, systems such as interactive digital menus, online table reservations, cashless payments, and data-driven promotions have become essential elements of daily operations. All these systems generate data that can be used to understand customer

behaviour, predict demand, monitor stock, and devise more effective marketing strategies.

Schymanietz, Jonas & Moslein (2022) stated that successful businesses in the digital age are those that not only produce products but also develop a data-driven service ecosystem (Schymanietz, Jonas & Moslein, 2022). Therefore, understanding and applying data analytics is now an important aspect in ensuring the survival and growth of F&B businesses, especially for small and medium enterprises (SMEs) that need to compete in an increasingly challenging and competitive landscape.

Problem Statement

In this fast-paced digital era, the food & beverage (F&B) industry is rapidly evolving in line with the growing demand for convenience, speed, and enhanced customer experiences. Today's consumers no longer only evaluate food quality but also pay attention to aspects of the overall experience, such as the ordering process, customer service, and the suitability of offers to personal needs. Therefore, providing a personalised customer experience has become a necessity, not an option (Ali & Harrison, 2022).

One effective approach to meeting this need is using data analytics, especially by analysing customer purchasing patterns. Data such as order times, favourite products, and payment methods can reveal consumer behaviour patterns that can be used to personalise services and enhance customer satisfaction (Afriyeni et al., 2024). However, most small and medium-sized enterprises (SMEs) in the F&B industry have yet to fully leverage this potential due to constraints such as a lack of skills, use of complex analytical tools, and low awareness of the strategic value of customer data (Hasan, Ibrahim & Koh, 2025).

Furthermore, most previous studies related to the use of data analytics have focused more on the e-commerce and retail industries (Ali & Harrison, 2022), while this study specifically examines how purchasing pattern analysis can improve customer experience in the local F&B industry, which is still very limited. The lack of a suitable local framework makes it difficult for SMEs to convert data into impactful strategies.

Without clear guidance, F&B SMEs are at risk of being left behind in digital competition. Therefore, this study was conducted to identify how purchasing data can be analysed to improve customer experience in the F&B industry in Malaysia, as well as propose an analytical framework that is practical and relevant to the current needs of the industry.

Research Question

As a result of the statement of the research problem above, three research questions were formulated, namely:

1. What are the purchasing patterns in enhancing customer experience in the F&B industry?
2. How can the F&B industry leverage data analytics to improve customer experience in purchasing patterns?
3. What framework can be developed to enhance customer experience through data analytics in the F&B industry based on purchasing patterns?

Research Objective

The main aim of this research was to present enhancing customer experience in the F&B Industry by using data analytics. Hence, the related research objectives are as follows:

1. Identify the customer purchasing patterns in enhancing customer experience in the F&B industry
2. Evaluate the role of data analytics in enhancing customer experience and decision-making based on purchasing patterns.
3. Propose a data analytics framework for enhancing customer experience in the F&B industry by using purchasing patterns.

LITERATURE REVIEW

In the rapidly evolving digital age, the landscape of the food and beverage industry has changed drastically.

Businesses in this sector now face competition that is not only based on price and product quality alone but also depends on the level of customer experience they can offer. Customer experience is now a key indicator in determining the success of an F&B business, particularly in urban areas like Kuala Lumpur, where digitally engaged customers expect a seamless, personalised experience from the first order to post-purchase interactions (Lemon & Verhoef, 2016).

The rise of tech-savvy consumers has pushed F&B businesses to adopt digital platforms like Point-of-Sale (POS) systems, e-menu, delivery apps such as Foodpanda and Grabfood, and social media to stay competitive. These platforms generate a wealth of transactional and behavioural data, including ordering time, payment method, frequently ordered items, and customer feedback. Analysing these purchasing patterns through data analytics allows businesses to understand consumer behaviour and strategically enhance customer satisfaction (Fikry et al., 2024).

Therefore, this study focuses on the digital F&B environment in Kuala Lumpur, using secondary data to explore how purchasing patterns can be analysed to improve customer experience. Businesses that can effectively utilise this data are more likely to remain relevant, responsive, and competitive in Malaysia's digital economy

Data Analytics Concepts

Data analytics refers to the overall process of collecting, cleaning, interpreting and using data to support more accurate and informed decision-making. In today's data-driven business world, data analytics has become a key component in an organisation's digital transformation. According to Mahmud et al. (2021), there are four main categories in data analytics, namely descriptive analytics, which provides a picture of what has happened. The second category is diagnostic analytics, which looks for the reasons behind an event. Next, predictive analytics, which makes predictions about what might happen. Finally, prescriptive analytics suggests the best course of action based on the analysis of the data (Mahmud et al., 2021).

In the retail business industry, the implementation of comprehensive data analytics allows organisations to predict customer demand, adjust inventory and form more effective marketing strategies (Mahmud et al., 2021). Furthermore, in the context of e-commerce, the integration of Big Data and artificial intelligence (AI) enables companies to identify purchasing patterns, determine consumer preferences, and generate automated and personalised product recommendations (Oktaviani et al., 2024). Although the focus of the study is e-commerce, the principles and approaches used are highly relevant in the F&B industry, especially in efforts to improve customer experience based on solid data.

Customer Purchasing Patterns in the F&B Industry

Customer experience in the food and beverage (F&B) industry encompasses various aspects such as food preparation, cleanliness of the premises, ease of ordering, and digital interaction through applications or websites. All these aspects have a direct impact on customer satisfaction levels and their tendency to use the service again or recommend it to others.

According to Lukita et al. (2023), the use of digital menus (e-menus) can speed up the ordering process and reduce errors in delivery, thus improving the smoothness of the customer experience. This technological advancement supports not only operational efficiency but also improves the dynamic between businesses and customers (Lukita et al., 2023). This study also shows that customers tend to place orders faster when using more visual and interactive digital displays. Furthermore, these e-menu systems are often accompanied by automatic recommendation features such as 'add-ons' or 'recommended items', which indirectly influence customer purchasing patterns towards increasing order value.

Meanwhile, research by Oktaviani et al. (2024) emphasises the role of artificial intelligence (AI) in analysing customer purchasing behaviours through online reviews and social media feedback. Such analysis enables businesses to identify service issues more quickly and respond proactively, thereby reinforcing customer trust and satisfaction. More importantly, AI helps detect specific purchasing patterns, including peak hours, frequent orders, and repeat ordering behaviour. These patterns allow businesses to personalise customer experiences

through systems like Customer Relationship Management (CRM), which can offer time-based promotions or loyalty rewards based on an individual's order history by making interactions more relevant and meaningful (Oktaviani et al., 2024).

Overall, these two studies show that investing in digital technologies and behavioural data analysis is no longer optional but essential. Customer purchasing patterns act as a critical foundation for enhancing F&B customer experience, enabling businesses to personalise service delivery, optimise operations, and continuously adapt to evolving customer needs. It is no longer an option, but a necessity in the increasingly competitive F&B landscape.

Peak Hours for Purchasing

Understanding peak buying times is one of the most important components of analysing customer purchasing patterns in the F&B industry. These patterns, such as frequent lunch orders between 12 pm and 2 pm or high weekend demand, can reveal when customers are most active and allow businesses to optimise both service delivery and resource management. According to Oktaviani et al. (2024), the use of artificial intelligence (AI) allows businesses to detect peak demand periods based on historical transaction data, facilitating more effective planning for staff and inventory (Oktaviani et al., 2024).

In addition, when this data is integrated with a customer relationship management (CRM) system, businesses can implement time-sensitive and personalised offers. For example, lunch promotions can be automatically triggered for loyal customers during peak lunch hours, increasing their satisfaction by providing timely and relevant offers. This not only improves business performance but also reinforces the perceived value of the service provided.

Lukita et al. (2023) further emphasise that interactive digital menus help speed up the ordering process during peak periods. By providing automated recommendations and visually appealing displays, customers can make faster decisions, reducing wait times and queue congestion, two key factors that affect the quality of customer experience during peak hours (Lukita et al., 2023).

In short, peak-hour purchasing patterns, when analysed and effectively utilised through technologies such as AI, CRM and e-menus, enable F&B businesses to deliver faster, more relevant and more satisfying customer experiences. These tools transform what can be stressful and congested time into a seamless interaction tailored to the needs of customers.

Order Frequency

Customer order frequency is a key purchasing pattern that reflects customer loyalty and engagement in the F&B industry. According to Oktaviani et al. (2024), artificial intelligence (AI) enables businesses to detect repeat purchasing behaviour from historical transaction data. By identifying customers who order weekly, monthly, or seasonally, businesses gain deeper insights into individual commitment levels, which in turn inform strategies to improve the overall service experience (Oktaviani et al., 2024).

When coupled with customer relationship management (CRM) tools, these insights support segmenting customers into groups such as loyal, occasional, or inactive users. Businesses can then personalise communications and rewards that offer exclusive offers to loyal customers or re-engagement promotions to those with declining activity (Oktaviani et al., 2024). This targeted engagement not only encourages repeat purchases but also increases perceptions of brand care and relevance, contributing positively to customer satisfaction.

Furthermore, as noted by Lukita et al. (2023), user-friendly digital interfaces such as e-menus streamline the ordering process, making it faster and more intuitive. When customers consistently experience convenience and efficiency, they are more likely to return, thus increasing their purchase frequency. Over time, this builds a more consistent and loyal customer base that associates the brand with reliability and convenience (Lukita et al., 2023).

Favorite Menu Types

Identifying the types of food or beverages that customers like the most is an important purchasing pattern in the F&B industry. A study by Oktaviani et al. (2024) shows that the use of artificial intelligence (AI) technology

allows businesses to analyse past order data to identify the most frequently ordered menus (Oktaviani et al., 2024). With this information, management can increase the stock of popular items or create new variations, thus increasing customer satisfaction because their needs are met more accurately.

Knowledge of favourite menus also allows for more targeted marketing strategies. For example, if data shows that coffee-based beverages are most ordered in the morning, promotions such as "Morning Coffee Deals" can be offered at that time. This approach, supported by a CRM system, makes offers more relevant and effective and encourages repeat purchases (Oktaviani et al., 2024).

In addition, according to Lukita et al. (2023), the visual presentation on menus also influences customer selection. Attractive and interactive image displays can highlight certain items and lead to the formation of customer preference trends (Lukita et al., 2023). This combination of data analysis and digital presentation contributes to a more engaging and satisfying customer experience.

Interactive Visuals and E-Menus

Interactive visuals in e-menu systems play a key role in shaping customer purchasing patterns and enhancing the overall experience. According to Lukita et al. (2023), displaying menus with high-resolution images, animations, and additional information such as ingredients or side dish suggestions can increase customer confidence when making a choice. These features not only speed up the ordering process but can also trigger impulsive purchases, especially among mobile app users (Lukita et al., 2023).

In addition to convenience, interactive e-menus also support inclusivity and personalisation. Clear labels such as "gluten-free" or nutritional information displays allow customers with special dietary needs to feel more appreciated. This helps create a more trustworthy and relevant dining experience for individuals (Lukita et al., 2023).

Another major advantage is the ability of e-menus to be updated in real time. As stated by Lukita et al. (2023), this functionality allows businesses to inform customers of stock availability or the latest promotions without having to reprint physical menus. This capability is particularly useful during peak hours as it reduces confusion, speeds up ordering, and contributes to a smoother and more efficient customer experience (Lukita et al., 2023).

Recommendations Based on Purchase History

In today's digital F&B environment, personalised recommendations based on customer purchase history have become an important element in enhancing customer experience. According to Lukita et al. (2023), e-menu systems equipped with functions such as "most frequently ordered" or "other customers also bought" use past order data to automatically suggest complementary items. This facilitates customer decision-making and adds value to the ordering process (Lukita et al., 2023).

Oktaviani et al. (2024) also stated that when AI is combined with a customer relationship management (CRM) system, businesses can offer highly personalised promotions and menu suggestions. By analysing customer purchase patterns and tendencies, the system can suggest items that are compatible with individual tastes and purchasing habits (Oktaviani et al., 2024). This approach makes the customer's experience easier, more relevant and enjoyable.

Furthermore, such personalised recommendations contribute to increased customer loyalty. When customers feel that the system understands their needs and provides accurate recommendations, they are more likely to return to using the service. As stated by Oktaviani et al. (2024), this data-based strategy not only increases satisfaction but also builds strong long-term relationships between customers and businesses (Oktaviani et al., 2024).

The Role of purchasing patterns in enhancing customer experience through data analytics

Understanding customer purchasing patterns, such as order frequency, loyalty to a particular menu, and price sensitivity, provides important insights to improve customer experience in the F&B industry. According to Mittal et al. (2023), analysis of this behavioural data allows businesses to better understand customer expectations and

tailor services to their needs. This includes more personalised pricing strategies, loyalty programs, and menu offerings, thereby making the dining experience more satisfying and relevant (Mittal et al., 2023).

The use of data analytics tools such as customer segmentation also strengthens the decision-making process. Calvo-Porral & Levy-Margin (2017) stated that by grouping customers according to behavioural patterns, businesses can deliver more personalised communications and adjust promotions to be more targeted (Calvo-Porral & Levy-Margin, 2017). This approach makes customers feel more valued, as the offers and services they receive are in line with their purchasing habits.

In addition, machine learning techniques such as Support Vector Regression are used to predict demand based on purchase history and location. According to Ismail & Hooy (2023), this predictive model helps businesses make smarter decisions in inventory management, employee scheduling, and production planning (Ismail & Hooy, 2023). Ismail & Hooy (2023) also show that AI-based systems can optimise delivery times and order accuracy. These data-driven decisions not only improve operational efficiency but also ensure that customers receive faster, more accurate, and more consistent service, especially during peak hours (Ismail & Hooy, 2023).

Targeted Promotions

Targeted promotions tailored to customer purchasing patterns are among the most effective strategies for improving customer experience in the F&B industry. According to Mittal et al. (2023), segmenting customers based on behaviours such as ordering frequency, menu preferences, or price sensitivity allows businesses to offer more relevant and meaningful promotions. Customers who receive offers that align with their interests are more likely to respond positively and make repeat purchases (Mittal et al., 2023).

Technologies such as artificial intelligence (AI) and customer relationship management (CRM) systems allow customer data to be automatically analysed to identify potential segments. For example, customers who frequently order in the morning can be offered breakfast promotions, while customers who frequently order in large quantities can receive bulk discounts. A study by Calvo-Porral & Levy-Margin (2017) supports this approach by stating that marketing personalisation based on behavioural data has been shown to increase campaign effectiveness and promotion redemption rates (Calvo-Porral & Levy-Margin, 2017).

Additionally, the use of automated systems to deliver promotions via mobile apps or customer emails implements targeted promotions more consistently and efficiently. Calvo-Porral & Levy-Margin (2017) also asserted that automation in marketing based on behavioural segmentation not only increases campaign effectiveness but also reduces costs by avoiding sending promotions to irrelevant segments. As a result, customers receive more relevant offers and a more personalised and seamless interaction experience (Calvo-Porral & Levy-Margin, 2017).

Menu and Pricing Optimisation

Customer purchasing pattern analysis plays a key role in menu optimisation and pricing strategies in the F&B industry. Through historical order data, businesses can identify best-selling items, less popular menus, and price points that are sensitive to customers. According to Mittal et al. (2023), understanding customer price sensitivities allows managers to adjust prices without affecting demand, thus maintaining customer satisfaction while silently making strategic adjustments (Mittal et al., 2023).

A study by Ismail & Hooy (2023) shows that the use of machine learning models such as Support Vector Regression can predict sales performance and support more accurate pricing decisions. This model not only considers sales history, but also location factors, allowing prices to be adjusted according to branch or operating area. As a result, businesses can adjust prices more strategically based on the context of the customer's environment, thus increasing relevance and satisfaction with the value offered (Ismail & Hooy, 2023).

In addition, purchasing pattern data can also be used to restructure the menu by emphasising popular items and reducing or replacing less popular items. This approach not only reduces raw material waste and operating costs but also helps customers make faster and more satisfying choices. A study by Ismail & Hooy (2023) confirmed that data-based sales analysis helps management make strategic decisions such as menu adjustments and more

effective production capacity management, all of which contribute to a better and more efficient customer experience (Ismail & Hooy, 2023).

Personalisation and Customer Loyalty

loyalty, and its implementation becomes more effective with the help of collected purchase data. According to Mittal et al. (2023), customer behavioural data such as purchase history and price sensitivity play a key role in developing a truly meaningful loyalty program. For example, rewards can be given based on frequently purchased items or at consistent purchase times and make customers feel valued and understood (Mittal et al., 2023).

In a regional context, a study by Liem et al. (2023) showed that AI-based ordering systems used in Southeast Asian countries have helped personalise services. Through these systems, customers receive recommendations and rewards based on their purchasing habits. This approach not only makes the customer experience more relevant but also strengthens the long-term relationship between the customer and the brand (Liem et al., 2023).

Consistent personalisation also contributes to increased satisfaction and repeat purchases. When customers realise that the system is constantly adapting the experience based on their individual needs, they are more likely to remain loyal and not switch to competitors. Mittal et al. (2023) stated that personalisation based on purchase data increases perceived brand value and drives customer loyalty (Mittal et al., 2023). Liem et al. (2023) also confirmed that AI systems that provide personalised purchase recommendations directly contribute to increased satisfaction and repeat purchases in Southeast Asia (Liem et al., 2023).

Increasing Average Transaction Value

One of the important strategies in the F&B business is to increase the average transaction value per customer. Understanding customer purchasing patterns, promotions and product recommendations can be designed to encourage customers to buy more than was planned. A study by Mittal et al. (2023) showed that implementing upselling and cross-selling strategies based on purchasing behaviour has proven effective in increasing customer order volume (Mittal et al. 2023).

For example, an AI system that suggests “additional drinks” or “combo packages” during the ordering process can indirectly increase purchase volume. Liem et al. (2023) proved that an automated ordering system in the Southeast Asian region successfully implemented this strategy, through product suggestions displayed when customers place an order in the application. This approach not only makes it easier for customers but also triggers impulsive purchases that enhance the digital shopping experience (Liem et al., 2023).

Furthermore, this strategy is supported by interactive visuals in the e-menu that are attractive and convincing. Engaging visual displays help customers make decisions more easily, as well as provide relevant and valuable recommendations. According to Liem et al. (2023), AI-based ordering systems that contain product recommendation functions and interactive visuals have helped drive additional purchases more efficiently, thereby contributing to increased transaction value and overall customer satisfaction (Liem et al., 2023).

Customer Retention Strategies

Attracting new customers is important, but retaining existing customers is more cost-effective and profitable in the long run. Through customer purchase data, F&B businesses can design more targeted and high-impact retention strategies. A study by Calvo-Porral & Levy-Margin (2017) shows that customer segmentation based on behavioural data helps to shape more personalised communications, thus strengthening the emotional connection between customers and brands (CalvoPorral & Levy-Margin, 2017).

In addition, Ismail & Hooy (2023) emphasise that business performance can be predicted in advance through data analysis, including changes in purchase frequency or order value reduction (Ismail & Hooy, 2023). This information allows proactive actions to be taken, such as providing coupons, special promotions, or automatically reactivating customers who have not interacted for a long time. This makes the service more agile and responsive to changes in customer behaviour.

Finally, data-driven loyalty programs provide more meaningful rewards and are aligned with customers' purchasing habits. When rewards are tailored to customers' real needs, they are more likely to stay with the brand. This combination of data-driven strategies and personalised communications provides a solid foundation for building sustainable and ongoing customer loyalty.

The Role of Data Analytics in Enhancing Customer Experience

The use of data analytics allows businesses to understand customer needs and wants more deeply. Through various channels such as online booking systems, mobile applications, customer reviews and social media sites, companies can collect valuable data to form the basis for more focused and impactful strategic decisions.

A study by Abell, Biswas, & Arroyo Mera (2024) shows that digital ordering systems not only make things easier for customers, but also produce detailed data such as ordering patterns, peak times and customer preferences. This data can be used to reorganise staff work schedules, plan special promotions at certain times, and run tailored offers based on customer order history (Abell, Biswas, & Arroyo Mera, 2024).

Meanwhile, Jain et al. (2023) asserted that monitoring customer sentiment through social media allows businesses to detect issues early. Through proactive actions, the company's reputation can be maintained, and customer loyalty levels can be increased (Jain et al., 2023). A study by Oktaviani et al. (2024) also shows that using AI to segment customers and predict behaviours such as customer churn risk allows businesses to implement special offers or loyalty campaigns targeting high-risk groups. The ability to interpret data quickly and accurately is a key advantage for modern F&B businesses in building more effective, consistent and personalised customer experiences (Oktaviani et al., 2024).

Challenges in The Use of Data Analytics

While the use of data analytics in the F&B sector provides many benefits, its implementation also faces several complex challenges. One of the main issues is cost. Investment in technologies such as advanced analytics software, data integration systems, and hiring a highly skilled workforce requires significant financial resources, something that may be difficult for small and medium-sized businesses (SMEs) to achieve (Abell, Biswas, & Arroyo Mera, 2024).

In addition, there are challenges in terms of the quality and completeness of the data collected. Inconsistent or incomplete data can affect analytical capabilities and produce inaccurate results. The issue of silo systems, where data is stored separately on different platforms, can also prevent comprehensive information integration and affect the efficiency of strategic decision-making.

From an ethical and legal perspective, the use of customer data needs to comply with personal data protection guidelines such as GDPR or PDPA. The use of AI and algorithms can also raise issues of bias if not handled transparently and fairly. According to Oktaviani et al. (2024), bias in analytical models can cause some customers to receive disproportionate services or offers, thus eroding trust in the brand. Therefore, implementing a strong data management system, continuous staff training, and adherence to data ethics principles are important steps to ensure that data analytics provides long-term benefits to customers and businesses (Oktaviani et al., 2024).

CONCEPTUAL FRAMEWORK

The conceptual framework of this research is built by combining and adapting key elements customer purchasing patterns to enhance the F&B industries, role of customer purchasing patterns to enhance the F&B industry's profitability, the role of data analytics in enhancing customer experience, challenges in the use of data analytics and the following three major studies relevant to the topic, namely the research by Sukwadi (2015), Latino & Menegoli (2022), and Abu Khalifeh & Mat Som (2012). All three models offer different but complementary approaches to understanding how analytical data can be leveraged to improve customer experience in the food and beverage (F&B) industry.

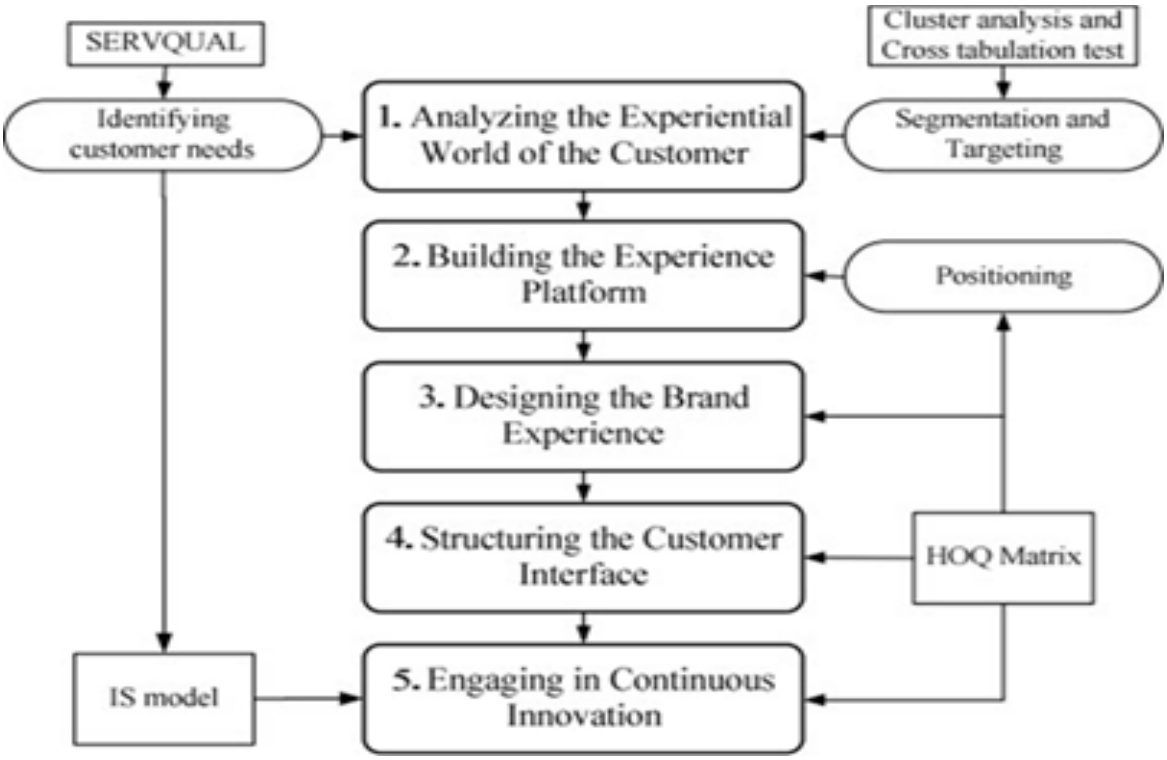
Business Analytics for Data-Driven Decisions

The first model referenced in this research is from Sukwadi (2015), which emphasises the important role of business analytics in helping organisations make better decisions and improve service quality based on customer data (Sukwadi, 2015). In today's digital era, customer data can be obtained from various touchpoints such as purchase records, customer feedback, and user behaviour on websites and mobile applications.

Through the use of techniques such as descriptive analytics and predictive analytics, organisations can identify customer purchasing patterns and their preferences (Sukwadi, 2015). This information is then used to tailor products and services to better align with customer needs. For example, if data shows that customers often buy plant-based foods on weekends, management can offer special promotions during those times.

This data-driven approach not only helps in improving operational efficiency, such as inventory management and resource allocation, but also contributes to a more satisfying overall customer experience. This is because customers feel valued when their needs and preferences are understood and met accurately.

Figure 1. Customer Experience Management (CEM) (Sukwadi, 2015)



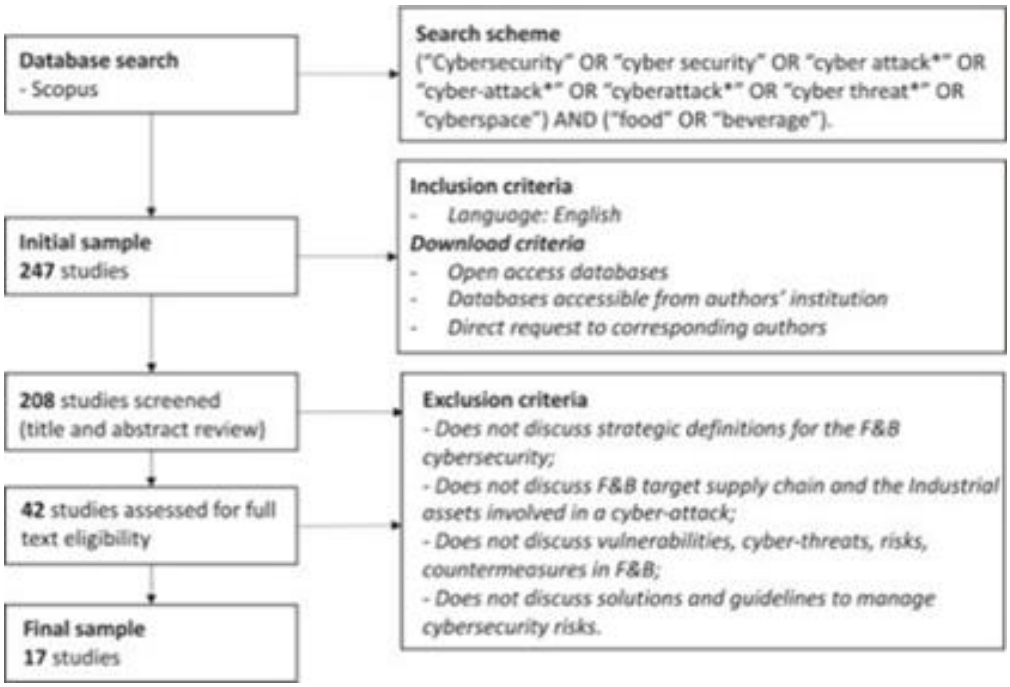
Cybersecurity and Customer Trust

The second model refers to research by Latino & Menegoli (2022), which emphasises the importance of cybersecurity in maintaining customer trust in a brand or digital platform. In an increasingly sophisticated digital environment, customers are now increasingly concerned about the security of their personal information, such as payment data, email addresses, and online behaviour (Latino & Menegoli, 2022).

This research shows that secure digital systems can increase consumer confidence in brands while also having a positive impact on the user experience. This is because when customers are confident that their information is well protected, they will be more open to interacting, making repeat purchases, and sharing feedback without worry (Latino & Menegoli, 2022).

With this, security issues are no longer considered merely technical issues but become an important component of customer experience strategies. For example, the introduction of two-factor authentication (2FA), the use of data encryption, and continuous cyber threat monitoring systems are among the steps that can increase customer trust (Latino & Menegoli, 2022).

Figure 2. Cybersecurity in F&B (Latino & Menegoli, 2022)



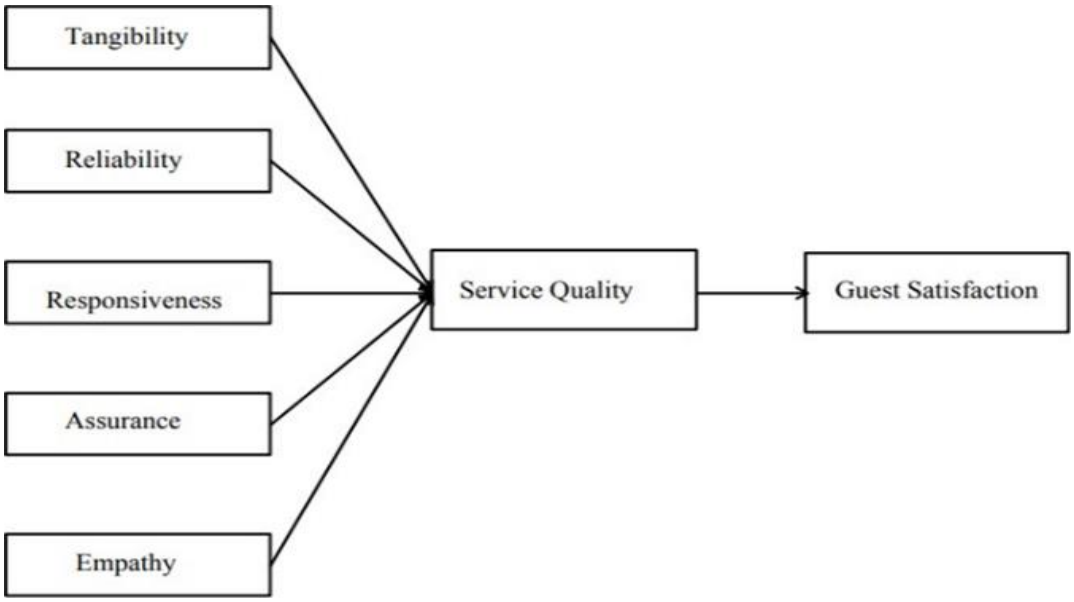
Digital Analytics and Customer Engagement

The third model used in this study is from Abu Khalifeh & Mat Som (2012), which explores how digital analytics, such as sentiment analytics and customer segmentation, can be leveraged to increase customer engagement. The data used in this model is collected from various digital sources such as social media, mobile applications, and online platforms (Abu Khalifeh & Mat Som, 2012).

By analysing this data, businesses can build more personalised and tailored marketing strategies according to specific customer segments. For example, if the analysis finds that customers in their 20s to 30s are more responsive to promotions on Instagram, then the marketing strategy can focus on visual and interactive content on that platform (Abu Khalifeh & Mat Som, 2012).

These analytics also allow businesses to identify customers who are at risk of discontinuing their services, and act early to renegotiate them. This approach not only encourages active interaction between customers and brands but also indirectly builds customer loyalty in the long term (Abu Khalifeh & Mat Som, 2012).

Figure 3. Data Analytics for Customer Engagement (Abu Khalifeh & Mat Som, 2012)



Synthesis of the Model and Research Framework

Based on the three models described, a conceptual framework for the research was formed that combines four main components that are closely related to each other. First, the process of collecting customer data digitally is carried out using mobile applications, websites, and social media. This method allows organisations to obtain a comprehensive picture of customer behaviour, needs, and preferences in real time. Second, the data that has been collected will be processed and analysed using various methods, including descriptive analytics, predictions, and segmentation, to provide a basis for more informative and responsive decision making.

Third, the aspect of customer information security is also given attention through the implementation of a strong cybersecurity system. This is not only important to protect customer sensitive information but also helps build user trust and confidence in the company's digital platform. Fourth, the results of the data analysis are utilised in the implementation of more targeted business strategies that are in line with customer tastes. This includes the production of customised promotional offers, relevant digital marketing campaigns, and improving the quality of service based on user feedback.

The framework is designed to achieve four key outcomes, which are improving service quality, ensuring security and reliability of digital systems, implementing promotions based on consumer preferences, and strengthening customer loyalty in the long term. Overall, the framework not only provides a solid theoretical foundation for this study but also serves as a practical guide for businesses in the food and beverage industry who want to implement a more data-driven and customer experience-focused approach digitally.

RESULTS AND DISCUSSION

Comparison of Three Framework Models Based on Literature

This section is to systematically compare the frameworks for the three models used in this research. This comparison includes elements such as similarities, differences in terms of approaches and technologies used, as well as how the frameworks can be integrated into this research. To strengthen the theoretical foundation, a comparative summary of prior studies (Table 1) shows that existing research explores customer experience management (Sulwadi, 2015), cybersecurity and trust in F&B systems (Latino & Menegoli, 2022; Liem et al., 2023), and data-driven customer engagement (Abu Khalifeh & Mat Som, 2012; Jain et al., 2023). While these frameworks contribute valuable insights into service quality, digital trust, and analytics-driven marketing, they remain fragmented. Few studies integrate operational analytics, cybersecurity, and customer engagement into a unified strategic framework. Furthermore, prior research often focuses on single data sources such as customer reviews, segmentation analytics, or security systems without examining how multi-source data can collectively enhance customer experience on digital F&B platforms. Thus, there remains a research gap in developing a holistic model that merges customer experience management, data analytics, and cybersecurity to drive continuous improvement in digital food-service environments.

Table 1. Comparison of Customer purchasing elements to enhance decision making and customer value

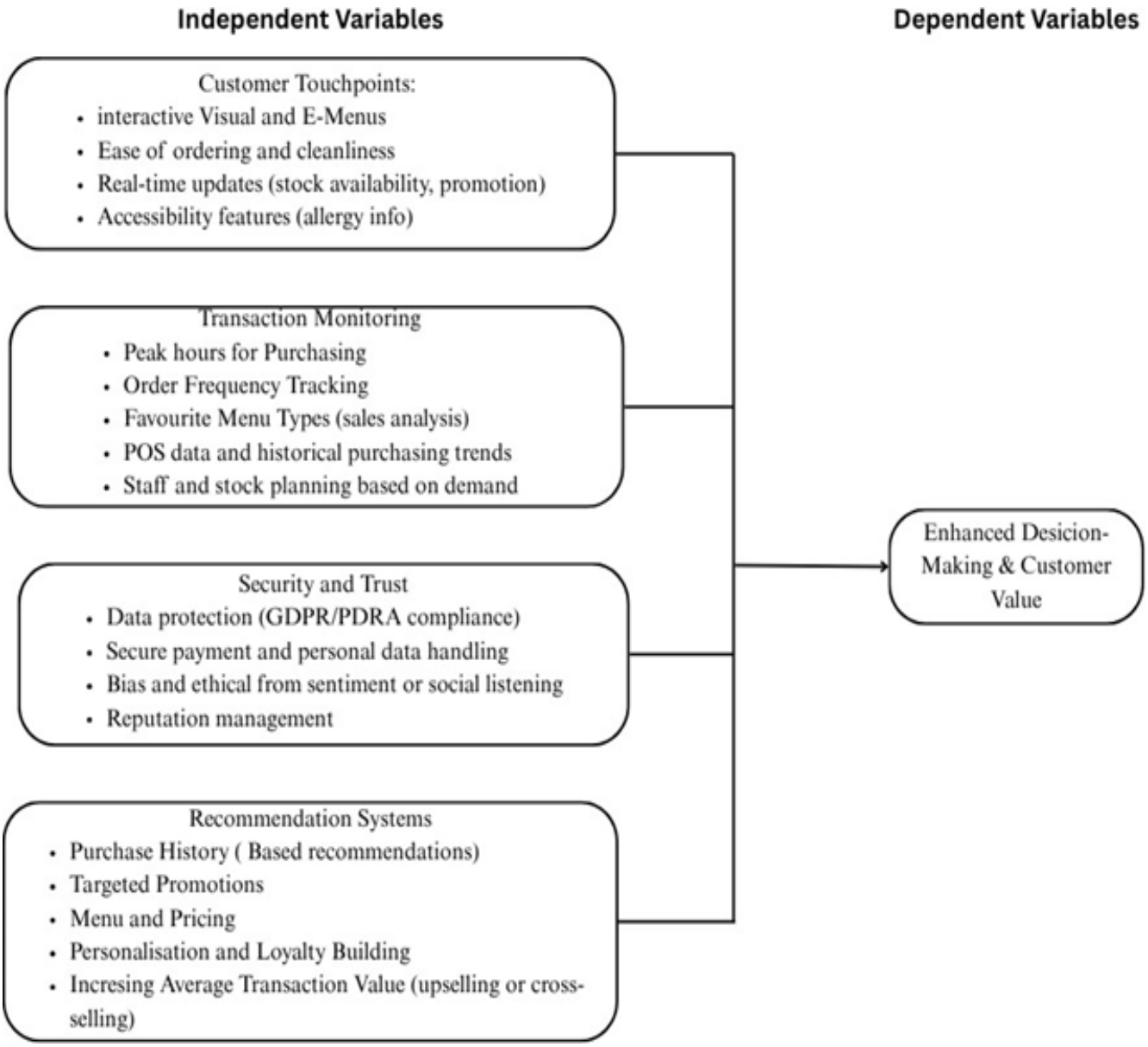
Framework	Author & Year	Similarity	Difference	How the Framework Can Be Integrated
Customer Experience Management (CEM)	Sukwadi (2015)	Both studies emphasise the importance of experience and the use of data in making strategic decisions. Using technology such as customer feedback systems, service quality monitoring, and	Focus on comprehensive customer experience management with a combination of SERVQUAL and Quality Function Deployment models. More operational and	Can be used to identify customer touchpoints in the purchasing and delivery process through food apps (Lukita et al., 2023; Oktaviani et al., 2024). Analysing digital feedback and point-of-sale (POS) transaction data can help build more accurate customer

		analysis of consumer perctions.	focused on restaurants or cafes, The data flow is linear, referring to the level of customer interaction in	experience strategies (Jain et al. 2023). Useful for developing real-time dashboards to monitor satisfaction and delivery times (Abell, Biswas, & Arroyo Mera, 2024). The main goal is to increase customer satisfaction through continuous service system improvement.
Cybersecurity in F&B	Latino & Menegoli (2022)	Demonstrate the connection between digital systems in the F&B industry operations, with direct contact with end users. Using technologies such as IoT, cloud computing, security monitoring systems, and customer data privacy protection.	Focus on information without customer security, directly emphasising the customer experience aspect in the context of services. The data flow starts from user input to security threat detection mechanisms.	Useful for evaluating the security and trust aspects of F&B applications (Oktaviani et al., 2024). Critical for building customer confidence, especially in digital payments and personal data handling (Liem et al., 2023). Can be integrated to support the trust and reliability layer of digital customer experience platforms.
Data Analytics for Customer Engagement	Abu Khalifeh & Mat Som (2012)	Emphasising the capabilities of digital analytics in improving customer understanding, through techniques such as segmentation and sentiment analysis. Including artificial intelligence technologies (AI), data mining, social media, and automated product recommendation systems.	Focus more on marketing strategies to increase customer engagement, rather than the entire delivery process. Data flow is hierarchical from data collection, processing, to personalised promotions.	Based on Purchase History (Lukita et al., 2023; Oktaviani et al., 2024). – Supports personalised promotions through AI and customer relationship management integration (Mittal et al., 2023; Calvo-Porral & Levy-Mangin, 2017). Enable sentiment analysis of the online reviews service (Jain et al., 2023). Main goal: strengthen long-term relationships through data-driven customer segmentation and loyalty enhancement (Liem et al., 2023; Ismail& Hooy, 2023).

CONCLUSION

The proposed framework, by referring to Abu Khalifeh & Mat Som (2012), demonstrates how data analytics can be used strategically to improve customer experience and profitability in the F&B industry. By combining elements such as customer touchpoints, transaction monitoring, security and trust, and recommendation systems, businesses can gain a deeper understanding of customer purchasing patterns and respond proactively. For example, the use of user-friendly digital menus not only simplifies the purchasing process but also allows data to be collected to personalise future offers. Similarly, monitoring sales data can help plan stock and staff more efficiently. All of these elements not only increase customer satisfaction but also contribute to increased sales and customer loyalty, thus positively impacting overall business growth.

Figure 4. Data-Driven Framework for Enhancing Customer Experience in the F&B Industry through Customer Purchasing Pattern Analysis



LIMITATIONS AND FUTURE RESEARCH

The proposed framework is conceptual and requires empirical validation to determine its effectiveness across different F&B contexts. Additionally, the integration of multi-source data raises important data privacy concerns, particularly regarding regulatory compliance and secure data handling, which future research should address through privacy-preserving analytical methods. The increasing reliance on AI-driven personalisation also introduces ethical challenges, including algorithmic bias, transparency, and accountability, warranting further exploration of responsible AI governance in the F&B sector. Moreover, the framework does not consider implementation costs, cybersecurity investments, or workforce capabilities, which may limit adoption, especially among SMEs. Future studies should therefore examine cost–benefit implications, scalable solutions, and supporting policies to enhance the practical applicability of data analytics in improving customer experience.

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