

Predicting Online Vs Offline Preference of the Customers in Choosing Apparels Using Discriminant Analysis

Shwetha S, Dr. Srinivasakumar V

School of Management, SASTRA Deemed to be University

Abstract—The dynamic intersection of online and offline re- tailing has created a shift on how customers adopt to shopping especially when it comes to apparel sector. This research paper attempts to understand the factors that influence a customer in his or her choice of choosing apparels either in online stores or at physical stores. In this study discriminant analysis is used to classify and predict the customer’s shopping habits based on the variables like convenience, price, quality, and variety. The results show distinct behavioral patterns, and highlight the factors determining the customer’s choice. The report offers actionable insights for optimizing multichannel strategies incorporating both traditional advantages and newer digital innovations. This research also bridges the gap between the theoretical frameworks and the practical aspects of understanding a predictive model that aligns with the current consumer trends. This implication is hence broader as it pertained to the academics, practitioners, and policymakers interested in improving customer engagement in an ever-evolving retail environment.

Index Terms—Online shopping, Offline shopping, Apparel, Retail, Customer behavior, Discriminant analysis, Omnichannel retailing

I. INTRODUCTION

The evolution of technology at such a rapid pace has greatly impacted how the consumer interacts with businesses, most specifically in the retail sector. The apparel industry is very crucial to the global economy as it has dramatically trans- formed with the emergence of new online shopping platforms that began gobbling up market shares from traditional brick- and-mortar stores, giving their customers more convenience and many more choices than were found in the latter for price competitive advantages. Offline, though, is relatively strong in its tactile and immersive feel. This is a contrasting scenario of how people shop online versus offline. It offers an interesting area of research to understand why consumers choose one over the other and what drives their choices. The retail sector in the last few years

has had a digital revolution, and the momentum of this revolution is online shopping with consumers. Industry reports indicate that the global online apparel market size is expected to grow at a compound annual growth rate of 10.6%. In the context of online and offline stores, it is relevant to understand the dynamics of customer churn in the apparel sector.

Churn is the rate at which customers stop doing business with a retailer; thus, it directly influences profitability and market share. In online contexts, issues of cart abandonment and lack of loyalty mean that offline stores suffer from fewer footfalls and more intense competition from digital marketplaces. The present study aims to explore the factors related to the impact of customer churn and the differences that exist between online and offline shopping behaviors. The core research problem this study attempted to answer is the growing complexity in customer preference prediction in the apparel sector. It is actually very difficult for retailers to determine what makes the customer stick or leave as an outcome of emerging online and offline channels of shopping. On top of that, this digital revolution blended with conventional retailing practice created an ever-changing environment in the marketplace, making it fundamentally important to understand the intricacies prevailing in consumer behavior. This study will attempt to outline and analyze the prime factors determining customer churn in the apparel industry. Among the most prevalent variables are price sensitivities, quality of products sold, convenience, and the value added by customers themselves. Second, it will discuss shopping behavior in the case of both internet and off-net channels—that would speak of buying patterns wherein purchasing behavior is not different; purchase frequency per transaction as well as the appearance of promotion/discounts effect. This research aims at predicting customer preferences

using advance statistical techniques, namely discriminant analysis, and will, therefore, give actionable insight to retailers regarding the improvements of customer retention strategies. The implications of this research are quite important for stakeholders within the apparel sector. The drivers of customer churn have important implications for online retailers who can learn from understanding the drivers and then utilize strategies to enhance website usability, personalization, and brand loyalty. Off-line retailers can use insights to optimize in-store experiences, deepen community engagement, and offer a differentiating factor from their digital competitors. In addition, the current research contributes to the academic debate on consumer behavior with a more comprehensive analysis of the shift in the retail landscape. Customers should decide their choices under a very dynamic environment of retailing to get the competitive advantage in apparel retailing. Keeping in view the drift of customer's behavior between online and offline shopping, this research study will discuss the determinants of customer churn and retention. Moreover, discriminant analysis involves the integration with customer choices, hence it provides a better framework for forecasting consumer choices. This study further underlines the play of advanced technology and the constantly changing traditional retail methods. Apparel can be a fine case to study how the changes in technology have altered consumers' attitudes and reordered the competition. Retailers need to win in this challenging landscape through help from alignment with the growing needs of customers, loyalty acquisition, and churn avoidance. As the online and offline distinctions between buying blur, the future will demand a hybrid model, blending the best of both worlds, to create an experience seamless and engaging for the customer. This study also highlights the customer-centric approach in today's retail industry. Personalization, convenience, and trust keep recurring as themes that inform consumer choice. Online will excel in providing tailored recommendations and hassle-free transactions, and offline stores will capitalize on the sensory and social experience of shopping. Understanding these nuances allows retailers to craft targeted initiatives that resonate with their audience, ensuring sustained growth and profitability. Beyond the circle of academics, the findings are practically useful to the stakeholders in policy and industry practice. Policymakers can draw insights from these findings

to propose regulations that further consumer welfare, data privacy, and help small and medium-sized enterprises cope with digital trends, therefore nurturing an innovative competitive environment for the apparel sector as it expands. Similarly, industry experts can also learn from the case studies of success or best practices for perfecting and fine-tuning their business models to have a cutting edge over others. Finally, in this paper, it contributes to a deep understanding of consumer behavior relative to the apparel sector. It addresses the intricacies of customer preferences and churn and equips retailers with knowledge and tools to be effective in an increasingly interconnected and competitive marketplace. The insights gleaned from the findings of this research will provide valuable resources for businesses, academics, and policymakers in an increasingly inclusive and dynamic retail ecosystem.

II. OBJECTIVES

1. To find out the most important determinants of consumer's preferences for online versus offline shopping in the apparel retail industry.
2. To develop a discriminant analysis-based predictive model used for the classification and prediction of customer preferences between online and offline shopping channels.
3. To deliver practical recommendations for retailers regarding their multichannel strategy with an aim to increase customer engagement within apparel sector.

III. LITERATURE REVIEW

Digital transformation has changed the shape of consumer behaviour in retail, influencing online and offline purchasing patterns. (Ersatria, 2024) looked at how digital transformation influences customer preference for shopping, discussing how technological advancement and strategic responses have improved customer experience in the channels. The author (Zhao, 2023) used deep learning techniques for demonstrating the technology's easy way of personalization and enhancement of retail journey by analyzing the touchpoints in online. (Barbara, 2011) identified people's preference in choosing online store vs offline stores by considering factors such as, convenience, pricing, and various choice of products that impulse consumers to shop online. On the other hand, traditional stores continue to be preferred choice for the consumers because of their attractive ambience, quality products and

effective communication of the staffs. This divergence underscores the dynamic and yet complementary nature of these two channels, Post purchase experience plays a significant role in making the customers to a loyal consumer and satisfaction. (Neera, 2023) used structural equation model to understand the factors that influence customer satisfaction in online apparel sector. This study highlights the importance of exchange policies, quality products and on time delivery thus gaining a long-term trust in ecommerce platforms. These findings align with broader trends in enhancing customer experience in a competitive retail market. The main factor that influences customer behaviour is promotional strategies. (Hang, 2022) studied the effects of online promotional strategies that create a customer value, and he finds that aggressive promotions often create short term sales but may have a long-term customer loyalty if it is done in a right manner. This research suggests a need for balanced promotional strategies to sustain customer relationships while driving conversions. Predictive models are one of the important tools for understanding customer preferences. (Alireza, 2024) illustrates the effectiveness of personalized content-based methods in predicting the preference of the customers in online apparel sector. This study highlights the role of algorithms in tailoring recommendations, improving the shopping experience, and boosting sales. Likewise, (Baoshen, 2023) constructed a two-tower gated transformer model to predict the customer churn in logistics, showcasing the growing reliance on machine learning for consumer behaviour analysis. (Sana, 2016) studies about the customer preference in showrooming (viewing the products in-store but purchasing the product in online) and webrooming (viewing the product in online but buying in physical stores). This research found that trust, convenience, and deals are the main factors for webrooming, while showrooming is driven by the attractive experience and desire to compare the physical product attributes before making online purchase. To add with (Davis, 2022) examined how shopping experience and store attributes influence apparel retail format preference, the significance of aligning retail strategies with customer expectations. (Yan, 2023) mainly focused on apparel shopping; he analyzed customer preferences in online shopping. This study examined the factors such as easy navigation, detailed product descriptions, and size recommendations are very important for online

apparel sectors, then only they can gain their competitive edge. Additionally, he studies on format preferences that highlights the increasing need to integrate offline and online platforms to meet the customer needs without any hazels. A considerable amount of research has been undertaken on consumer behavior in online and offline shopping, but still several gaps remain unattended in the context of the apparel sector. Most of the studies focused on individual aspects such as consumer's motivations, customer satisfaction, or channel-specific strategies. However, not much research integrates a predictive model to classify and analyze customer preferences across both channels. To add with, the structural equation modeling and regression analysis have been employed as the most-used techniques for understanding customer behavior; yet the application of discriminant analysis for forecasting customer preferences about the apparel industry is scarcely seen. The current existing studies does not explore how information factors like convenience, pricing, sensory experience, as well as brands' confidence exert a conspicuous effect on the choice of shopping formats concerning multichannel retailing. In this regard, the research is set to fill this gap by using discriminant analysis, coming up with a strong model that can classify customer preferences about offline versus online shopping; this also addresses the lack of context-specific insights regard to the apparel sector and should provide retailers with implications that what types of design they have use to address and satisfy the needs of the consumers.

IV. METHODOLOGY

A. *Research Design*

Quantitative research with a descriptive and predictive focus is used in this study. The main purpose of this research paper is to understand the factors that influence the customer preference for choosing online versus offline apparel shopping and predict the preferences using statistical modeling. Cross-sectional design is used since the data was collected at a single point in time.

B. *Sampling Methodology*

The dataset is gathered from Kaggle, hence there is no actual sampling was done. However, it is assumed to represent consumer behaviours across diverse demographic and behavioural traits. Overall, 300 individuals were taken as sample size.

C. Data Collection

The data was collected from Kaggle. The dataset includes sections like demographic details, shopping preferences, and factors influencing customer’s decisions like convenience, quality of the product, price, ease of exchange and customer services. The main aim was to monitor the online and offline to ensure the inclusion of a diverse respondent base.

D. Tools and Techniques Used

Discriminant analysis is used in this study to determine the factors that significantly discriminate between online and offline shopping preference. This analysis is performed by using Python tool. Data processing was made to handle the missing data (if any), for scaling the numerical variables and to encode the categorical ones. Exploratory data analysis was made to summarize statistics, correlation analysis and visualizations. Accuracy scores was calculated to find the best fit model for predicting the customer’s preference.

E. Dependent and Independent Variables

The dependent variable in this study is Shopping preference which is Online or Offline. The independent variables in this study includes the demographic factors like age, gender, income, education, shopping behaviours like frequency of online and offline purchase, motivational factors, and satisfaction level of the customers like the quality of the products, convenience, pricing, ease of exchange and customer service.

F. Statistical Analysis

In this study, descriptive statistics was performed to find out the mean, median, standard deviation for continuous variables like age, income, and the frequency distribution for categorical variables like gender, preferred shopping modes. Correlation analysis is used to identify the relationships between variables. Discriminant analysis is used to predict the outcome which is the preference of the customer based on independent variables. Statistical significance testing is made to determine which predictors significantly impact the preference of the customers. The plot used for visualizations are bar chart, histogram, scatterplots, and box plots for feature distribution and relationships.

Linear Discriminant Analysis (LDA) achieved an accuracy of 84.44%, while Quadratic Discriminant Analysis (QDA) achieved 83.33%. Figure 1 illustrates the accuracy comparison. The bar chart shows that LDA has a slightly higher classification accuracy than QDA, making it more suitable for this dataset.

B. Scatter Plot Analysis

A scatter plot (Figure 2) visualizes the clustering of online and offline preferences based on discriminant features.

The clusters in the scatter plot indicate strong separation between online and offline preferences, with minor overlaps. These overlaps suggest borderline cases where additional features or advanced preprocessing may improve classification.

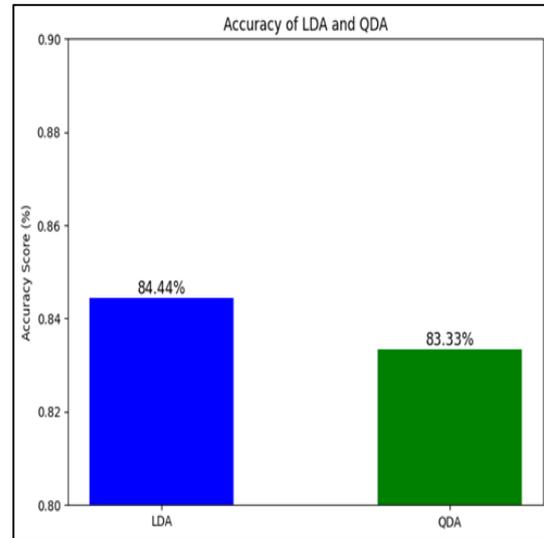


Fig. 1. Accuracy comparison of LDA and QDA.

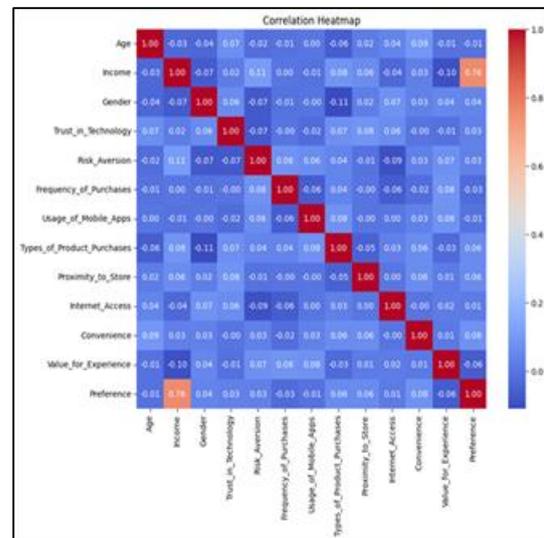


Fig. 2. Scatter plot of discriminant features.

V. RESULTS

A. Accuracy of LDA and QDA

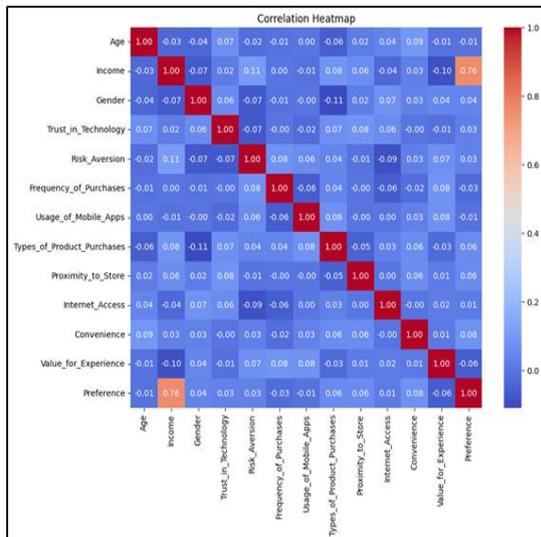


Fig. 3. Correlation matrix of variables.

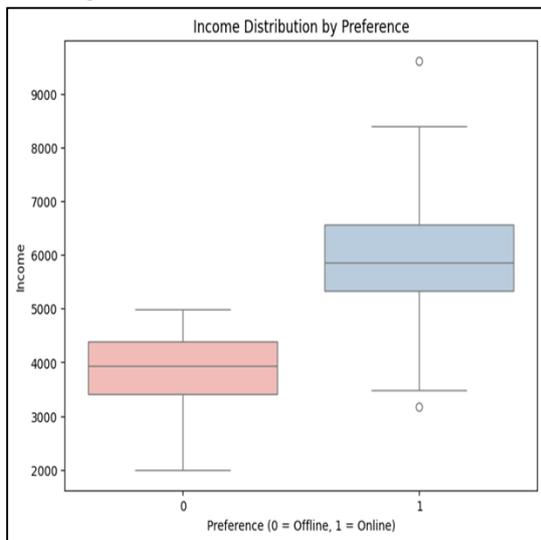


Fig. 4. Box plot showing spending habits of online and offline shoppers.

C. Correlation Matrix

Figure 3 displays the correlation matrix, which highlights relationships between variables. The correlation matrix shows that variables like price and convenience are positively correlated, supporting their relevance in discriminant analysis.

D. Box Plot Analysis

Figure 4 illustrates the variability in spending habits between online and offline shoppers. The box plot reveals that online shoppers tend to spend less on average but show greater consistency, while offline shoppers display a wider range of spending patterns.

VI. FINDINGS AND DISCUSSIONS

The findings of this research bring out the huge intricacy of consumer behavior in the apparel sector, with stress on online versus offline shopping preferences and customer churn determinants. This approach has brought out the variables that influence customer preferences through discriminant analysis, thus giving good insight into the changing dimension of retailing. There were different preferences among online and offline shoppers. Online buyers seem to emphasize convenience, price competitiveness, and variety. They want to shop anywhere and at any time—a largely strong reference for switching to online shopping. Besides, algorithm-driven personal recommendations and targeted promotions attract many users towards online shopping. Despite this, buyer churn in the online segment is, however, influenced by concerns for product-on-hand touch-and-feel experience, trust in product quality, data-security problems. On the other hand, offline shopping presents the other side of the coin and speaks to different sets of consumer priorities. Physical examination of products and firsthand experience of wearing garments before purchase builds confidence and satisfaction. Besides, the whole concept of social interaction in shopping—whether by interacting with sales consultants or shopping with groups—injects an element of human touch that clicks with many buyers but cannot find expression in an online platform. Shopping centers or offline retailers meanwhile have gigantic worry over declining foot traffic, increasing competition with e-commerce portals and increased overhead operational costs. Customer churn is impacted by several universal factors: price sensitivity, convenience, product quality, and customer service across both selling channels. The study found that impending cart abandonment rates indicate an urgent need for online retailers to address issues of trust and improve the usability of their websites. Improved delivery, return policies, and clarity of communication are critical in the fight against abandonment rates. Whereas offline retailers face the challenge of adjusting to customers’ changing expectations. Creating interesting in-store experiences, providing exclusive deals, integrating technology to streamline shopping interactions—this would offset churn, in part. The research looks further into the impact of promotional activities and loyalty programs. While the online stores win on targeted campaigns and personalized offers, offline retailers have an upper hand with localized

promotions and community engagement in keeping their loyal customer base. Programs like the Star Program and Magic Stick serve as examples of incentives for repeat purchases aimed at establishing long-term relationships. A fundamental insight from the study is the increasing overlap between online and offline shopping behaviours. A consumer may opt for a hybrid shopping style whereby he does product research online and actually goes everything offline-only to make a purchase, or he researches offline and goes online to make the purchase. This is perhaps an indication that the future of retail is in creating an integrated experience wherein both channels become one, such as a customer picking up their orders placed online from a physical store and virtual trial runs for customers who shop online. Thus, the theoretical implications clearly show that customer-centric strategies based on diverse preferences are necessary for retailers. For instance, technology investments in online retailing should rather focus on facilitating consumer personalization, establishing trust, and logistics enhancements, while offline retailing should develop capabilities to differentiate between stores, as well as develop community ties. In this case, it provides knowledge to the regulators regarding building a balanced regulatory environment wherein new devices for the competition in the apparel business can thrive. In summary, as per the discussion, the dynamic alterations of consumer preference from time to time give birth to unlearning and relearning in the apparel sector. Retailers need to make headway against market fluctuations by building competence through aligning strategies with consumer expectations as well combining both the stronger assets from online and brick-and-mortar outlets to truly become what they ascertain as resilient force for sustainable growth.

VII. CONCLUSION

The study highlights the dynamics of customer preferences in the apparel sector and indicates that the experiences have a dual nature - online and offline. It has carried out a very critical analysis of churn factors in terms of price sensitivity, convenience, and customer service, and these indicate that the motives vary for consumers with each type of channel. Thus, the ease of accessibility and personalized recommendations make it preferable to go online and reduce costs. Offline stores are adept at delivering sensory engagement,

instant gratification, and social interaction. The discriminant analysis used in this paper was successful in predicting customers' preferences. It builds a strong framework to explain the determinants of customer's behaviour. Such information equips retailers with opportunities to fill gaps between their online and offline channels while building a hybrid model of customer satisfaction and loyalty. Overall, the paper argues that the behaviour of apparel consumers is dynamic because the technological factors, changed lifestyle, and market factors may change their behavior pattern constantly. So, retail performance must be constantly alert to maintain competitiveness as well as growth.

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