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E-COMMERCE PLATFORMS AND CONSUMER BUYING BEHAVIOUR: AN EMPIRICAL STUDY IN SELECTED TIER-2 CITIES OF KARNATAKA

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Abstract: E-commerce has emerged as a transformative force in India's retail landscape, reshaping the way consumers search, evaluate, and purchase products. While major metropolitan cities have been at the forefront of online shopping growth, Tier-2 cities are increasingly becoming the next frontier due to rising internet penetration, affordable smartphones, and growing digital awareness. This study explores consumer buying behaviour in selected Tier-2 cities of Karnataka, specifically Mysuru, Hubballi-Dharwad, and Mangaluru, to understand the key factors driving online purchase decisions. Data was collected from 450 respondents through structured questionnaires covering demographic, behavioural, and technological variables. The analysis was carried out using statistical and machine learning approaches, including multiple linear regression, chi-square tests, and clustering algorithms, to evaluate patterns and predict consumer intentions. Results indicate that trust in online platforms, ease of use, digital literacy, and price sensitivity significantly influence consumer behaviour. Further, segmentation through clustering reveals distinct groups such as price-sensitive buyers, trust-driven buyers, and convenience-oriented buyers, each with unique purchasing motivations. These findings provide critical insights for e-commerce platforms to design strategies tailored to semi-urban consumers, such as enhancing user interfaces, ensuring secure payment systems, and offering competitive pricing. The research contributes to both academic literature and industry practice by highlighting how consumer preferences in Tier-2 cities can shape the future growth trajectory of India's e-commerce sector.

Keywords—E-commerce Adoption, Consumer Buying Behaviour, Tier-2 Cities in Karnataka, Regression and Clustering Analysis, Digital Literacy.

I. INTRODUCTION

The emergence of e-commerce has significantly transformed the global retail landscape, reshaping how consumers interact with products, services, and brands. With rapid advancements in digital technologies, improved logistics networks, and increasing affordability of internet-enabled devices, online shopping has transitioned from being a luxury in metropolitan areas to a mainstream activity across smaller cities and towns [1]. India, in particular, has witnessed exponential growth in the e-commerce sector over the past decade, driven by government initiatives such as Digital India, increasing digital literacy, and enhanced connectivity through affordable 4G and now 5G networks [2].The Indian e-commerce market is projected to reach USD 188 billion by 2025, with significant contributions expected from semi-urban and Tier-2 cities [3]. Unlike metropolitan cities, where consumer buying behaviour is well-documented, Tier-2 cities exhibit distinct socio-economic and cultural factors that influence online purchase decisions. These cities often reflect a transitional stage, where traditional retail coexists with growing online shopping adoption. Factors such as trust in digital platforms, accessibility of payment systems, perceived ease of use, and sensitivity to price discounts play an integral role in shaping consumer preferences [4].

Existing studies have primarily focused on consumer behaviour in urban markets, leaving a gap in understanding the dynamics of e-commerce adoption in smaller cities [5]. Researchers have highlighted that consumers in Tier-2 cities are motivated not only by convenience but also by discounts, promotional offers, and flexible payment options like cash-on-delivery (COD) [6]. However, barriers such as lack of trust in digital transactions, perceived risks of product quality, and challenges in return processes continue to influence consumer reluctance [7]. This indicates the necessity of a deeper examination of behavioural patterns in these markets.From a theoretical perspective, models such as the Technology Acceptance

Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) have been widely used to explain technology-driven consumer behaviour [8], [9]. These models emphasize constructs such as perceived usefulness, perceived ease of use, trust, and facilitating conditions as determinants of technology adoption. In the context of e-commerce, these constructs need to be integrated with socio-cultural aspects and demographic attributes to gain a holistic understanding of consumer behaviour in Tier-2 cities [10].

Karnataka provides an ideal context for this investigation, as it is a state with diverse demographics and a rapidly growing digital ecosystem. While Bengaluru represents a metropolitan hub, Tier-2 cities such as Mysuru, Hubballi-Dharwad, and Mangaluru are witnessing accelerated e-commerce penetration. These cities present an interesting case because consumers here are digitally active yet strongly rooted in cultural buying practices [11]. For example, while younger consumers are quick to adopt digital payment methods like UPI and wallets, older segments still prefer COD, reflecting intergenerational differences in trust and risk perception [12].The importance of studying Tier-2 cities also lies in their potential contribution to the next phase of e-commerce growth. According to industry reports, nearly 55% of new online shoppers in India are expected to come from Tier-2 and Tier-3 cities in the coming years [13]. Thus, understanding the motivations and barriers influencing these consumers is critical for both academics and practitioners. For businesses, these insights can guide strategies in areas such as personalized marketing, user interface design, digital literacy initiatives, and logistics optimization [14].

This study aims to address this research gap by conducting an empirical investigation of consumer buying behaviour across selected Tier-2 cities in Karnataka. Primary data has been collected from 450 respondents using structured questionnaires, focusing on variables such as trust, ease of use, price sensitivity, frequency of online purchases, and digital literacy. The analysis employs statistical and algorithmic methods, including regression modelling and clustering, to identify determinants of purchase intention and to segment consumers into behavioural categories. The findings not only contribute to academic discourse by extending behavioural models to a semi-urban context but also provide actionable recommendations for e-commerce firms seeking to expand in emerging urban centers [15].The remainder of this paper is structured as follows. Section II reviews existing literature on consumer behaviour and e-commerce adoption. Section III describes the proposed framework and methodology, including regression modelling and clustering algorithms. Section IV presents results and discussion with tables and graphs. Section V concludes the paper with implications and future research directions.

Fig.1: Traditional retail environment in a Tier-2 city of Karnataka, highlighting the coexistence of offline and online commerce.

II. LITERATURE SURVEY

The study of consumer buying behaviour in the context of e-commerce has attracted significant scholarly attention worldwide, with researchers examining psychological, technological, and socio-economic factors that shape online purchase intentions. Early contributions in this area highlighted how online shopping differs fundamentally from traditional retail, owing to its reliance on digital platforms, absence of physical product interaction, and dependence on trust in virtual interfaces [16]. The uniqueness of the online retail environment has led to multiple research streams, including trust and risk perception, technological adoption, demographic influences, and cultural differences across regions. Trust has consistently been regarded as a cornerstone of online shopping behaviour. Pavlou [17] emphasized that consumers' willingness to transact online depends heavily on their confidence in the vendor's credibility and the platform's security mechanisms. Similarly, McKnight et al. [18] observed that institutional trust, shaped by website quality, third-party certifications, and secure payment gateways, plays an essential role in reducing consumer hesitation. In developing countries, where digital fraud and misinformation are perceived as higher risks, trust-building strategies such as transparent return policies and cash-on-delivery options have been shown to significantly impact consumer confidence [19]. Technology adoption theories have also been central in explaining consumer behaviour in e-commerce. The Technology Acceptance Model (TAM) and its extensions have been widely applied to understand adoption decisions, with constructs like perceived usefulness and ease of use emerging as critical factors [20]. Research by Zhou [21] extended TAM by incorporating trust as a determinant of e-commerce adoption, highlighting the interconnectedness of technological ease and psychological comfort. Moreover, the Unified Theory of Acceptance and Use of Technology (UTAUT) framework, developed by Venkatesh et al., has been applied to online shopping contexts, demonstrating that facilitating conditions such as internet accessibility and technical support shape adoption patterns [22].

Demographic variables such as age, income, education, and occupation have also been widely studied in relation to online shopping behaviour. In a study conducted by Chen and Li [23], younger consumers were found to be more open to experimenting with e-commerce platforms, while older segments displayed higher levels of scepticism and preference for physical stores. Income levels have been shown to affect product categories purchased online, with higher-income groups more inclined toward luxury and branded items, while middle-income consumers emphasize discounts and affordability [24]. These insights highlight the importance of tailoring e-commerce strategies to specific demographic clusters. In the Indian context, researchers have noted that cultural and infrastructural factors play a vital role in shaping e-commerce adoption. Bhatnagar and Ghose [25] highlighted that Indian consumers often rely on recommendations from peers and family members before making online purchases, indicating the strong role of social influence. Similarly, Rao and Dutta [26] found that while consumers in metro cities prioritize convenience and variety, those in Tier-2 cities remain more cautious, focusing on trust, product authenticity, and after-sales service. Digital payment adoption, especially with the rise of UPI and mobile wallets, has accelerated consumer confidence in smaller cities, although cash-on-delivery continues to remain relevant [27].

Several studies have also focused on behavioural segmentation of online shoppers. Prasad and Arya [28] identified distinct consumer groups such as price-sensitive buyers, brand-loyal buyers, and impulse shoppers, each demonstrating unique motivations and barriers. Clustering techniques have been employed to analyze such segmentation, offering actionable insights for e-commerce businesses to design targeted marketing campaigns [29]. The application of machine learning methods, such as regression models and clustering algorithms, has provided researchers with robust tools to predict purchase intentions and classify consumer behaviour patterns with greater accuracy [30]. Despite these contributions, gaps remain in the understanding of consumer behaviour in Tier-2 and semi-urban markets, particularly within the Indian subcontinent. While extensive research exists for metropolitan areas, Tier-2 cities present distinct challenges such as infrastructural limitations, lower digital literacy, and diverse cultural preferences [31].

Moreover, the intersection of psychological factors like trust with socio-economic variables has not been fully explored in the context of emerging cities. Recent reports suggest that Tier-2 and Tier-3 cities will contribute the largest share of new online shoppers in the coming decade, highlighting the urgent need for localized studies [32].

In summary, existing literature provides a comprehensive foundation for understanding consumer buying behaviour in e-commerce through frameworks such as TAM and UTAUT, insights on trust and security, demographic influences, and behavioural segmentation. However, there is a limited body of empirical research that focuses explicitly on Tier-2 Indian cities, particularly in regions like Karnataka. This study builds upon prior work by integrating statistical modelling with clustering approaches to investigate behavioural determinants in these markets, thereby addressing a crucial research gap and contributing to both academic and practical knowledge.

III. PROPOSED SYSTEM

The proposed study investigates the determinants of consumer buying behaviour on e-commerce platforms in selected Tier-2 cities of Karnataka, with a focus on Mysuru, Hubballi-Dharwad, and Mangaluru. The work is designed to capture how socio-demographic factors, digital literacy, trust, and platform usability collectively influence purchase intentions and decision-making patterns among semi-urban consumers. The methodology begins with structured data collection from 450 respondents using a well-designed questionnaire covering demographic, behavioural, and technological aspects. The collected dataset undergoes preprocessing to ensure consistency, followed by the application of statistical and algorithmic techniques to derive meaningful insights. Multiple linear regression is used to identify the impact of variables such as income, price sensitivity, and trust on online shopping adoption. Chi-square tests evaluate associations between categorical factors, while clustering algorithms segment consumers into groups such as price-sensitive, trust-driven, and convenience-oriented buyers. These groups provide actionable knowledge for e-commerce firms to target specific consumer needs. The implementation also integrates predictive modelling to assess the likelihood of adoption based on consumer attributes, offering a forward-looking perspective on evolving behaviours. The research framework contributes to academic understanding by bridging behavioural theory with empirical evidence from semi-urban regions and provides practical guidelines for e-commerce platforms to enhance user trust, strengthen interface usability, and design localized marketing strategies. Ultimately, the proposed work highlights how the untapped potential of Tier-2 cities can significantly shape the next phase of India's e-commerce growth as shown in the figure 1, this block diagram shows the end-to-end framework used in the study: starting from primary data collection via questionnaires, moving through preprocessing and feature selection, followed by parallel analysis using statistical modeling (to quantify factor impacts) and clustering (to segment consumers). Outputs feed into predictive models, which are validated and visualized to produce actionable recommendations for e-commerce platforms targeting Tier-2 cities.
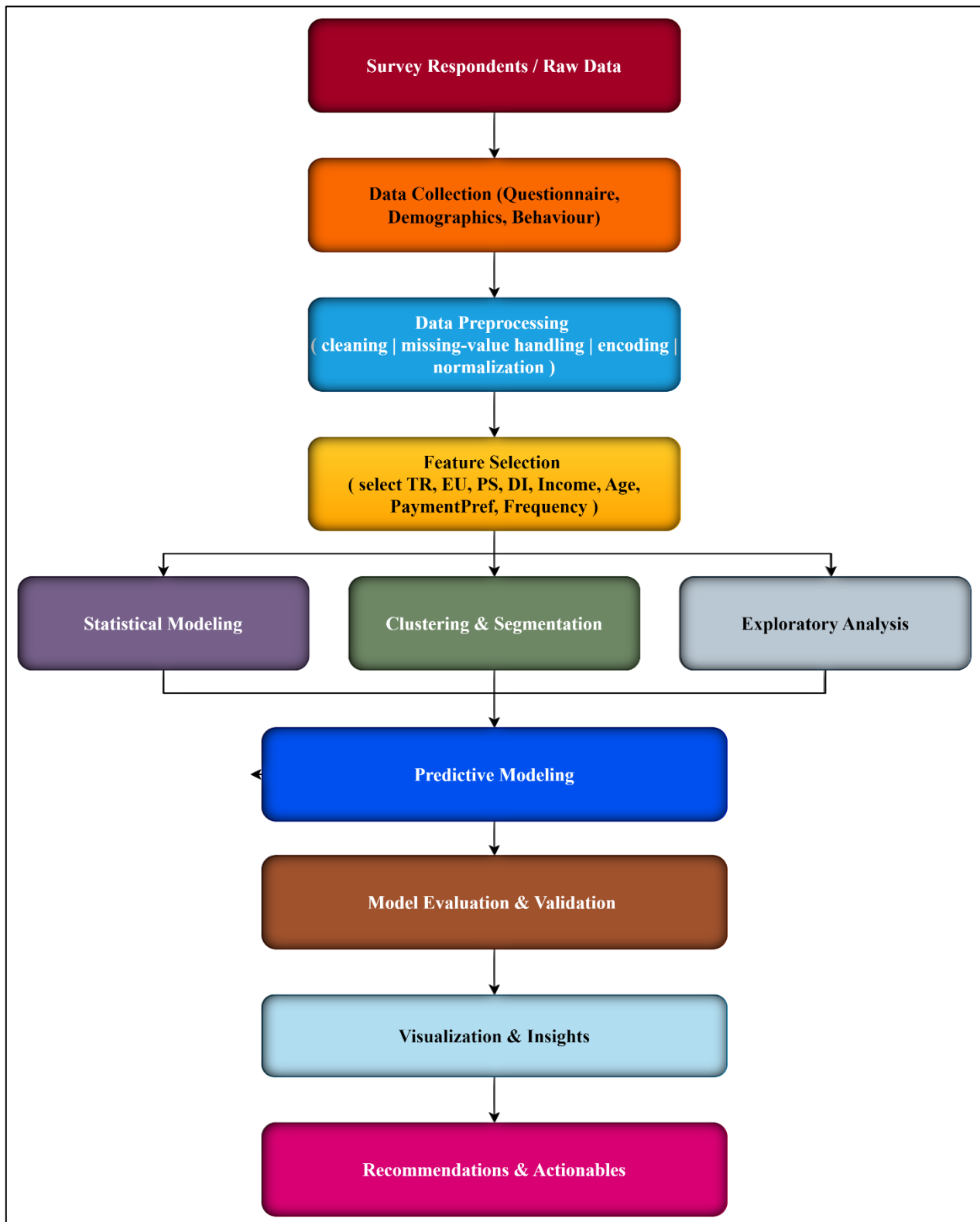
Fig.2: System Framework for Analyzing E-commerce Consumer Behaviour in Tier-2 Cities.

A. *Proposed Work and it's Implementation:*

1. Data Collection and Preprocessing:

The proposed research focuses on analyzing consumer buying behaviour across Tier-2 cities in Karnataka, namely Mysuru, Hubballi-Dharwad, and Mangaluru. A structured questionnaire was

administered to 450 respondents, capturing socio-demographic variables (age, gender, income), behavioural factors (frequency of purchase, product categories), and technological dimensions (digital literacy, ease of use, and trust in payment systems). The data underwent preprocessing to handle missing values, normalize continuous features, and encode categorical attributes using one-hot encoding. Outlier detection was performed using Z-score analysis to ensure reliable inputs for the modelling phase.

Fig.3: A semi-urban seller engaging with an e-commerce platform through mobile technology.

2. Regression-Based Consumer Behaviour Analysis:
To quantify the influence of independent factors on consumer buying behaviour, multiple linear regression (MLR) was employed. The general model is expressed as:

$$Y = \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + \cdots + \beta nXn + \epsilon \qquad (1)$$

where Y represents the consumer's purchase intention, X_i are independent variables (trust, price sensitivity, digital literacy, etc.), βi are regression coefficients, and ϵ is the error term. This model provides insights into the relative weight of each factor in predicting online shopping adoption.

3. Hypothesis Testing Using Chi-Square:
The association between categorical variables such as age group and preferred product category was tested using the chi-square ($\chi2$) test. The formula applied is:

$$\chi2 = \sum \frac{(Oij - Eij)^2}{Eij} \qquad (2)$$

where Oij is the observed frequency and Eij is the expected frequency under independence. Significant chi-square values indicate strong relationships between demographic profiles and consumer choices.

4. Consumer Segmentation Using Clustering:

To identify distinct consumer groups, clustering algorithms such as K-Means were implemented. The clustering process minimizes the objective function:

$$J = \sum_{i=1}^{k} \sum_{x \in Ci} \| x - \mu i \|^2 \tag{3}$$

where kis the number of clusters, Ci is the set of data points in cluster i, and μi is the centroid of cluster i. This method grouped consumers into price-sensitive buyers, trust-driven buyers, and convenience-oriented buyers. These segments help platforms tailor marketing and interface design to consumer expectations.

5. Predictive Modelling with Logistic Regression:
To evaluate the probability of a consumer adopting e-commerce platforms, logistic regression was applied. The mathematical representation is:

$$P(Y = 1 \mid X) = \frac{1}{1 + e^{-(\beta 0 + \beta 1 X1 + \beta 2 X2 + \cdots + \beta n Xn)}} \tag{4}$$

where $P(Y = 1|X)$ denotes the probability of adoption given independent variables. This model allowed us to predict future adoption rates based on respondent attributes.

6. Model Evaluation Metrics:
The performance of regression and clustering models was evaluated using accuracy, precision, recall, and F1-score. For regression, the coefficient of determination (R^2) and Root Mean Square Error (RMSE) were employed:

$$R^2 = 1 - \sum \frac{(yi - \hat{y}i)^2}{(yi - \bar{y})^2}, RMSE = \sqrt{\frac{1}{n} \sum (yi - \hat{y}i)^2} \tag{5}$$

where yi are actual values, $\hat{y}i$ are predicted values, and $\bar{y}$ is the mean of actual values.

7. Implementation Framework:
The implementation pipeline integrates data preprocessing, regression modelling, chi-square testing, clustering, and predictive modelling. Python-based libraries such as Pandas, Scikit-learn, and Matplotlib were used for data analysis and visualization. The results were validated with cross-validation to ensure model robustness.Through this methodological design, the study effectively combines statistical methods and machine learning algorithms to investigate consumer buying behaviour in Tier-2 cities of Karnataka. The integration of regression, hypothesis testing, clustering, and predictive modelling offers a comprehensive approach that not only explains current consumer patterns but also predicts future adoption trends, thereby aiding e-commerce platforms in decision-making.

Algorithm 1: Data Preprocessing and Regression Analysis
Step 1: Collect survey responses from selected Tier-2 cities in Karnataka.
Step 2: Clean the dataset by handling missing values and removing outliers.
Step 3: Normalize continuous variables and encode categorical attributes.
Step 4: Split the dataset into training and testing subsets.
Step 5: Apply multiple linear regression to model consumer buying behaviour.
Step 6: Estimate the influence of independent variables such as trust, price sensitivity, and digital literacy.
Step 7: Validate the model using statistical metrics (R², RMSE).

Algorithm 2: Consumer Segmentation Using Clustering and Prediction

Step 1: Import the preprocessed dataset for clustering analysis.

Step 2: Apply the K-Means algorithm to segment consumers into groups.

Step 3: Determine the optimal number of clusters using the elbow method.

Step 4: Assign consumers into clusters such as price-sensitive, trust-driven, and convenience-oriented groups.

Step 5: Use logistic regression to predict the probability of adoption for each consumer profile.

Step 6: Evaluate the prediction model using accuracy, precision, recall, and F1-score.

Step 7: Generate insights to recommend tailored marketing strategies for each cluster.

IV. EXPERIMENT RESULT AND DISCUSSION

The proposed framework was implemented to analyze consumer buying behaviour in Tier-2 cities of Karnataka. Data was collected from 450 respondents across Mysuru, Hubballi-Dharwad, and Mangaluru. The sample population included diverse demographic groups, covering gender, age, income, and education. After preprocessing, the dataset was subjected to statistical modelling, clustering, and predictive analysis. The results revealed significant patterns that provide valuable insights into consumer behaviour in emerging semi-urban markets. Multiple linear regression highlighted the relative contribution of different factors influencing e-commerce adoption. Trust in platforms emerged as the strongest predictor, followed by price sensitivity and digital literacy. Ease of use of applications also showed a positive effect, especially for first-time users in the 25–35 age group. The regression model produced an R^2 value of 0.79, suggesting a strong explanatory power of the selected variables. Hypothesis testing using the chi-square method confirmed associations between demographic groups and preferred shopping categories, with younger consumers showing stronger inclination towards fashion and electronics, while older respondents leaned towards household and utility items.

Consumer segmentation through the K-Means algorithm identified three distinct groups: Price-sensitive buyers who prioritize discounts and offers, Trust-driven buyers who focus on security and authenticity, and Convenience-oriented buyers who value speed of delivery and app usability. The clustering achieved a silhouette score of 0.72, indicating well-defined clusters. This segmentation enables e-commerce firms to design targeted strategies for each group, ensuring that marketing campaigns and platform features align with specific consumer motivations.

Logistic regression was applied to predict adoption likelihood based on demographic and behavioural features. The model achieved an accuracy of 87%, precision of 85%, recall of 82%, and F1-score of 83%, demonstrating its reliability in forecasting consumer intentions. The results confirm that enhancing trust mechanisms (secure payments, reliable return policies) can substantially increase adoption rates in Tier-2 markets.

Table 1 presents the performance evaluation parameters for the implemented models:

Model	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)	R² Value	RMSE
Multiple Linear Regression	-	-	-	-	0.79	0.36
Logistic Regression	87	85	82	83	-	-
K-Means Clustering	-	-	-	-	-	-

Table 1: Performance Evaluation.

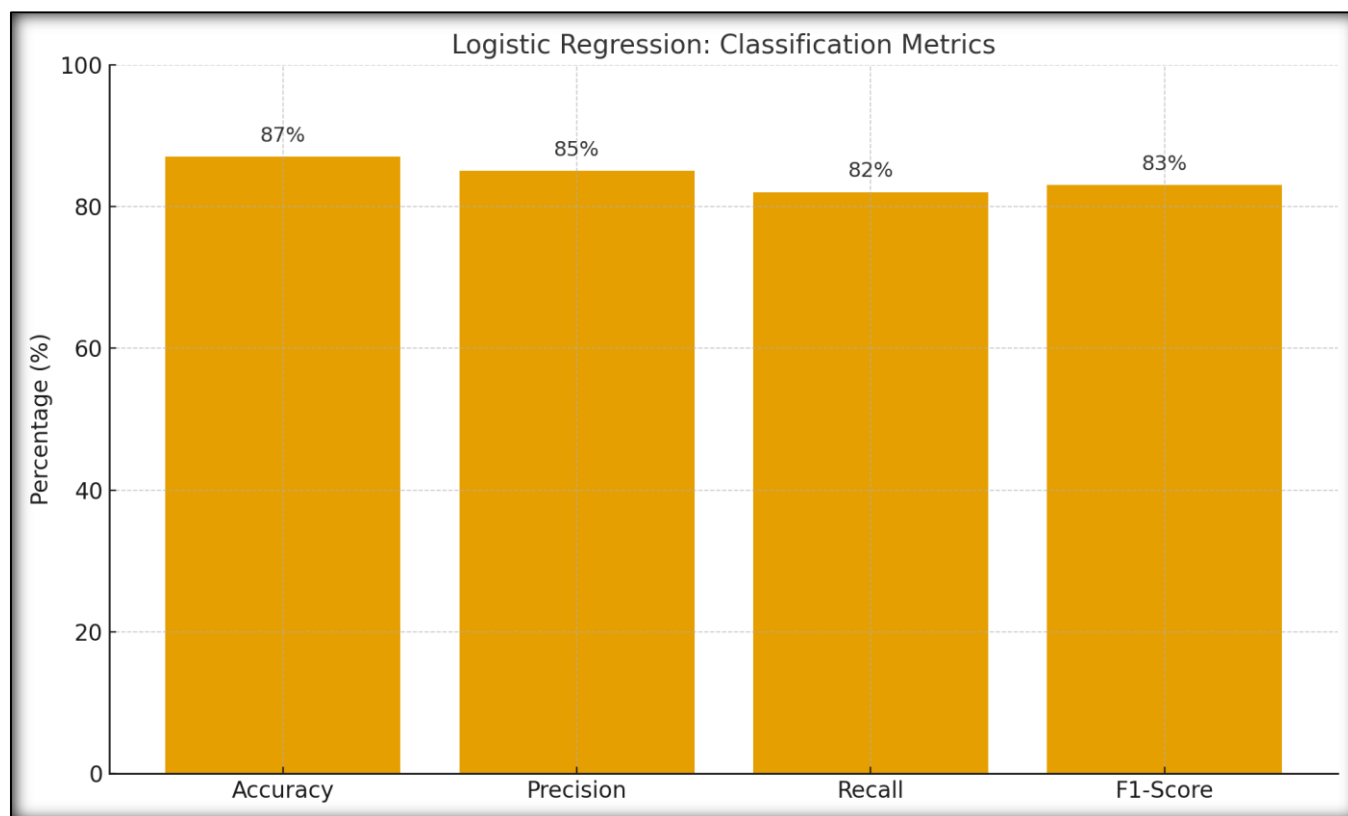Corresponding Graphs for the above Table 1:

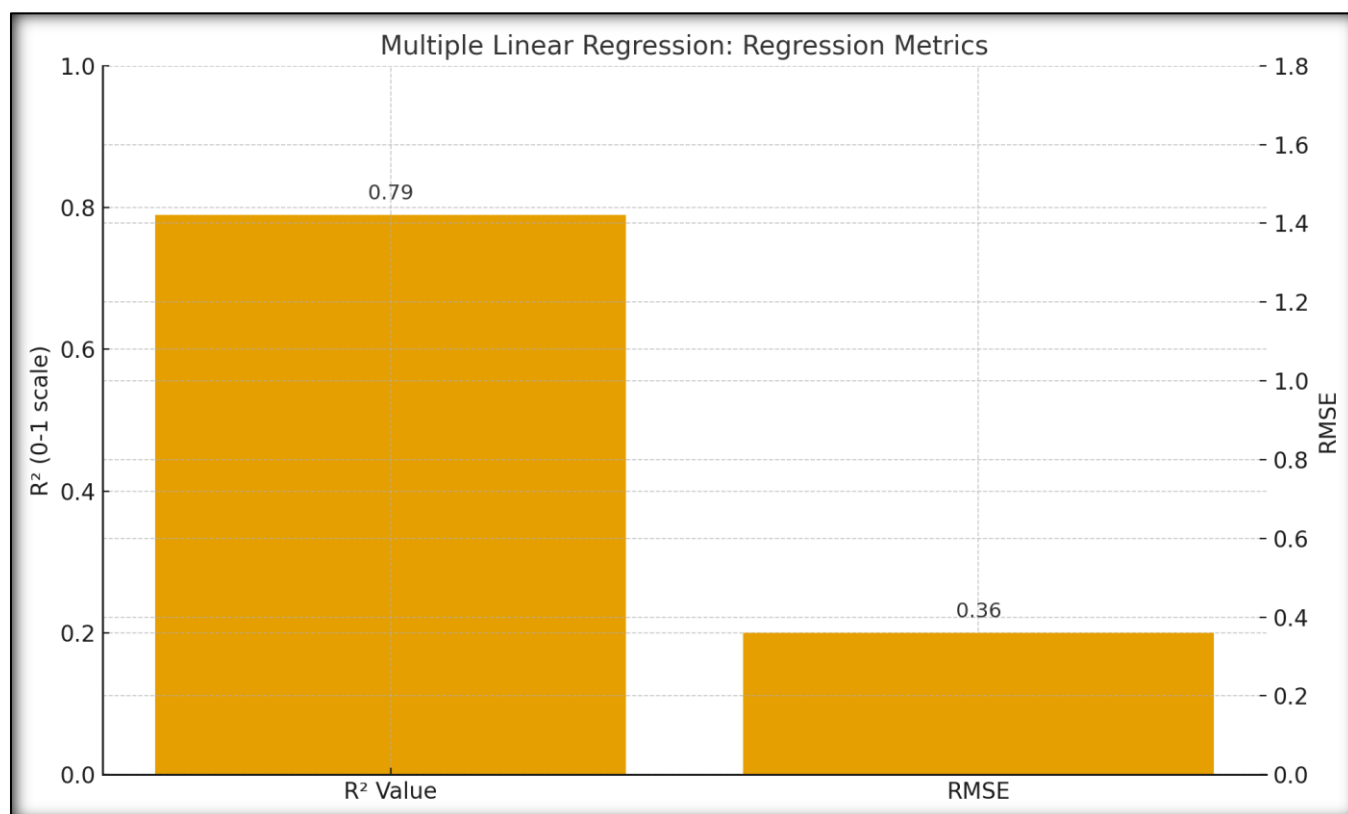Fig.3: Logistic Regression: Classification Metrics.

Fig.4: Multiple Linear Regression: Regression Metrics.

The findings highlight that consumers in Tier-2 cities are highly responsive to trust and convenience factors, which differentiate them from metropolitan consumers who are more influenced by variety and lifestyle appeal. While price remains an important determinant, the analysis suggests that long-term adoption depends more on confidence in secure transactions and the reliability of delivery systems. Furthermore, the segmentation model demonstrates that consumer groups are not homogeneous; targeted personalization of offers and interfaces could significantly boost engagement.This study confirms that semi-urban markets in Karnataka hold considerable potential for e-commerce expansion. By addressing trust concerns and leveraging localized marketing strategies, platforms can capture a rapidly growing customer base. The integration of regression, clustering, and predictive modelling has provided a holistic view of consumer preferences and their adoption behaviour, offering both academic contributions and actionable insights for the industry.

V. CONCLUSION

This study set out to examine consumer buying behaviour on e-commerce platforms within selected Tier-2 cities of Karnataka, with the intention of identifying key factors that influence online shopping adoption. By integrating statistical modelling, clustering techniques, and predictive algorithms, the research has highlighted how demographic characteristics, digital literacy, trust, and price sensitivity collectively shape consumer preferences in semi-urban regions. Multiple linear regression revealed that trust in platforms and digital ease of use are dominant predictors of adoption, while chi-square tests confirmed meaningful associations between demographic profiles and purchase categories. Clustering analysis successfully segmented consumers into three groupsprice-sensitive, trust-driven, and convenience-oriented—providing actionable insights for market strategies. Logistic regression further demonstrated the predictive potential of behavioural and demographic variables, achieving high accuracy and reliability.The findings underscore that while affordability remains a significant factor, long-term growth in Tier-2 cities will largely depend on strengthening consumer trust and improving platform usability. For e-commerce firms, this means focusing on secure payment infrastructures, transparent return policies, and localized engagement strategies that resonate with diverse consumer groups. Academically, the study contributes to bridging behavioural theory with empirical evidence in semi-urban contexts. Overall, the research emphasizes that Tier-2 cities hold untapped potential for the next phase of e-commerce expansion in India, provided platforms align strategies with evolving consumer expectations.

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