International Journal of
DATA SCIENCE AND IOT MANAGEMENT SYSTEM
Peer Reviewed, Referred & Indexed Journal
ISSN: 3068-272X www.ijdim.com Original Research Paper

E-COMMERCE CONSUMPTION ANALYSIS AND PREDICTION

[1] V Soujanya, [2] G Karthik, [3] G Tejaswini , [4] G Venkata Sandeep
[1]AssistantProfessor, [234]Students
Department of Data Science
Siddhartha Institute of Technology & Sciences, Narapally
vsoujanya.cse@siddhartha.org.in, 23TQ1A6701@siddhartha.co.in, 23TQ1A6704@siddhartha.co.in, 23TQ1A6759@siddhartha.co.in,

ABSTRACT

The E-Commerce Consumption Analysis and Prediction system is a data-driven application designed to analyze online purchasing behavior and predict future consumption patterns. E-commerce platforms generate large amounts of transactional data through customer orders, products, prices, quantities, payment methods, locations, and purchase dates. Analyzing this information can provide valuable insights into customer preferences and purchasing trends.

The proposed system collects and processes e-commerce transaction data containing attributes such as customer ID, product category, product price, quantity, order date, payment method, location, and total purchase value. Data preprocessing techniques are applied to remove duplicate records, handle missing values, correct inconsistent data, and prepare the dataset for analysis. The cleaned data is then used for exploratory and predictive analysis.

The system performs consumption analysis to identify frequently purchased products, popular categories, customer spending patterns, revenue trends, and purchasing frequency. It can analyze sales according to product categories, customer segments, geographical locations, and different time periods. Interactive dashboards, charts, graphs, and KPI cards provide an easy way to understand e-commerce consumption behavior.

The prediction module uses historical transaction data and selected features to estimate future sales or consumption patterns. Machine Learning techniques can be applied to identify relationships between customer behavior, product demand, purchasing frequency, and transaction value. The prediction results can support inventory planning, sales analysis, and business decision-making.

Overall, the proposed system converts raw e-commerce transaction data into meaningful insights and predictive information. It can help businesses understand customer consumption patterns, monitor sales performance, and improve planning. Future enhancements can include personalized product recommendations, customer segmentation, demand forecasting, fraud detection, dynamic pricing analysis, and real-time consumption prediction.

I. INTRODUCTION

E-commerce has transformed the way customers purchase products and services. Online shopping platforms process a large number of transactions every day, generating information about customers, products, prices, quantities, orders, payment methods, and delivery locations. This data provides valuable opportunities for understanding consumer purchasing behavior.

Consumer purchasing patterns can vary depending on product category, price, season, location, customer preferences, promotions, and previous purchase history. Understanding these patterns is important for businesses because it can help them plan inventory, improve product availability, and analyze sales performance.

International Journal of
DATA SCIENCE AND IOT MANAGEMENT SYSTEM
Peer Reviewed, Referred & Indexed Journal
ISSN: 3068-272X www.ijdim.com Original Research Paper

Traditional e-commerce systems mainly focus on product browsing, order processing, payment, delivery tracking, and customer management. Although these functions are necessary, basic transaction systems may provide limited analytical capabilities. Businesses may need separate spreadsheets or reporting tools to analyze large volumes of transaction data.

Data analytics provides techniques for examining customer transactions and identifying meaningful patterns. Descriptive analytics can calculate total sales, average order value, purchase frequency, popular products, and category-wise performance. Visualization tools can represent these metrics through dashboards and charts, making complex information easier to understand.

Machine Learning can extend traditional e-commerce analytics by predicting future consumption and identifying customer behavior patterns. Predictive models can use historical transactions to estimate product demand, customer purchasing trends, or future sales. The proposed system combines data preprocessing, consumption analysis, visualization, and Machine Learning-based prediction to provide a centralized analytical platform.

II. LITERATURE SURVEY

E-commerce data analytics has become an important area of research because online platforms generate extensive transactional and customer data. E-commerce datasets commonly contain information about customers, products, quantities, prices, dates, categories, locations, and order values. Researchers and businesses analyze these datasets to understand purchasing behavior and sales performance.

Descriptive analytics is commonly used to summarize e-commerce transactions. Metrics such as total revenue, total orders, average order value, quantity sold, and purchase frequency provide an overview of business performance. These metrics can be grouped by product category, customer segment, location, or time period for detailed analysis.

Customer behavior analysis is another important area in e-commerce research. Customers may have different purchasing frequencies, spending levels, product preferences, and ordering patterns. Customer segmentation techniques can divide customers into meaningful groups based on purchasing behavior and transaction characteristics.

Product and consumption analysis can identify frequently purchased products and high-demand categories. Market-basket analysis can also be used to identify products that are frequently purchased together. These insights can support product placement, cross-selling, inventory planning, and recommendation systems.

Time-series analysis and Machine Learning techniques are increasingly used for demand and sales prediction. Historical transaction data can be used to identify seasonal patterns and forecast future consumption. Algorithms such as Linear Regression, Decision Trees, Random Forest, Gradient Boosting, and time-series models can be evaluated for suitable prediction tasks.

Modern e-commerce analytics platforms combine data processing, visualization, customer analytics, recommendation systems, and predictive modeling. Interactive dashboards allow users to examine sales and consumption patterns using filters and visualizations. The proposed E-Commerce Consumption Analysis and Prediction system follows this approach by integrating transaction analysis, customer and product insights, visualization, and predictive capabilities.

III. SYSTEM ANALYSIS

International Journal of
DATA SCIENCE AND IOT MANAGEMENT SYSTEM
Peer Reviewed, Referred & Indexed Journal
ISSN: 3068-272X www.ijdim.com Original Research Paper

The E-Commerce Consumption Analysis and Prediction system is designed to process online transaction data and generate useful consumption insights. The system accepts information such as customer ID, product category, product price, quantity, order date, payment method, location, and total order value. The input dataset is first validated to ensure that required fields and supported formats are available. A preprocessing module removes duplicate transactions and handles missing, invalid, or inconsistent values. Date and numerical fields are standardized to support accurate analysis. Feature engineering creates useful attributes such as purchase month, weekday, customer spending level, purchase frequency, and order value. The analytics engine calculates total sales, total orders, average order value, quantity sold, and purchase frequency. Product and category analysis identifies popular products and high-demand categories. Customer analysis examines purchasing behavior, spending patterns, and customer segments. Trend analysis identifies changes in consumption across different time periods. Visualization components present results through charts, graphs, tables, and KPI cards. A Machine Learning module can be trained using historical transaction data to predict future consumption or product demand. The final system displays analytical insights and prediction results through an interactive dashboard.

Existing System

Existing e-commerce platforms primarily focus on product browsing, shopping-cart management, order processing, payment, and delivery services. These systems maintain transaction records that can contain valuable information about customer purchases and product performance. However, basic e-commerce systems may provide limited capabilities for detailed consumption analysis. Businesses may depend on spreadsheets or separate reporting systems to analyze historical transaction data. Manual analysis of large datasets can be time-consuming and difficult to maintain. Identifying frequently purchased products may require additional calculations. Customer spending patterns and purchasing frequency may not be easily visible through standard transaction reports. Seasonal consumption trends can also be difficult to identify without dedicated analytics tools. Traditional systems may provide sales reports but limited interactive visualization. Predicting future product demand or customer consumption may require separate Machine Learning applications. Data from different sources may also need to be combined manually before analysis. These limitations create a need for an integrated system that combines e-commerce consumption analysis, visualization, and prediction.

Disadvantages of Existing System

- Limited consumption analytics.
- Manual preparation of business reports.
- Difficult to analyze large transaction datasets.
- Limited customer purchasing insights.
- Difficult to identify popular products automatically.
- Limited product-category analysis.
- Seasonal trends may be difficult to identify.
- Limited interactive dashboards.
- Manual comparison of customer segments.
- Limited predictive capabilities.
- Demand forecasting may require separate tools.
- Data may be distributed across multiple systems.

International Journal of
DATA SCIENCE AND IOT MANAGEMENT SYSTEM
Peer Reviewed, Referred & Indexed Journal
ISSN: 3068-272X www.ijdim.com Original Research Paper

Proposed System

The proposed E-Commerce Consumption Analysis and Prediction system provides a centralized platform for analyzing online transaction data and predicting future consumption patterns. Users can upload historical transaction datasets or connect the application to an authorized e-commerce data source. The system validates the incoming data and performs preprocessing to remove duplicates and handle missing, invalid, or inconsistent records. Date and numerical attributes are standardized for reliable analysis. Feature engineering creates useful attributes such as purchase month, customer spending category, purchase frequency, and average order value. The analytics module calculates important KPIs including total revenue, total orders, quantity sold, average order value, and purchase frequency. Product and category analysis identifies popular products and high-demand categories. Customer analysis provides insights into spending patterns and purchasing behavior. Trend analysis examines consumption changes across days, months, seasons, and other time periods. Interactive dashboards present results using KPI cards, charts, graphs, tables, and filters. The Machine Learning module can use historical data to forecast future consumption or product demand. Overall, the proposed system integrates e-commerce analytics and predictive modeling into a unified decision-support platform.

Advantages of Proposed System

- Provides centralized e-commerce consumption analysis.
- Automates transaction-data preprocessing.
- Calculates important business KPIs.
- Identifies popular products and categories.
- Analyzes customer purchasing behavior.
- Supports customer segmentation.
- Identifies consumption trends and patterns.
- Provides interactive dashboards.
- Supports time-based sales analysis.
- Reduces manual reporting effort.
- Supports future demand prediction.
- Provides a foundation for recommendation systems.

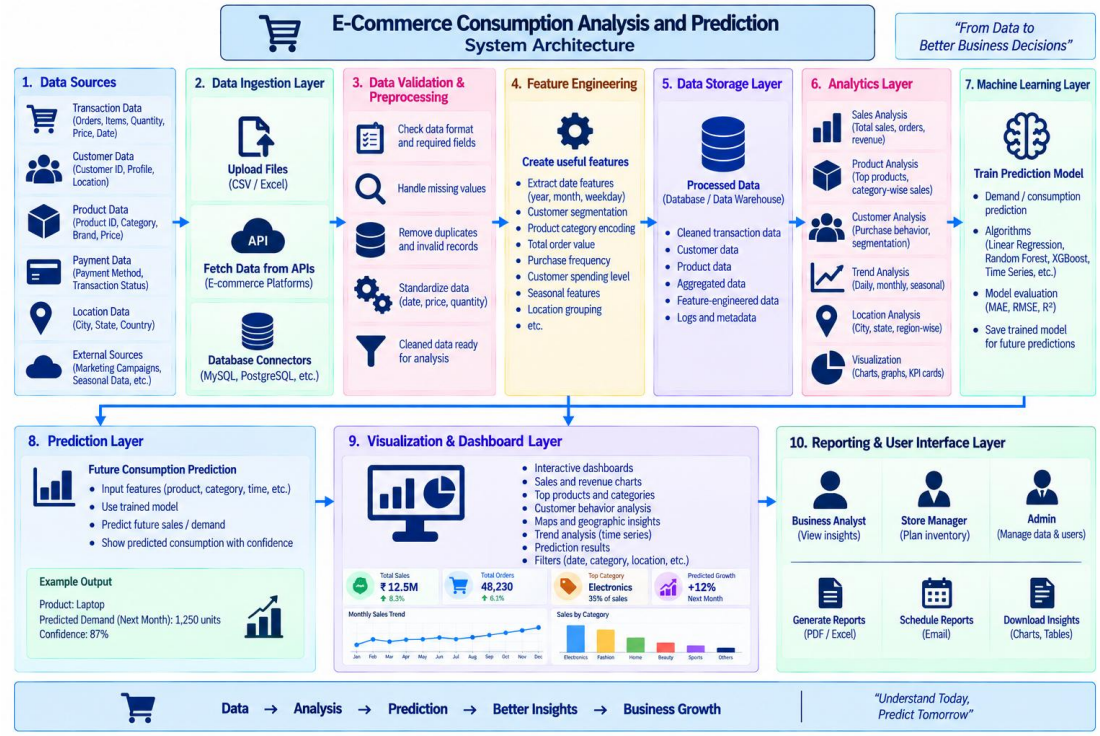
IV. METHODOLOGY

The methodology begins with collecting historical e-commerce transaction data from an authorized dataset, database, or application source. The collected data is validated to check its structure, required fields, data types, and completeness. Data preprocessing is performed to remove duplicate records and handle missing, invalid, and inconsistent values. Numerical fields such as price, quantity, and order value are standardized when required. Date fields are transformed into useful attributes such as year, month, weekday, and season. Feature engineering is performed to generate customer spending level, purchase frequency, average order value, and other relevant features. Exploratory Data Analysis is conducted to understand overall consumption and purchasing patterns. Product and category analysis is performed to identify frequently purchased products and high-demand categories. Customer analysis is used to examine spending patterns, purchase frequency, and customer segments. Time-based analysis identifies consumption trends and seasonal variations. Visualization techniques present the results through bar charts, line graphs, pie charts, tables, and interactive dashboards. Machine Learning models can then be trained using historical

International Journal of
DATA SCIENCE AND IOT MANAGEMENT SYSTEM
Peer Reviewed, Referred & Indexed Journal
ISSN: 3068-272X www.ijdim.com Original Research Paper

transaction features to predict future consumption or product demand. The model is evaluated using suitable prediction metrics before generating final prediction results.

SYSTEM ARCHITECTURE



The system architecture consists of several interconnected layers that process e-commerce transaction data and generate consumption insights and predictions. The Data Source Layer provides customer, product, order, payment, location, and transaction information from authorized e-commerce sources. The Data Input Layer accepts data through CSV, Excel files, databases, or APIs. The Data Validation Layer checks file formats, required fields, data types, and basic data quality. The Data Preprocessing Layer handles missing values, duplicate transactions, invalid records, and inconsistent formats. The Feature Engineering Layer creates attributes such as purchase month, customer segment, spending category, purchase frequency, and average order value. The Data Storage Layer securely stores cleaned transaction records and historical e-commerce information. The Analytics Processing Layer calculates revenue, orders, quantity sold, average order value, and purchasing frequency. The Product and Customer Analysis Layer examines product performance, category demand, customer behavior, and spending patterns. The Trend Analysis Layer identifies daily, monthly, seasonal, and other consumption trends. The Machine Learning Layer trains and evaluates models for future consumption or demand prediction. The Prediction Layer generates estimated future consumption or product demand using the trained model. The Visualization Layer presents results through dashboards, charts, graphs, tables, and KPI cards. The Reporting Layer generates analytical summaries and reports for authorized business users.

V. RESULT AND OUTPUT

International Journal of
DATA SCIENCE AND IOT MANAGEMENT SYSTEM
Peer Reviewed, Referred & Indexed Journal
ISSN: 3068-272X www.ijdim.com Original Research Paper

VI. CONCLUSION

The E-Commerce Consumption Analysis and Prediction system provides a data-driven solution for analyzing online purchasing behavior and predicting future consumption patterns. The system combines data preprocessing, exploratory analysis, visualization, and Machine Learning techniques to transform raw e-commerce transaction data into meaningful business insights.

The system analyzes important factors such as customer purchases, product categories, quantity, price, order value, purchasing frequency, location, and transaction dates. This helps identify popular products, high-demand categories, customer spending patterns, and changes in consumption over different time periods.

The interactive dashboard presents important metrics such as total sales, total orders, total customers, average order value, product performance, customer segments, and sales trends. Charts, graphs, KPI cards, tables, and filters make complex e-commerce data easier to understand and support efficient business analysis.

The prediction component can use historical transaction data to estimate future sales or product demand. These insights can assist businesses in inventory planning, sales monitoring, customer analysis, and identifying changing consumption patterns. The system also reduces the effort required for manual data processing and report preparation.

In the future, the system can be enhanced with advanced demand forecasting, personalized product recommendations, customer churn prediction, dynamic pricing analysis, fraud detection, real-time analytics, sentiment analysis, and automated business alerts. These improvements can make the platform more intelligent and effective for modern e-commerce decision-making.

REFERENCES

[1] Kumar, R. D., Prudhviraj, G., Vijay, K., Kumar, P. S., & Plugmann, P. (2024). Exploring COVID-19 through intensive investigation with supervised machine learning algorithm. In Handbook of Artificial Intelligence and Wearables (pp. 145-158). CRC Press.

International Journal of
DATA SCIENCE AND IOT MANAGEMENT SYSTEM
Peer Reviewed, Referred & Indexed Journal
ISSN: 3068-272X www.ijdim.com Original Research Paper

[2] Swathi, B., Vijay, K., Sushanth Babu, M., & Dinesh Kumar, R. (2024, November). Machine Learning Techniques in Cloud Based Intrusion Detection. In The International Conference on Artificial Intelligence and Smart Environment (pp. 557-564). Cham: Springer Nature Switzerland.

[3] Sv satyakrishna, shirisha rangu ,bhargavi nalacheruve.(2024) Prospective investigation on colorectal cancer with SMOTE on machine learning Algorithm

[4] Dr.G.Vishnu Murthy, BhargaviNalacheruve 1Professor, Department of computer Science & engineering, Anurag University, TS, India. 2Student, Department of computer Science & engineering, Anurag University, TS, India.

[5] V. N. S. Manaswini, K. K, C. Nigam, S. S. Ali, R. Niranjana, and Suman, "Real-Time Object Detection in Drone Surveillance Using YOLOv5," in Proc. 2025 3rd Int. Conf. IoT, Communication and Automation Technology (ICICAT), Gorakhpur, India, 2025, pp. 1–6, doi: 10.1109/ICICAT68430.2025.11414670.

[6] B. Soundarya, V. N. S. Manaswini, M. Ayyakrishnan, R. D. Kumar, "Contextual Analysis of Big Data Analytics in Intelligent Transportation Frameworks," in Intersection of Artificial Intelligence, Data Science, and Cutting-Edge Technologies: From Concepts to Applications in Smart Environment, Lecture Notes in Networks and Systems, vol. 1353, Cham: Springer, 2025, doi: 10.1007/978-3-031-88304-0_79.

[7] R. D. Kumar, V. N. S.Manaswini, "Applications of blockchain in smart cities: detecting fake documents from land records using blockchain technology," in Blockchain for Smart Cities, Elsevier, 2021, pp. 105–117, doi: 10.1016/B978-0-12-824446-3.00017-X.

[8] Tejavath Veeramma, Badarla Anil, Guguloth Ravinder, "An advanced movie recommender using collaborative filtering and sentiment analysis," International Research Journal of Modernization in Engineering Technology and Science, vol. 7, no. 7, July 2025, doi: 10.56726/IRJMETS81618.

[9] Ravi Kumar Banoth, Ramana Murthy B V, "Automatic crop recommendation system using LightGBM and decision tree machine learning models," Journal of Machine and Computing, vol. 5, no. 1, pp. 343, Jan. 2025, doi: 10.53759/7669/jmc202505026.

[10] Ravi Kumar Banoth, Dr. B.V. Ramana Murthy, "Smart agriculture through IoT and machine learning for analyzing carbon footprints," in Proc. Int. Conf. Computer Science and Communication Engineering (ICCSCE), Apr. 2025.

[11] Ravi Kumar Banoth, B. V. Ramana Murthy, "Soil image classification using transfer learning approach: MobileNetV2 with CNN," SN Computer Science, vol. 5, art. no. 199, 2024, doi: 10.1007/s42979-023-02500-x.