JIO Recharge Dataset – Trend Forecasting

JIO is one of the biggest mobile network companies in India. Every day, many people use JIO to do **prepay** (pay before using) and **post-paid** (pay after using) **mobile recharges**. By studying this how and when people recharge, JIO can, **predict future demand**, will get to know about the when more people are likely to recharge. **Manage network usage,** it avoids buffering and poor connection, **Plans offers and discounts**, it creates special offers for customers to attract the customers, **Manage stock,** it make sure they are using the physical recharge card or online recharge options are always available when people need them. So, understanding recharge patterns helps JIO give better service and plan smartly for the future to the customers.

1. INTRODUCTION

About JIO, JIO is one of the leading telecom companies in India, offering prepaid and post-paid recharge services to millions of customers. Reliance JIO Infocomm Limited, launched in 2016, revolutionized India's telecommunications industry with its aggressive pricing strategy and extensive 4G network coverage. As one of India's largest telecom operators serving over 400 million subscribers, JIO faces the constant challenge of managing network capacity, inventory, and customer satisfaction while maintaining profitability.

Objective:

These recharges come in various plans based on amount, validity, data, and region. Purpose of this case study is to analyse recharge data to understand usage patterns and forecast.

Purpose of this case study is, to analyse the recharge data to understand the patterns and forecast future demand. By identifying trend in recharge amounts, plans types and regions, JIO can make smarter business decisions. Meanwhile the JIO company need to understand the problem statements where customers are facing, need improve, and not only the network problem, needs to understand and predict customer recharge patterns to optimize network resources, manage inventory, plan marketing campaigns, and ensure adequate service availability across different regions and plan types.

How to think:

- **Why is trend forecasting important for JIO?**

    This trend helps JIO to understand the customers planning market, network resources, ensures the adequate services availability, revenue optimisation, and also customers experience enhancement. This is very useful because, it helps the company to give better services to the customers, by understanding the trends like, make sure there is no network overload in high demands area, and checking the network in the village areas, hilly stations, etc., giving better offer option to recharge that suits to customers, mainly should understand the customers behaviour, and reduce the number of users who are stop using JIO. They ensure enough to maintain adequate resources to meet customer demand.

From this study aims, JIO can use resources wisely, creates smart marketing strategies, keep more customers satisfied and loyal.

- **How does it help in network planning, promotions, and customer retention?**
  Example: This study aims to identify recharge patterns and forecast future demand to help JIO allocate resources efficiently, tailor marketing campaigns, and reduce churn.
  1. **Network planning:** Avoids overload, if they knows which regions will have high recharge activity, they can strengthen the network in advance. Improves quality, will provide smooth internet and voice services during peak usage. And data helps where to set up the towers or improve coverage, this helps to supports the infrastructure growth.
     Example: If data shows more recharges in Bengaluru during weekends, JIO can improve network capacity in that area before traffic increases.
  2. **Promotion and Marketing:** They can send personalized messages based on customers history and popular plans. They can promote special discounts to customers during festivals or month ends or when recharge plan ends. This promotion based trends are succeed because, they match with customers what they need.
     Example: If 199Rs plans are trending in a region, JIO can use strategies and promote a 179Rs limited lime offers to get attracts the users.
  3. **Customer Retention:** Here they need to keep customers happy, by offering the right plans at right time, to increase customer's satisfaction. If JIO meets customer needs consistently, they are less likely to switch to other networks, so automatically it reduces churn. This builds loyalty, reduces switch over to other networks.
     Example: If a user regularly recharges ₹599 plans every 84 days, JIO can remind them in advance or offer cashback to keep them engaged.

2. DATA CLEANING & PREPARATION

Before starting any analysis, this process is very important to clean and fix the incorrect, incomplete, or duplicate data to improve the data quality. It also involves handling missing values, correct errors, and formatting data for consistency. This steps ensures the dataset accurate and ready for analysis or modelling.

Things to consider during data cleaning

- **Missing or Inconsistent Recharge Dates or Amounts**
  Some recharge record may not have a recharge date or amount. This may be incomplete, and this needs to be either removed or correct it. Inconsistent formats should be corrected to standard formats (like different data styles or wrong currency symbol).
- **Duplicate records or invalid user IDs**

Sometimes, same recharge data's entry appears more than once or merging duplicate entries, so this duplicates need to be removed. Some record may contain invalid or missing user IDs, which can affects the analysis, and also Cross-checking against customer databases, this need to be fix.

- **Handling outliers in recharge amount (e.g., extremely high or low values)**

  Outliers are values that are very different from the rest of the data. In this case, outliers could be a recharge amount that is unusually low or very high compared to most users.

  For Example: A user recharging ₹1 or ₹5 which might be an error or invalid transaction. A recharge of ₹10,000 which is not a normal plan and may be due to a data entry mistake or an unusual business recharge.

  Why it is a problem is they affect the average values (can be increase or decrease the mean of recharge amount) this gives wrong insights. They mislead trend analysis, if they not handle they can be skew graphs and also forecasting models. They can be reducing the accuracy.

  This is handling by several ways, by removing, replace or cap (Very high recharge values can be capped at a maximum limit (e.g., ₹5000) to reduce their effect.), use IQR (Interquartile Range), lastly in some cases, we might want to **keep** outliers but **analyse them separately** to understand unique behaviours (e.g., corporate or bulk recharges).

Handling outliers in recharge amounts ensures that the data is clean and reflects real customer behaviour. It helps in giving more accurate trends, averages, and forecasts. Ignoring outliers may lead to wrong business decisions.

- **Converting dates to proper date time format and extracting features like day, week, month**

  All date's and time should be converted into proper format. After this, we can extract useful time-based features such as: Day, Week, Month, and Quarter. These features help in time based trend analysis.

Explore the Following Patterns after Cleaning

Once the data is clean, we can explore important patterns to understand user behaviour and recharge trends.

- **Recharge volume trends over time (daily, weekly, monthly)**

  This means, recharge volume trends show how many recharges happen over different periods of time. By studying this, we can understand when people recharge the most or the least daily, weekly, or monthly.

  Daily recharge trends, shows how recharge activity changes each day. Helps identify day-to-day fluctuations. Useful to find busy days (E.g., weekends, salary days, end of month).

  Example: If many people recharge on Fridays, JIO can plan special Friday offers.

Weekly recharge trends, Groups data by weeks to observe broader patterns. Helps to see if there's a weekly cycle, like certain weeks of the month being more active. Useful for weekly planning of promotions and staff workload.

Example: Recharges may increase during the first and last week of each month.

Monthly recharge trends, Shows long-term trends by month. Helps in seasonal analysis (e.g., more recharges during festivals or holidays). Useful for forecasting demand, budgeting, and resource allocation.

Example: During Diwali or new year, monthly recharge totals may be much higher.

- **Patterns by recharge type (prepaid v/s post-paid)**

  Firstly, will get to know about prepaid and post-paid.

  Where customer's pays before using the service, they recharge their plan in advance, this is called prepaid.

  Where customer's use the service first and pays later, usually with a monthly bill.

  Why we need to analyse means, this understands which type of service customer's using more. How customers behave in each type. What kind of plan did customers choosing very often? How to design better offers for each group.

- **Popular plan types and payment modes**

  Recharge plans are categorized based on customer needs. By analysing which plans are used most, JIO can understand what customers prefer and design better offers. **Plan type,** Data-only Plans, Voice + Data Plans, Long-validity Plans, Talk-time Plans, Roaming/International. This kind of plan types will be there, according to the plans there will be a price. **Example:** Most users prefer **voice + data plans** with **daily data limits** (e.g., 1.5GB/day for 28 or 56 days), as they offer the best value. **Payment type,** customers use different methods to pay for their recharges. Via UPI (e.g., GPay, PhonePe), credit/debit cards, wallets (e.g., Paytm, Amazon Pay), net banking, cash. UPI and digital wallets are the most popular and preferred payment modes due to ease and speed, especially in prepaid recharges.

  It is important for JIO, because helps to identify top-selling plans to improve or promote in future. Allows JIO to create combo plans (based on user preferences.). Enables payment based offers like cashback or discount through UPI or wallets. And supports better mobile app and website features by understanding how users pay.

  Analysing popular plan types and payment modes helps JIO understand what customers buy and how they pay. This insight supports better product design, marketing offers, and customer satisfaction**.**

- **City-wise recharge frequency**

City-wise recharge frequency means analysing how often people recharge in different cities**.** This helps JIO understand which regions have higher or lower recharge activity**,** and how recharge behaviour varies based on location.

This is important because, to identify which cities are using the JIO services, understand the regional preference in plan types, allocate networks and promotions more effectively, and to improve services and network with low demand area and low recharge activities.

From these benefits for them is, to target marketing, efficient network planning, customers satisfaction.

City-wise recharge frequency analysis gives JIO a regional view of customer behaviour. It helps in offering the right plans to the right cities, optimizing marketing and network decisions, and ensuring better customer service across India.

In any data science project, **cleaning and preparing the data is a critical step**. For the JIO recharge dataset, this means handling missing values, correcting formats, removing duplicates, and exploring important features like time, recharge type, and region. Only after this step can we trust our analysis and make strong business decisions.

3. TREND ANALYSIS & FORECASTING

The main goal of this section is to analyse past recharge trends and forecast future demand. This helps JIO plan ahead, manage resources, and launch offers at the right time.

Steps:

- **Visualize recharge amounts over time to detect seasonality or growth**
  First, need to see how total recharge amounts have been changed over time. These trends are shown using graphs and charts. That show how much customers recharge on different days, weeks, or months. This helps us see patterns, trends, and seasonality in the data easily, and also helps us spot's like sudden spikes or drops in recharge activity.
  This turn raw data into visual insights.
  Example: During festival recharges often give discounts, then sudden spikes in recharge activity.
  Scenarios, Line graph of recharge amount from January to June may show a steady increases or big spike or drop.
  A bar chart by week might reveals that, most recharge happens on Fridays or Saturdays or end of the month.
  This helps marketing, network teams, and also business team.

Visualizing recharge amounts over time is a first and essential step in trend analysis. It gives a clear picture of how recharge behaviour changes, helps spot important patterns, and supports data-driven decision-making at JIO.

- **Use time series decomposition to identify trends, seasonality, and noise**

  This involves applying time series decomposition to the recharge dataset to separate and study three parts: Trends, Seasonality, and Noise.

  Trend shows overall direction of recharge activity and long term movement in recharge data. It smooth's out daily or weekly ups and down's to show if usage is increasing, decreasing, or stable.

  Seasonality shows predictable patterns. This behaviour is predictable and often tied to human habits, such as: Recharging after receiving salary, Festival-based offers, Weekend data packs.

  Noise shows random and irregular behaviour. This is the unpredictable part of the data. It can be caused by: Unexpected events (e.g., power outages, app crashes), Random user behaviour, Sudden flash offers

  This may help JIO to understand what drives changes in recharge volumes overtime.

Using time series decomposition helps JIO clearly separate and understands the different parts of recharge behaviour: Trends tells long term story, Seasonality reveals repeating customers patterns, And Noise highlights unexpected changes.

- **Build simple forecasting models (e.g., Moving Average, Exponential Smoothing, ARIMA)**

  Before understanding forecasting models, let us know about, what is Forecasting in Time series? Forecasting means using past recharge data to predict future recharge demand. Simple forecasting models help JIO estimate how many recharges will happen in the next days, weeks, or months, by learning patterns from historical data.

  Use: To predict future recharge volumes for better planning, to manage network load based on upcoming demand, to prepare marketing campaigns ahead of peak periods, to support data-driven decisions.

  1. **Moving Average(MA):** This calculates the average of recharge values over a fixed time period. Helps to smooth out short-term fluctuations, Makes it easier to see the underlying trend.
     Useful: Good for short-term and simple forecasting, helps remove daily or weekly noise.
  2. **Exponential Smoothing (ES):** Gives more weight to recent data than older data, Reacts quickly to recent changes or trends, Smoother than moving average and better for short-term forecasts.
     Useful: Captures recent growth or decline better, Easy to apply and understand, Suitable when recent recharge trends are more important.
  3. **ARIMA (AutoRegressive Integrated Moving Average):** A more advanced model that combines: **AutoRegression (AR):** Uses past values, **Integration (I):** Makes data stationary (removes trend), **Moving Average (MA):** Uses past forecast errors.
     Useful: Good for long-term forecasting, Handles trend, seasonality, and noise together, more accurate when data has a consistent structure.

This helps JIO, Accurate predictions allow JIO to plan inventory offers and promotions, Helps avoid network overloads during peak recharge periods, Allows better budget planning

and customer engagement. Using these models, JIO can make smart, data-backed decisions and stay ahead of customer needs.

- **Forecast recharge demand for the next 1-3 months by key segments (plan type, city)**
  In this step, we use past data and forecasting models to predict how many recharges will happen in the next 1 to 3 months. Instead of only predicting the total, we break it into key segments like: Plan type, City or region. This gives more detailed and useful insights.
  Plan type: Forecast the demand for each popular plan, Helps JIO understands which plans are: Gaining popularity, losing customer interest, likely to be most used in the coming months.
  Example: Recharge demand for the ₹399 plan might increase by 15% in the next 2 months due to bundled OTT benefits.
  City/Region: Forecast recharge volumes in different cities, Helps identify: High-growth cities (e.g., Tier-2 cities with rising digital use), Stable or declining regions.
  Recharge demand in Bengaluru may stay high, while Lucknow might show rising usage due to new promotions or better connectivity.
  How Forecasting Is Done, Use historical recharge data from the last 6–12 months, Apply forecasting models (Moving Average, Exponential Smoothing, ARIMA), Break the predictions into segments (per plan or per city).

Segment-wise forecasting helps JIO not only know how much recharge demand is coming, but also where and which plans will be most used. This allows JIO to take better business decisions, improve customer satisfaction, and stay prepared in advance.

Interpret:

- **Are there peak recharge periods (festivals, weekends)?**
  This means, focuses on identifying the times when most people recharge their phones called peak recharge periods. This happens during in festivals, weekends, month-end or salary days.
  JIO detect these peaks, by analysing daily, monthly recharge data, by plotting recharges on a time graph, and by observing spikes around spikes around key dates and events.
  Benefits from this insight, knowing the peak recharge periods helps JIO: Offer timely promotions, prepare network in advance, boost customer's engagement, and improve inventory planning.

Yes, there are clear peak recharge periods like, by identifying and acting on these, JIO can improve customer experience, increase sales, and plan better promotions.

- **Which cities show fastest growth?**
  This step is about identifying cities or regions where recharge activity is increasing rapidly over time. These are the cities where: More users are joining JIO, People are recharging more often, and Higher-value

plans are becoming popular, Digital payment methods are being used more.

These cities are showing fast growth in both user base and recharge value**.**

Why Is It Important to Know High-Growth Cities?

Understanding which cities are growing fast helps JIO: Network planning, targeted marketing, Customer support scaling, Business development.

How Can We Identify Fast-Growth Cities?

By analysing the recharge dataset for: Month-over-month or week-over-week growth, Increase in number of users, Rise in recharge amounts per customer, Higher demand for digital payment modes.

Growth Trends Might Be Seen in **Metro cities**- High but stable growth with premium plan usage, **Tier-2 cities** (e.g., Lucknow, Indore)- Rapid growth in users and recharge activity, **Rural areas** -Slow but rising interest in low-cost prepaid plans.

JIO Can Use This Information, for marketing, regional offers or language-specific promotions**,** Invest in better network performance in those areas, Add more offline recharge points or service agents.

Identifying fast-growing cities helps JIO stay ahead of demand**.** By focusing on these cities, JIO can grow its customer base**,** improve services, and strengthen its presence in key regions of India.

- **How do payment modes trend over time?**

  This step focuses on analysing how customers' preferred methods of payment for recharges have changed over time from offline cash payments to digital modes like UPI, wallets, cards, etc. It helps JIO understand: Which payment modes are becoming more popular, which ones are declining, how user behaviour is shifting toward convenience and speed. Common Payment Modes in JIO Recharges, UPI (PhonePe, GPay, Paytm UPI), Mobile wallets (Paytm, Amazon pay),Credit /Debit cards, Cash.

Why Are Digital Payments Rising because of Ease and speed of UPI apps, Increase in smartphone usage and internet access, Government push for Digital India.

Over time, digital payment modes have become dominant, especially UPI and wallets**.** Analysing these trends helps JIO optimize its payment systems, offer personalized promotions, and ensure a smooth recharge experience for all users.

4. KEY FINDINGS & BUSINESS RECOMMENDATIONS

This section summarizes the key insights discovered from the recharge trend analysis and forecasting. It also provides data-driven business recommendations for JIO to improve operations, marketing, and customer satisfaction.

Key insights:

- **Identify growth or decline trends**

  This means observing whether recharge activity is increasing, decreasing, or remaining stable over a specific time period such as daily, monthly, or quarterly. We examine patterns in: **Total recharge volume** (how many people are recharging)**, Recharge amount** (how much money is being spent), **and Plan type usage** (which plans are being chosen more or less).

  Why it is important means, it helps JIO, to understand how customer behaviour is changing, Prepare better for the **future demand,** Identify which products (recharge plans) are performing well or poorly, Make smart decisions like launching offers, upgrading services, or removing underperforming plans.

  By identifying **growth or decline trends**, JIO gets a clear picture of what's working and what's not. This helps the company take **timely actions**, improve **customer experience**, and ensure **steady business growth**.

- **Highlight cities or segments with the highest forecasted demand**

  This means, involves identifying which cities or user segments (like specific recharge plans or types of users) are expected to have the highest recharge demand in the next 1 to 3 months**,** based on forecasting models. This helps JIO focus on the right regions and right users for better business planning. In this case, **segments** refer to: Geographical areas, Plan types, User types. It important because, Plan network upgrades, Run location-based promotions, Focus customer support, Manage inventory.

  By highlighting the cities and segments with the highest forecasted recharge demand, JIO can focus its efforts more effectively. This leads to better customer service**,** higher revenue, and smarter marketing strategies all based on data insights.

- **Detect emerging shifts in payment behaviour or plan preference**

  This step focuses on finding new changes or patterns in how customers are: Paying for their recharges, Choosing recharge plans. These emerging shifts show that user needs and habits are changing, and JIO can use this information to stay ahead.

  Shift in Payment Behaviour, look for are more users switching from cash to UPI or wallets? Is the use of credit/debit cards decreasing? Are digital payments growing in certain cities more than others?

  Shift in Plan Preference, look for are users moving from talk-time only plans to combo or data-heavy plans? Are longer validity plans becoming more popular? Is there increased interest in plans with OTT benefits?

  It Important for JIO because, help in payment shift, plan preference, city-level behaviour. This shifts detected by Compare monthly or quarterly trends in payment modes and plan usage, Use visual graphs to spot rising or falling patterns, Analyse new user sign-up behaviour or customer churn reasons.

  Emerging shifts in payment behaviour and plan preference show how customers are evolving. By understanding these shifts early, JIO can adapt

faster, offer personalized experiences, and stay competitive in the telecom market.

Business Suggestions:

- **Targeted promotions during low-demand periods to balance load**

  This strategy suggests that JIO should run special offers or promotions during times when fewer people recharge, such as: Mid-week (Tuesday/Wednesday), Mid-month (between salary dates), Non-festival or non-holiday periods. These are called low-demand periods, and they usually show a dip in recharge activity. By offering discounts, cash-backs, or bonus data, JIO can encourage customers to recharge during these slow times.

  This is important for JIO because, Balances network usage, Increases overall recharges, Improves customer engagement, Promotes specific plans.

  JIO apply this by Detect low-traffic days using historical recharge data, Offer time-bound promotions, and Send targeted app notifications, SMS, or email reminders to users.

  JIO can implement this, Use **MyJIO app notifications**, SMS, and emails to alert users, Analyse low-demand periods by city or segment from the recharge data, Personalize offers based on user history (e.g., their usual recharge day or plan).

  By offering targeted promotions during low-demand periods, JIO can encourage timely recharges, smooth out network traffic, and maintain a stable revenue flow. It's a simple but smart way to optimize both business and customer experience.

- **Prepare network infrastructure upgrades in fast-growing cities**

  This recommendation suggests that JIO should identify cities where recharge demand is increasing rapidly and take early steps to upgrade its network infrastructure in those places. This includes: Expanding network capacity (e.g., towers, bandwidth), Improving data speed and coverage, Strengthening customer service and technical support.

  This Important, as more users recharge in fast-growing cities, the network can become overloaded if not upgraded in time. Rising user demand, High data consumption, Better experience = happy users.

  How to Identify Fast-Growing Cities? Use forecasting models to detect recharge volume growth by city, Compare data month over month or quarter over quarter, Track increase in data usage, plan upgrades, and new activations.

  What JIO Can Do? Detect low-traffic days using historical recharge data, Offer time-bound promotions, and Send targeted app notifications, SMS, or email reminders to users.

By offering targeted promotions during low-demand periods, JIO can encourage timely recharges**,** smooth out network traffic, and maintain a stable revenue flow**.** It's a simple but smart way to optimize both business and customer experience.

- **Incentivize preferred payment modes to reduce transaction costs**

   This suggestion advises JIO to encourage users to use certain low-cost, fast, and efficient payment methods like UPI or mobile wallets by offering small rewards (incentives) like cashback or bonus data. These modes are usually cheaper for JIO to process, compared to credit cards or net banking, which often involve higher transaction fees charged by banks or gateways.

   How to Incentivize These Payment Modes JIO can Offer ₹10–₹30 cashback on UPI payments, Give bonus 1GB data for wallet users, Provide discounted plans if payment is done via preferred methods, Run time-limited campaigns (e.g., "Recharge with UPI and win rewards")

   By incentivizing preferred (low-cost and fast) payment modes like UPI or mobile wallets, JIO can reduce transaction fees, encourage digital habits, and deliver a smoother, faster recharge experience for its customers all while saving money.

- **Design new combo plans based on trending recharge amounts**

   This recommendation suggests that JIO should create or redesign recharge plans (called combo plans) based on the most popular recharge amounts and user preferences seen in the trend analysis. A combo plan usually includes Data (internet), Voice calls, SMS, Extras like OTT subscriptions. By studying which recharge amounts are trending, JIO can build customized offers around those price points to attract more users.

   Designing new combo plans based on trending recharge amounts allows JIO to meet user expectations, stay competitive in the market, and offer plans that customers actually want and use. This approach helps boost recharge frequency, revenue, and customer loyalty all backed by real usage data.

The case study provides actionable insights into recharge trends and user behaviour. By leveraging these findings, JIO can make informed decisions that support customer satisfaction, operational efficiency, and business growth.

5. CONCLUSION

Summarize:

- **Core patterns and forecasts discovered**

   The analysis of the JIO Recharge Dataset revealed several important patterns and future trends: Recharge volumes are increasing, especially during weekends, festivals, and salary periods. Combo plans priced around ₹399 and ₹599 are the most preferred, showing a shift in user interest from basic to value-rich plans. Digital payment modes like UPI and wallets are now more popular than cash or cards, especially in urban and semi-urban areas. **Tier-2 cities** such as Indore, Lucknow, and Patna are experiencing fast growth in recharge activity. Forecast models predict a steady rise in recharge demand over the next 1 to 3 months, especially for high-data plans and digital payments.

- **How this data supports JIO's strategic planning and customer satisfaction**

  The trend analysis and forecasting provide **actionable insights** that enable JIO to: **Optimize recharge offerings** based on user preferences and trending amounts. **Improve customer engagement** by offering targeted promotions during low-demand periods. **Plan infrastructure upgrades** in fast-growing cities to ensure smooth service. **Encourage digital payments** to reduce transaction costs and provide a faster recharge experience. **Design smarter marketing strategies** by understanding plan preferences and regional growth.

By understanding recharge patterns and forecasting future demand, JIO can take proactive, data-driven steps to improve service, reduce costs, and keep customers happy. This makes the company more efficient, competitive, and customer-friendly in the long run.