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Multi-Linear Regression-Based Fast-Moving Consumer Product Demand Forecasting Model

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ABSTRACT- FMCG consumption has significantly increased as a result of the Indian economy's robust expansion over the past decade. India's FMCG industry has seen a 21.4 percent revenue growth rate over the past ten years, with revenues increasing from US$ 31.6 billion in 2011 to US$ 52.8 billion in 2017 and 2018 respectively. The FMCG industry in India was anticipated to reach US$103.7 billion by 2020 at a CAGR (combined annual growth rate) of 27.9 percent. In addition, a CAGR of 14.6% is anticipated for the rural FMCG market, which is expected to reach US$100 billion in 2020 and US$220 billion in 2025. Rural businesses generate 45 percent of the FMCG industry's total revenue, while urban businesses generate 55 percent. In India, over 65% of people live in rural areas, where they spend approximately 50% of their income on fast-moving consumer goods. By 2025, it is anticipated that 850 million Indians will make online purchases of consumer goods. Using aggregate demand patterns, the purpose of this paper is to attempt an econometric analysis of the sector-by-sector growth in FMCG market demand in India. It tries to project request supply holes up to 2017 - 2018. Academics and businesses would be interested in the findings.

KEYWORDS- Fast Moving Consumer Goods, Annual growth Rate, aggregate demand, demand – supplygaps.

I. DEMAND PLANNING AND FORECASTING

An essential part of an organization's planning efforts is demand forecasting. Typically, the formulation of the problem or objective and an initial evaluation of the available data precede the selection of the forecasting model. Alongside these, variables, for example, intricacy of the relationship not set in stone, and the ideal degree of guaging precision looked for from the displaying exercise help to settle on the nature and utilization of the estimating model[1,2]. The sharp rise in FMCG consumption in emerging economies like India is one of the characteristics of growth. These factors include: an increase in the number of working women in the country; an increase in disposable income and per capita expenditure; an increase in customers' purchasing power; an increase in their awareness of online shopping; increased brand recognition and consciousness; a constant shift in consumer preference; banking policies and regulations; a growing interest from foreign investors. The following are some of the most common forecasting techniques for estimating demand:

- Methods based on judgment
- Econometric methods
- Other methods.

II. JUDGEMENTAL FORECASTS

This method is highly subjective and relies on intuition and personal opinion to make predictions. The simple survey method, the Delphi method, which is an interactive forecasting method that relies on a panel of experts, the analogy method, which uses analogies between the phenomenon to be forecasted and some historical event or popular physical or biological process, and scenario-building methods are all examples of techniques that fall under this category. [3].

III. ECONOMETRIC FORECASTS

Econometric techniques for anticipating principally incorporate two sorts: causal/structural forecasting and time series forecasting. Time series techniques are frequently considered just like a hypothetical in nature as future forecasts are made completely based on verifiable information/information. Contrary causal/structural forecasting techniques impose a priori assumptions or limitations on the theoretical links between the variables[4]. Artificial neural networks, which are basically simple mathematical models that are associated with a specific learning algorithm or learning rule, simulation, probabilistic forecasting, reference class forecasting, and SVM (support vector machines, a set of related supervised learning methods that analyze data and recognize patterns) are all examples of other methods. Among these categories, econometric forecasting methods are typically used to predict shifts in patterns of demand and supply. Probabilistic forecasting is a method that is typically used for weather forecasting and relies on Moving average, linear extrapolation or trend estimation, exponential smoothing, autoregressive integrated moving average (ARIMA) models, ARIMAX (ARIMA with explanatory variables), and vector autoregressive (VAR) methods are just a few examples of the many approaches that fall under this category. This paper attempts to develop a method for predicting the supply and demand for steel in India. The relevance and accuracy of these models for estimating demand vary depending on the nature of the variable being forecast.

IV. OUTLINE

Fast-moving consumer goods (FMCG) sector is India's fourth largest sector with household and personal care accounting for 50% of FMCG sales in India. Growing awareness, easier access and changing lifestyles have been the key growth drivers for the sector. The urban segment (accounts for a revenue share of around 55%) is the largest contributor to the overall revenue generated by the FMCG sector in India. However, in the last few years, the FMCG market has grown at a faster pace in rural India compared to urban India. Semi-urban and rural segments are growing at a rapid pace and FMCG products account for 50% of the total rural spending.

V. MARKET SIZE

The FMCG sector in India reached a revenue of Rs. 3.4 lakh crore (US$ 52.75 billion) in FY18 . According to Nielsen, the Indian FMCG industry grew 9.4% in the January-March quarter of 2021, supported by consumption-led growth and value expansion from higher product prices, particularly for staples. The rural market registered an increase of 14.6% in the same quarter and metro markets recorded positive growth after two quarters.

Rise in rural consumption will drive the FMCG market. It contributes around 36% to the overall FMCG spending. In the third quarter of FY20 in rural India, FMCG witnessed a double-digit growth recovery of 10.6% due to various government initiatives (such as packaged staples and hygiene categories); high agricultural produce, reverse migration and a lower unemployment rate. The Indian processed food market is projected to expand to US$ 470 billion by 2025, up from US$ 263 billion in 2019-20[5].

VI. INVESTMENTS/ DEVELOPMENTS

- The Public authority has permitted 100 percent Unfamiliar Direct Venture (FDI) in food handling and single-brand retail and 51% in multi-brand retail. This would increase consumer spending, encourage more product launches, and boost employment, supply chain, and brand visibility in organized retail markets. From April 2000 to December 2020, the sector received US$ 18.03 billion in FDI.
- The following are some recent developments in the FMCG industry:
- In May 2021, the popular noodles brand Wai Wai's Nepalese owner CG Corp Global announced its intention to invest Rs. 200 crore, or 27.42 million, to establish two new manufacturing facilities in Uttar Pradesh and West Bengal.
- • In April 2021, Rasna introduced inexpensive immune-boosting syrup concentrates containing zinc, selenium, vitamin B12, and vitamin B6.
- • In order to expand into staples and chocolates, ITC Ltd. introduced cakes and milkshakes in March 2021.
- Sanjay Ghodawat Group introduced RIDER, an energy drink, in March 2021. It is available in supermarkets, general stores, and e-commerce platforms, among other modern retail formats.
- Nestle India announced plans in February 2021 to reach 1.2 lakh villages with a population of over 5,000 in each over the next two to three years.
- Haldiram's, a food and snack company, and Africa's Futurelife collaborated in February 2021 to bring their nutritional food product line to India. Crunchy Granola, High Protein, Smart Foods, and Smart Oats and Ancient Grains were the four products that the two companies introduced.
- Tata Consumer Products made the announcement in January 2021 that it is looking into ways to add more beverages to a direct-to-consumer platform in order to capture the urban online market[6].
- In January 2021, Tata Consumer Products introduced two new products—TATA Tea Tulsi Green and TATA Tea Gold Care—as well as reformulated its existing Tetley Green Tea with vitamin C. In January 2021, Dabur India made the decision to enter the "cow ghee" market. The milk used to make these products will come from indigenous cows that were raised in Rajasthan.
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- Del Monte will begin selling a limited-edition, one-liter pouch pack in India in January 2021 for Rs. 250 (or $3.42 USD), making olive oil more accessible to consumers.
- In order to meet the rising demand from customers for hygiene products, FMCG companies in India plan to enter new, niche categories like mouth sprays, ayurvedic mouth cleansers, and mouthwashes in January 2021.
- For instance, Colgate Palmolive (India) Ltd. and Dabur India introduced Pulling oil, an ayurvedic remedy for morning oral cleansing based on centuries-old Ayurvedic practices. [7].

VII. GOVERNMENT INITIATIVES

The following are some of the most important actions that the government has taken to promote the FMCG industry in India:

- The production-linked incentive (PLI) scheme to boost India's manufacturing capabilities, exports, and promote the "Atmanirbhar Bharat" initiative was approved by the Union Cabinet on November 11, 2020, in ten key sectors, including white goods and electronics.

- Both farmer prices will rise as a result of developments in the packaged food industry and the high levels of waste will decrease. Unique product lines with high growth potential and the capacity to generate medium- to large-scale jobs have been established in order to provide support through the PLI scheme.
- In addition to 51% FDI in multi-brand retail, the Indian government has approved 100% FDI in the cash and carry market and single-brand retail.
- A new Consumer Protection Bill has been drafted by the government, with an emphasis on the establishment of a comprehensive mechanism to guarantee the easy, quick, affordable, and timely delivery of consumer justice. The Goods and Services Tax (GST) is advantageous to the FMCG industry because, as opposed to the previous rate of 23-24%, many FMCG products, including soap, toothpaste, and hair oil, now fall within the 18% tax bracket. Additionally, the GST rates on hygiene products and food products have been reduced to 0-5% and 12-18%, respectively.
- As all major corporations are reorganizing their operations into larger logistics and warehousing[8], GST is anticipated to transform FMCG logistics into a modern and efficient model.

The importance of demand forecasting and planning to the FMCG sector The FMCG sector's supply chain operations can only succeed if demand forecasting is accurate, which in turn leads to accurate procurement, production, and supply planning. An accurate demand forecast helps with the right kind of planning to meet the changing demands and expectations of customers. Seasonality, a sudden change in demand levels, uncontrolled inventory levels, rough-cut capacity planning, price-cutting maneuvers of the competition, sudden strikes, and large economic swings are constant challenges for managers in all FMCG industry departments. By increasing visibility across various departments and processes both within and outside the business (supplier, distribution), demand forecasting and planning assists them in addressing these issues.

VIII. IMPORTANCE OF DEMAND FORECASTING & PLANNING FOR THE FMCG INDUSTRY

In the FMCG sector, demand forecasting and planning is done by using data and insights to predict how much of a particular product customers will likely buy during a given time period. Distributors and retailers of FMCG products benefit from this method of predictive analytics by knowing how much stock to keep on hand at any given time.

Products in the fast-moving consumer goods (FMCG) industry have a short shelf life, so an overstock or shortage at the sales counter caused by poor forecasting and planning can throw off the entire supply chain and hurt profits.

What role does demand planning and forecasting play in the FMCG industry?

Exact interest guaging and arranging helps FMCG partners to accomplish the accompanying while at the same time satisfying the clients' need for an item:

Further developed Stock

For FMCG businesses, precise interest guaging abilities gives clearness of supply arranging. As a result, they are able to accurately gauge the level of demand from their customers, determine the quantity of component parts required for production, and plan to fulfill orders accordingly.

By eliminating loss and significantly reducing the amount of time unused inventory is left in a warehouse, having an accurate forecast also helps plan supply operations and reduce the amount of warehousing or container space required.

Cost Reduction Accurate forecasting and planning reduce the cost of unused warehouse materials and components. By allowing manufacturers to anticipate any stock surplus or shortages necessary to meet customer demand, it aids in cost reduction.

In addition, it helps cut costs associated with a number of resources and essential production tasks, such as allocating and managing jobs, sourcing raw materials, logistics, and even some customer-facing and front-office duties. Having a more cost-effective and efficient production leads to a profitable FMCG company because forecasting and planning have an impact on the entire product life cycle.

IX. OPTIMIZED LOGISTICS

Accuracy in forecasting and planning enables FMCG manufacturers to systematically examine their transportation strategy and move forward in the right direction. It assists them with recognizing regions where efficiencies can be expanded, and redundancies wiped out. A quick and effective method for moving products within and outside the FMCG plant is provided by efficient logistics. Exact estimating and arranging permits the producer to see when, where, how, and why the most essential strategies choices can be arranged and executed to have the ideal result[5].

The global market is defined by the level of satisfaction enjoyed by customers. The success of the FMCG industry depends on ensuring that customers have access to. product in their possession at the appropriate time, location, and time of delivery entails meeting the customer's expectations. An all-encompassing strategy for enhancing an FMCG company's operational, logistics, and production cycle platforms is forecasting and planning. It boosts customer satisfaction and the short-, medium-, and long-term growth and expansion of the business.

Companies are able to investigate the future and avoid holding hypothetical product stocks thanks to accurate forecasting and planning. They are able to: • meet customer demands and market forces, • align production with the availability of raw materials and component parts, and • have effective production scheduling thanks to this.

Forecasting enables FMCG businesses to operate with greater agility, transparency, and adaptability because it helps them with these aspects of the planning and production lifecycles. They are able to adjust to shifting production environments and customer demands thanks to it.

X. FORECASTING

An effective forecasting strategy for an organization requires five things:

- Recognize the goal of forecasting.
- Implement demand estimation and planning throughout the supply chain.
- Determine the primary factors that influence estimates of demand.
- Forecast at the right level of aggregation.
- For the estimate, establish performance metrics and error rates.

Error in Forecasting When developing a forecasting model, validation is a crucial step in determining how well the forecasting method works. The test is used to determine the error in the forecasting result.

XI. MEAN ABSOLUTE PERCENTAGE ERROR (MAPE)

MAPE is calculated by dividing the actual observation values for each period by the absolute errors in that period.
Where: The term "actual" refers to actual data, "future" refers to predicted value, and "n" refers to the forecasting period. The first step in this stage is to identify the variables that have an effect on the number of requests. In determining this factor, a number of theories and journals are consulted. There was a study of the factors mentioned in more than two journals[7].
As a result, eight factors have a significant impact on product demand:

1. Number of clients:
2. Price
3. Cannibalization
4. Income
5. Cost of Other Items and Competitors
6. Holiday
7. Weather

The existence of a causal relationship between one independent variable and the dependent variable is the foundation of simple linear regression. Multiple linear regression is used when there are multiple independent variables. The data are made up of the n set observations X1, X2, X3, Xp, and y, which are random samples taken from a larger population. It has been observed that the Multilinear Regression forecasts have always been more accurate than the company forecasts in many instances. It is assumed that this observation satisfies a linear relationship. Below are comparisons of the results.

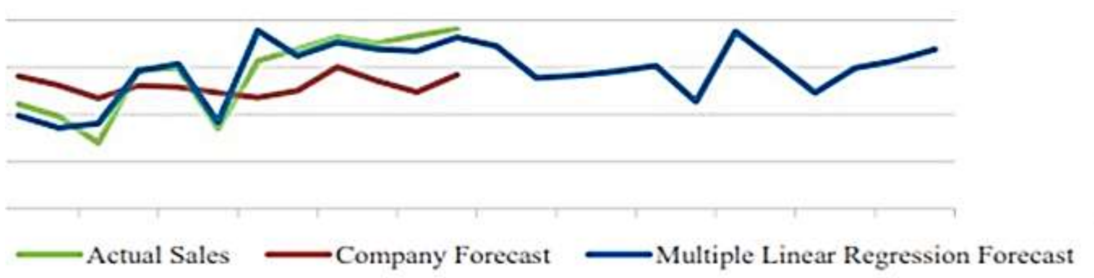

Figure 1: Comparisons of the results between Multilinear Regression forecasts and company forecasts

XII. ROAD AHEAD

Consumption in rural areas has gone up as a result of rising incomes and higher aspirations. In rural India, there is an increased demand for branded goods. By 2025, India's rural FMCG market is expected to reach $220 billion, up from $23.6 billion in FY18.
On the other hand, as the FMCG sector's unorganized market share decreases, organized sector growth is anticipated to increase due to increased brand awareness and modern retail growth. [3].

XIII. CONCLUSION

Another main consideration pushing the interest for food administrations in India is the developing youth populace, principally in metropolitan areas. Due to time constraints, India's young consumers, who make up the majority of the workforce, rarely have time to cook.
When businesses attempt to enter the hinterlands, online portals are anticipated to play a crucial role. The internet has made a big contribution, making it easier and cheaper to expand a company's reach. India is expected to have one billion internet users by 2025. By 2020, it is anticipated that 40% of all FMCG purchases in India will be made online. The web-based FMCG market is conjecture to arrive at US$ 45 billion of every 2020 from US$ 20 billion in 2017[6].
It is assessed that India will acquire US$ 15 billion a year by carrying out GST. In the long run, demand, both in urban and rural areas, as well as structured economic growth and improved performance of sector-specific businesses are anticipated to be fueled by GST and demonetisation.
Note: *Conversion rate used for May 2021 is Rs. 1 = US$ 0.01365*

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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