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The Role of Adaptive AI in Commodity Dynamics across India's Quick-Commerce Sector.

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Abstract

In the Contemporary times, the global economy is experiencing a VUCA (Volatile, Uncertain, Complex and Ambiguous) Environment. (Bennett, N., & Lemoine, G. J. 2014). Quick Commerce Platforms in India such as Blinket, Zepto and Instamart operate in this ecosystem which demands precise inventory management, strategic planning and real-time accurate pricing.

Commodities like fruits, vegetables, dairy etc face continuous price fluctuation, driven by various factors including climate, demand and supply, seasonal changes, supply chain disruption and global market influences. Traditional Business frameworks often struggle to keep pace with the rapid changes, making forecasting and decision making extremely challenging for businesses to survive. (Chakraborty & Kumar, 2021)

On the other hand, among the various types of static AI, Adaptive Artificial Intelligence has emerged as a game changer. Even though, the rise of Machine Learning and Big Data technology during 2000's for training AI systems with vast amount of data, self-learning algorithms drew attention of many commercial companies in the past few years. (Marthis, 2024). The concept of Adaptive AI became widely recognised in the recent times, due to its ability to continuously learn and evolve recommendations and responses in real-time, based on emerging patterns in dynamic business conditions. Therefore, moving beyond fixed algorithms. It can enable Q-Commerce Platforms to maintain flexibility, competitiveness and resilience in the modern business paradigm.

This paper attempts to analyse the price fluctuations in key commodities in India and seeks to analyse the availability of commodities on Q-Commerce Platforms. Lastly, the paper also aims to understand the role of Adaptive AI in helping Q-Commerce platforms maintain competitiveness.

Keywords; Q-Commerce, Adaptive AI, Commodity dynamics, VUCA.

INTRODUCTION

India, the land of commerce, has become the world's third largest retail market, where the gross market value of e-retail is almost \$60 billion. As per the Economic Times, Quick Commerce is the fastest growing sector expanding at the rate of 142% CAGR in the past financial years and is projected to reach a milestone growth rate in gross market value up to ₹2 Lakh Crore by financial year 2028.

Among the top 10 fastest growing Quick Commerce international Markets in 2025, India is growing at the fastest rate compared to the other countries. The most prevalent Q-commerce players in India market are Zepto, Swiggy Instamart, Blinket, big basket, and Flipkart minutes. These platforms dominate the market, by fulfilling two-third of all online grocery orders, supported by dark stores which grew 71% in the financial year 2025.

However, this market operates in a dynamic and highly sensitive environment. Climate changes, supply chain shocks and money, fluctuations, play a huge role in the profitability of these businesses. Adaptive AI has the capability to transform the way quick commerce conducts its operations and increase price stability, overall operational efficiency, profitability, and ensure competitiveness in this data driven VUCA world

Objectives

1. To analyse the price volatility in key commodities in India.
2. To analyse the availability of commodities on Q-Commerce Platforms.
3. To understand the role of Adaptive AI in helping Q-Commerce platforms to maintain competitiveness.

Research Methodology

This study is based on a Mixed-Method (Quantitative and Qualitative) Approach. A combination of Descriptive and Analytical Research design has been used for the purpose of the study. Primary data collected through a structured questionnaire has been used for the purpose of the study. The sampling technique used is Simple Random Sampling with a sample size of 205 respondents. Secondary data collected from Government databases, commodity price portals, Q commerce Platforms and published research papers have been used in this study. The research techniques used involve, trend analysis, descriptive statistics like mean average and correlation (r).

Adaptive AI

Adaptive Artificial Intelligence are the AI systems which are competent of independently learning, adjusting, and enhancing their behaviour in real time based on varying data, user partners, and environmental conditions. It differs from traditional static models as it unceasingly up-skill and improves itself to stay accurate under volatile situations (Gartner, 2022). The cornerstone of Adaptive AI goes back to early work in cybernetics by Norbert Wiener in the 1940s, adaptive control systems in the 1950s (Åström & Wittenmark, 1988), and reinforcement learning research beginning in the 1980s (Sutton and Barto, 1988). Latest Adaptive AI stemmed through breakthroughs in deep learning, online learning algorithms, and neural architecture search in the 2010s. Gartner officially endorsed the term “Adaptive AI systems” around 2021 to explain AI competent of prompt contextual tuning. In present, Adaptive AI is utilized in fields needing real- time decision-making

like e-commerce, finance, logistics, and autonomous systems (Gartner, 2022).

Adaptive AI in the E-Commerce Ecosystem

Adaptive AI is remolding the e-commerce systems that adapts persistently from user behaviour, market trends, and operational data. In product recommendation engines, Adaptive AI upgrades propositions based on real-time browsing habits, intents, and conditioning factors, enhancing personalization accuracy way more then static machine learning models (Zhang et al., 2021).

Within repository and supply-chain management, adaptive algorithms improve stock level actively by merging buying trends, seasonal differences, and demand forecasts (Choi et al., 2020). Consumer support systems also gains, as Adaptive AI improves chatbots and virtual assistants by understanding from interactions to enhance quality of response. Moreover, pricing engines utilise reinforcement understanding to autonomously modify prices depending upon competition, demand fluidity, and user habit (Chen et al., 2010). In total, Adaptive AI empowers efficiency and revenue production while allowing constant evolution of user experiences all over the e-commerce lifecycle.

Benefits and Impacts of Adaptive AI

The usage of Adaptive AI in E-Commerce creates visible operational, financial, and experiential gains. Some of its Benefits are as follows-

- It improves personalization by molding recommendations, offers, and search results depending upon changing user habits, enhancing conversion rates and consumer satisfaction (Kumar et al., 2021).
- Adaptive AI enhances operational efficiency via dynamic inventory management, automated logistics decisions, and real-time fine-tuning of supply chains (Gupta & George, 2022).
- Businesses get competitive gain by utilizing adaptive pricing plans and enhancing marketing campaigns vis constant self-education.
- From a consumer perspective, Adaptive AI fine-tunes service reliability with accurate delivery forecasting and good chatbot interactions.
- The technology also allows scalable automation, minimizing labor costs and human error.

In total, Adaptive AI take part in higher retention rates, better profitability, and more responsive consumer experiences, turning it a central component of modern e-commerce ecosystems.

Quick Commerce and Adaptive AI

Quick Commerce (Q-Commerce), structured around super-fast delivery and volatile fulfilment, gains substantially from Adaptive AI systems. Prediction models for delivery time constantly self-educate itself from traffic changes, rider 's conduct, weather conditions, and order density to give accurate real-time predictions (Wang & Hu, 2022). Adaptive routine algorithms modify delivery paths on the fly to minimize delays and enhance last mile logistics (Mladenow et al., 2020). Demand forecasting is another main region: Adaptive AI self-educates from micro-trends in nearby places, festive-based buying habits, and sudden demand spikes, allowing efficient micro-warehouse stocking. In fraud or scam detection and consumer habit analysis, Adaptive models modify with new fraud habits and shifting buying habits to maintain protection and trust. By allowing constant up enhancement, Adaptive AI permits Q-Commerce stages to maintain competitive delivery times (10-30 minutes), enhance rider efficiency, minimize operational prices, and provide highly personalized consumer experiences.

Analysis : Commodity Price Volatility In India

Commodity 1: Food Grains (Wheat and Rice)



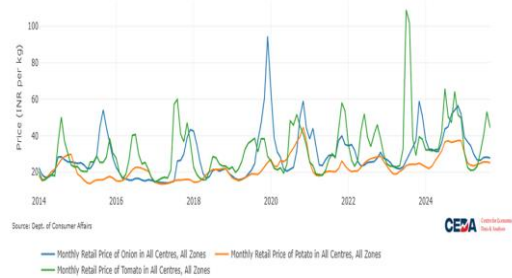
Source: CEDA (Centre for Economic Data & Analysis)

As per the Time-Series Analysis, the blue line depicts price line of Rice. As per the graph it is evident that a gradual steady price increase can be seen over the years from 2014 to 2024. The price rise from Rs. 27/kg in 2014 to Rs 42-44/Kg by 2024 is noted. There are no major fluctuations depicting large bugger stock, high domestic production and smooth upward inflation-driven growth.

Whereas, the orange line represents Wheat. A slow steady rise can be noted. Price increased from Rs. 23/kg in 2014 to 38/kg in 2024. A rise in price can be noticed during the pandemic, due to supply disruption.

Hence overall low volatility can be seen.

Commodity 2: Vegetables (Onion, Tomato, Potato)



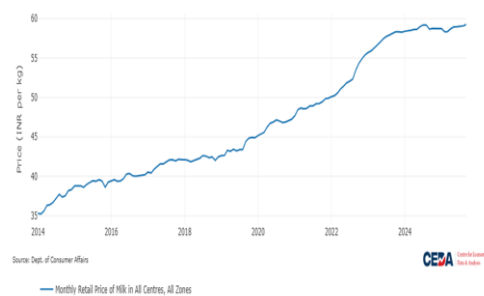
Source: CEDA (Centre for Economic Data & Analysis)

The Time series Analysis depicts that Onion prices fluctuate widely across the years, especially in 2019 in the onion crisis, 2020 during the pandemic and high spikes during 2022-2023. Price exceeds Rs.80 – 100/kg. This occurs due to seasonal changes, heavy monsoon dependence and poor storage infrastructure.

Tomato, the most unstable vegetable. Sharp spikes can be noticed in 2017, 2020, 2022 and 2023, crossing Rs.100-120/kg, causing the nationwide tomato price crisis. Since it is highly perishable, the price is highly volatile.

Potato is moderately volatile. Price remains much lower than onions and tomatoes, ranging from Rs.10-35/kg. Occasional spikes can be noted, but storage is comparatively better.

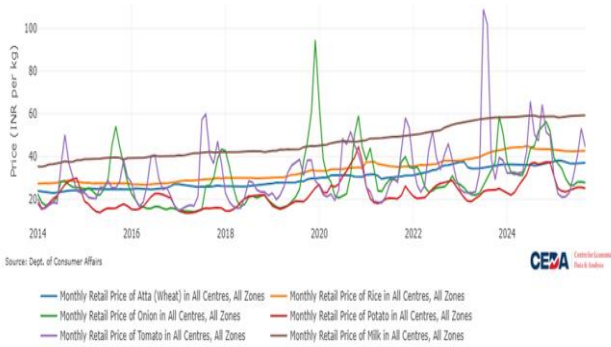
Commodity 3: Dairy (Milk)



Source: CEDA (Centre for Economic Data & Analysis)

The Time Series Analysis of Dairy products like Milk, shows a linear, smooth upward trend, showing a gradual upward trend in the price from Rs.35/kg to Rs.60/kg. No sudden rise or drops can be seen, this shows an organised dairy sector, controlled pricing and steady demand of milk throughout the year.

Combined Commodity Graph- Time Series Analysis



Source: CEDA (Centre for Economic Data & Analysis)

We can segment the 6 commodities in 3 behaviour groups

Group 1- Highly Stable – Milk (Gradual steady rise in milk prices)

Group 2 Moderately Stable – Rice and Wheat (Orange and blue lines showing gradual rise in price, and few sudden variations due to inflation)

Group 3 Highly Volatile – Onion, Tomato, Potato (Green purple and red lines on the graph, depict the vegetable prices. These lines oscillate sharply. Tomato shows most volatility, whereas onions show frequent crisis.

Hence, Vegetables face high volatility due to its perishable nature as compared to non-perishable goods due to instability of agricultural supply chains, climate vulnerability and storage limitations. Food grains and dairy are comparatively stable in India. Vegetables reflect Volatility increased after COVID-19 and climate change effects. Milk is the least volatile commodity among all Six.

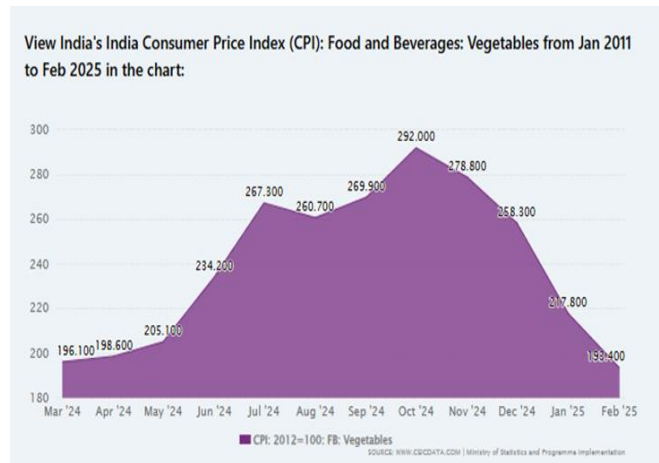
Comparison Table

Category	Commodities	Price trend	Volatility	Factors Responsible
Food Grains	Rice, Wheat	Stable Upward	Low	Adequate storage, ample buffer stock
Dairy	Milk	Continuous rise	Very low	Cooperative pricing strategies,

				Animal feed costs
Vegetables	Onion, Tomato, Potato	Unpredictable	High	Perishability, Weather, climate, supply chain

Source: Author

CPI Consumer Price Index for Vegetables in India



Source: Ministry of Statistics and Programme implementation

As per data from CEIC data, India CPI: Food and Beverages: Vegetables, has been reported as 193.4 in Feb 2024 and 182.300 in March 2025. The base year taken is 2012=100. From Jan 2011 to March 2025 1171 monthly observations averaging 152.800 . This graph shows the volatility in the price of vegetables, over the years.

Availability of Food essential Commodities on Q-Commerce Platforms

Q Commerce Platforms	Mean Stock Out (1-5 Scale)	Interpretation
Zepto	3.21	Highest stockout
Instamart	3.19	High Stockouts
Blinkit	3.07	Moderate Stockouts
BigBasket Now	2.81	Lower Stockouts
Flipkart Minutes	2.42	Lowest Stockouts

Source: Author

The median score = 3, which reflects how frequently the Q commerce platform, users experience, unavailability of items on each of the platforms.

For the purpose of the study, the median selected is three above, which high stockouts can be interpreted and below which low stock outs can be interpreted . Zepto shows the highest stockout rate in comparison to all the platforms,

indicating multiple users often face the problem of unavailability of products due to supply chain gaps, or inadequate inventory forecasting. Instamart also faces high stockouts, whereas Blinkit faces a moderate range of commodity stock out but possesses are relatively better inventory management than Zepto and Instamart

On the other hand, big basket and Flipkart minutes fall under the median range Suggesting stable supply chain, replenishment efficiency and strong inventory management.

Correlation between Q-commerce platform inadequacy and Consumer responses

Variable X	Variable Y	Correlation (x)	Relationship
Stockout	Switching Likelihood	+0.859	Strong Positive Relationship
Price Instability	Overall Satisfaction	-0.818	Strong Negative Relationship

The variables selected for the purpose of the study, measured using a five point like a scale. To understand the relationship between the variables, correlation analysis has been applied, which highlights important behavioural patterns. A strong positive relationship can be seen between stockouts and switching likelihood ($r=0.859$). This indicates that quick commerce platforms with higher stocks caused dissatisfaction among consumers, motivating them to switch to a different commerce platform to fulfil their commodity needs. Additionally, regular price instability is strongly negatively correlated with overall satisfaction ($r=-0.818$), indicating that consumers overall satisfaction decreases with regular price changes.

Role of Adaptive AI in helping Q-Commerce Platforms to maintain Competitiveness

A. Adaptive AI reduces price volatility in commerce platforms by

- Preventing sudden price jumps, through instant demand forecasting.
- Stabilizing extreme price fluctuations and fair commodity pricing
- Reducing shortage and overstock cost via inventory optimisation
- Preventing spikes in cost via early prediction of supply risks

- Stabilizing fresh item prices via optimal ordering and by reducing perishable waste

B. Adaptive AI contributes to making Q-Commerce platforms more competitive in today's VUCA world through the following benefits, such as:

- Offering smarter logistics
- Real-time route optimisation
- Hyperlocal demand prediction
- Personalised customer experience
- Fraud prevention using pattern recognition
- Accurate stocking
- Dynamic promotions via regular updating of real time consumer behaviour
- Operational automation
- Human error minimisation

Boon for Farmers

In India, the government helps farmers by providing a minimum support price(MSP) for the agricultural produce. However, there is no universal mandatory rule that compels private companies to purchase the produce at the MSP. This exposes farmers to inconsistent income, over supply risks and regular price fluctuations.

Adaptive AI works towards minimising these uncertainties by providing predictive insights of real time data to the farmers. Normally, farmers face the issue of cultivating products with low market demand, which later fetch poor market prices. As well as over producing commodities, which lead to over supply in the market, leading to selling at distress rates. Adaptive AI predict market demand accurately, and provides transparent data driven prices to the farmers so that they are able to understand the market demand and the customer needs.

Additionally, adaptive AI also provides other benefits to farmers such as

- Early prediction of market demand, for crop production
- Over supply indications to prevent price crashes
- Weather and Crop health insights for improved planning

- Increased Direct sourcing with Q commerce platforms

The way forward

It is evident that adaptive AI is a boon for quick commerce players in the e-commerce market. If used for pricing sourcing and logistics, it can provide an edge over other quick commerce platforms. The recommendations for these players to maintain competitiveness in the market are to build partnerships directly with farmers for steady supply and provide them with forecasting information. Improving storage and cold chain can lead to loss reduction for perishable items. Adopting a analytical based pricing method can prove to be beneficial for quick commerce players. Lastly, expansion of micro warehouse or dark stores can reduce stockouts leading to customer satisfaction. Government can invest in voice interfaces in local languages, set up call centres for advising the local farmers on data driven agricultural advice and automated crop insurance claims. On the other hand policy makers can use this study to understand the emerging technological trend and its need and develop AI friendly policies for improved market transparency.

Additionally, Agri-market advisers can utilize the boons of this technology and use adaptive AI in planning and forecasting.

CONCLUSION

In conclusion, in this rapidly changing VUCA driven World, Adaptive Artificial Intelligence has emerged as a boon for the quick commerce platforms in the market by not only reducing volatility in commodities that are perishable, but also stabilising prices, reducing wastage, and optimising business operations.

As quick, commerce continues to expand These players, need to be farsighted and adopt, adaptive artificial intelligence to maintain competitiveness and build a resilient and consumer centric ecosystem

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