

The Diet Coke Shortage in India: An Analysis of Upstream Strength and Downstream Weakness in the Aluminium Value Chain

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ABSTRACT

Recent shortages in Diet Coke beverage cans in India due to trade constraints because of the West-Asia crisis prompt an investigation into the larger issue regarding India's reliance on imports of Aluminium specialty products (sheets and beverage-grade cans) despite being the world's 2nd Largest Aluminium Producer. This apparent contradiction forms the foundation for this research.

This study analyses the five main constituent stages that lead to the final product of beverage-grade cans, including bauxite mining to primary aluminium smelting to can-sheet rolling, quantifying the value added in each stage and attempting to identify the bottleneck in India's Aluminium Production capabilities.

The findings indicate that India's strengths lie in upstream activities such as mining, refining, and primary aluminium production, while comparatively limited domestic capacity in specialised beverage can-sheet rolling, which has created a reliance on imports. The research concludes that this dependence is not the result of insufficient aluminium resources but is affected by a multiplicity of factors such as historically low demand and preference for plastic/PET beverage bottles, economics of scale and preference of producing other Aluminium Products.

Keywords: *Diet Coke Shortage, Aluminium Value Chain, Aluminium Value Chain, Upstream vs. Downstream Manufacturing, Import Reliance, Bottlenecks in Aluminium Production, Upstream vs. Downstream Disparity, Take-or-pay Agreement, Capacity Reservation Agreement, Closed-Loop Recycling Infrastructure.*

1. INTRODUCTION

In April 2026, Indian distributors started facing disruptions in deliveries of Diet Coke, due to the delayed shipments from the Gulf Region due to the Iran War [1]. In India, Diet Coke is only sold in Aluminium cans, as opposed to other beverages that have plastic (PET)/glass alternatives. The shortage of the same good became prominent due to the de facto blockade of the Strait of Hormuz by Iran. Noting that the Persian Gulf contributes to about 9% of worldwide aluminium production [2], the crisis has gotten worse before it gets better as it has emerged in and persisted in April and May of 2026 respectively.

This shortage prompted a further interrogation into the matter– Why does India import Aluminium products from the Gulf Region, when the fact remains that the latter has little to none Bauxite (Aluminium ore) reserves whereas the former has enough Bauxite to last consumption needs for about 350 more years [3], and happens to be the world's 2nd Largest Aluminium Producer. In fact, India has notably increased its alumina and aluminium production in the last five or so years [4], supplemented by one of the world's highest quality bauxite ores [5], hence the paradox intensifies further.

According to Kostas Bintas, Head of Mercuria Energy Group, which is one of the world's largest independent energy and commodity trading companies, there is a claim that the global aluminium market is facing a “black swan” of sorts (i.e. an unpredictable event that is beyond what is normally expected of a situation and has a potentially severe

consequence). The shortages in supply and lack of trade due to

hindrances in the Strait of Hormuz have been notable all across the world and for a multitude of parties. To tackle this supply shortage issue, Coca-Cola began to ration

their products to distributors to tackle this shortage [1], making the issue particularly relevant for current study.

The demand for Diet Coke in India has increased significantly over the past couple of years. In 2020, zero-sugar and low-sugar drinks were about 5% of Coca-Cola India's total volumes. The figure was 30% by 2025. Year-on-year sales volume of Diet Coke doubled [6]. Diet Coke, amongst other sugar-free beverages have phased out from an urban niche to a mainstream consumption habit for Indians, which is a telltale appreciation for the product considering that nearly 10% of Urban India is diabetic [7]. The Indian Gen-Z population also actively voices their affection for Diet Coke, some on social media pleading its importance by symbolising it to be “fridge-cigarettes”. Although Coca-Cola does not publicly release the demographic profiles of its product’s consumers (here, in reference to Diet Coke) it is plausible to infer that younger, more health-conscious consumers comprise a significant share of its customer base. Hence it is no shock that the absence of the beverage had an impact on a considerable amount of consumers in metropolitan Indian cities.

To answer the question of why India still imports a large sum of their Aluminium products, it is necessary to examine the complete aluminium value chain rather than focusing solely on the availability of raw materials. Aluminium (and Aluminium Products) production is not a single staged process but a sequence of specialised industrial activities, each adding economic value and requiring different technologies, investments and conditions.

A country's ability to produce primary aluminium does not necessarily imply that it possesses competitive capabilities in downstream manufacturing such as beverage-grade can-sheet rolling or can production. In fact this upstream-downstream manufacturing disparity is common to several nations [8].

This research hence analyses the five principal stages in production of Aluminium Beverage-grade cans and can sheets and the economic value added in each consequent stage, alongside India’s status at each level. This study seeks to identify where the bottleneck in India's aluminium ecosystem lies and why it has persisted despite abundant domestic resources.

2. THE FIVE PRINCIPAL STAGES OF ALUMINIUM PRODUCTION

To simplify the elucidation of value addition and based on the major steps of creation of beverage-grade cans, the value added and India’s production quality/quantity analysis is assessed for the series of five main processes: Bauxite (mining ore), Alumina Refining, Primary Aluminium (smelting), Sheet (rolling), Shaping into Beverage-grade cans. The exchange prices of each are also mentioned.

1. Mining Bauxite ore- This is the primary process to obtain Aluminium. It involves extracting bauxite from its ore for further processing. Bauxite can vary in price due to grade and origin thereby the global price of bauxite generally ranges between \$30 and \$85 per metric tonne, which averages out to US\$57.5 per metric tonne.
2. Alumina Refining- Bauxite is crushed and chemically refined using the Bayer Process, during which impurities are removed to produce alumina (Al_2O_3), a fine white powder that serves as the primary raw material for aluminium smelting. 1 tonne of aluminium typically requires about 2 tonnes of alumina, which in turn requires roughly 4/5 tonnes of bauxite. (Price of Alumina: \$330 based 15/07/26, London Metal Exchange, [9])
3. Smelting- Alumina is converted into primary aluminium (Al metal) through the Hall–Heroult Process, in which an electric current is passed through molten alumina to separate pure aluminium from oxygen. The molten aluminium is then cast into ingots for further processing. (Price of Aluminium: \$ 3177 based 15/07/26, London Metal Exchange)
4. Rolling- Primary aluminium ingots or slabs are reheated and passed repeatedly through rolling

mills, reducing their thickness until ultra-thin beverage-grade aluminium sheet is produced. The conversion from primary aluminium to beverage can sheet typically adds a premium of US\$300–700 per metric tonne over the standard London Metal Exchange (LME) aluminium price, resulting in an approximate market value of US\$3,477 to US\$3,877 per metric tonne, which averages out to US\$3,677 per metric tonne.

5. Preparing Beverage-ready cans- Beverage-grade aluminium sheets are cut and shaped into cans using specialised manufacturing processes. The cans are then coated internally with a food-grade protective layer to preserve beverage quality, while the exterior is printed for branding and product information. The estimated value of empty aluminium beverage cans ranges between US\$4,500 and US\$7,000 per metric tonne of aluminium equivalent, which averages out to US\$5,750.

Table 1. Market Value Across the Aluminium Value Chain

Stage	Average Price (Price as per London Metal Exchange [US\$ per tonne])	Market Value Multiplier
1. Mining-Bauxite Ore	57.5	-
2. Refining-Alumina	330	5.74x
3. Smelting-Aluminium Ingots	3,177	9.63x
4. Rolling-Aluminium sheets	3,677	1.16x
5. Converting to beverage-grade cans	5,750	1.56x

Note 1: The above table represents the price of the goods obtained at each stage from the London Metal Exchange which is the standard global benchmark for exchange price of metals as on 15th July 2026 or estimated average prices of the same based on average global price ranges. The same table does not claim exactitude in its being.

Note 2: Figures compare per-tonne market prices of intermediate products at each stage, not direct mass transformation. Since 4–5 tonnes of bauxite yield 1 tonne of primary aluminium, mass-adjusted value creation per raw unit is lower.

Market Value Multiplier refers to the marginal increment in the market value of the good from one stage to another.

Market Value Multiplier from Stage 1 of Mined Bauxite Ore to Stage 5 of Beverage-grade cans is

$$\frac{5750}{57.5} = 100 \text{ i.e 100 times}$$

We infer that The market value of aluminium increases approximately 100-fold as it progresses from bauxite ore to a finished empty beverage can. This illustrates the substantial economic value created through processing and manufacturing across the aluminium value chain.

Table 2. Value Added at Each Stage of the Aluminium Value Chain

Stage	Value Added [US\$ per tonne]	Share of Final Value (%)
1. Mining-Bauxite Ore	57.5	1.00
2. Refining-Alumina	272.5	4.74
3. Smelting-Aluminium Ingots	2,847	49.51
4. Rolling-Aluminium sheets	500	8.70
5. Converting to beverage-grade cans	2,073	36.05
Total	5750	100

Note: The above table represents the price of the goods obtained at each stage from the London Metal Exchange which is the standard global benchmark for exchange price of metals as on 15th July 2026 or estimated average prices of the same based on average global price ranges. The same table does not claim exactitude in its being. Here the Value Added is computed with the baseline being 0, considering the

mineral still being in the ground and having geological but absent market value. This helps us gather a more intuitive and clearer distinction in the values added at each Stage from 1 through 5.

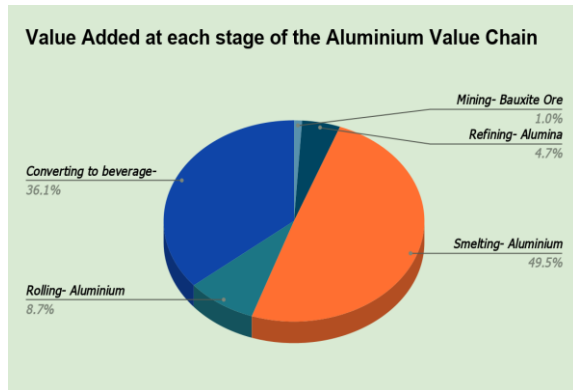


Fig. 1. Value Added at Each Stage of the Aluminium Value Chain

The rightmost column in Table B shows an arithmetic operation that helps us analyse and understand the value added in each of the five stages better. Share of Final Value answers "How much of the final market value of an empty beverage can is attributable to each stage?"

We infer that Stage 3, i.e. Smelting Alumina powder into metallic Aluminium ingots contributes to around half of the total/final value added. The final stage adds more than one-third of the value of the total sum. It must be noted that Stage 5 can only be done after the penultimate stage of rolling into aluminium sheets, hence its significance is to be stressed upon.

3. ALUMINIUM PRODUCTION VALUE CHAIN AND ASSESSMENT

Table 3. India's Capability at Each Stage- A Traffic Light Assessment

Stage	India's Capability	Assessment
1. Mining- Bauxite Ore	India possesses one of the world's largest and highest quality bauxite reserves, sufficient to meet domestic requirements for centuries.	● Strong

2. Refining- Alumina	India has substantial refining capacity and ranks among the world's leading alumina producers, with production increasing in recent years.	● Strong
3. Smelting- Aluminium ingots	India is the world's second-largest producer of primary aluminium and has a well-established smelting industry supported by major producers such as Hindalco, NALCO and Vedanta.	● Strong
4. Rolling- Aluminium sheets	Domestic production capacity for specialised beverage can sheet remains comparatively limited, resulting in continued reliance on imports from countries such as the UAE and Bahrain.	● Bottleneck
5. Converting to beverage-grade cans	India has domestic beverage can manufacturing facilities, but production remains dependent on a reliable supply of specialised beverage-grade aluminium sheet.	● Moderate

Note- A Traffic Light Assessment is a visual method to evaluate progress/performance of a project or plan. It is used here to visually gauge India's standing in the five main stages of Aluminium (and Aluminium Products) manufacturing.

4. OBSERVATIONS

4.1 Upstream-Downstream Aluminium Goods Export Disparity in India

We observe India's capability and efficiency in the first three stages of mining, refining and smelting, which aggregatively account for approximately 55% of the total value added (via Table B). Careful examination of the nation's production output and overall performance in upstream Aluminium products indicates that India is self-sufficient in these stages. Furthermore, India is a significant exporter of bauxite, alumina and primary aluminium, with imports of these upstream resources remaining comparatively limited [10]. The below table strengthens the claim suggesting India's high global ranks in production of these resources.

Table 4. Contribution and Rank of India in World Production of Principal Minerals & Metals, 2021 [11]

Commodity Name	Commodity Unit	World Production Qty.	India Production Qty.	Contribution (%)	India's World Order Rank
Bauxite	000 tonnes	342600	22495	6.56	5th
Aluminium	000 tonnes	67000	4016	5.99	2nd

Hence we infer India's Aluminium issue doesn't lie with the production of upstream but downstream aluminium products. We can further assess this by observing Hindalco Industries Ltd.- India's leading Aluminium (and Aluminium products) producers' financial results of the respective financial years 2026 and 2025.

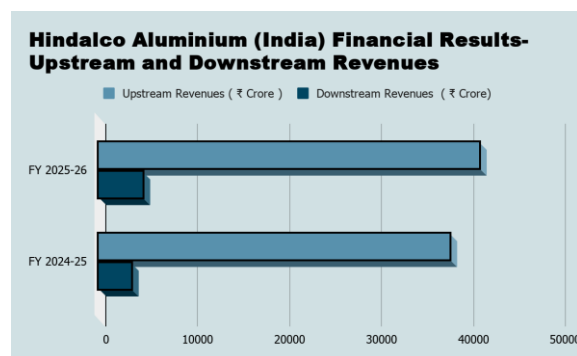


Fig. 2. Hindalco Aluminium (India) Financial Results Upstream and Downstream Revenues [12,13]

The figure elucidates the prodigious difference in revenues accrued from upstream and downstream production by Hindalco in the given years. This disparity is not limited to a singular company but also to the general case of the country. The aforementioned claim is supported by Graph 3.

Perhaps an alarming but true fact that contributes to India's upstream-downstream disparity, specifically deficit in downstream production of beverage-grade cans is that there is only one specialised domestic facility dedicated to aluminium beverage can body stock in the entire country, or in other words, Hirakud is the first and only manufacturer of can body stock in India [14].

The above statement refers to Hindalco's Hirakud Rolling Mill, which is located inside Hindalco Hirakud Complex in Odisha. It is conceivable that this rolling mill is the only one in India wherein the Stage 4 (Rolling Aluminium Sheets), which is also the assessed bottleneck phase, process is held. It remains India's only capable plant for rolling primary aluminium into beverage-grade sheets, which are further converted into cans.

This production ability only presented in one location leads to shortage in adequate domestic supply, hence requiring beverage-can manufacturers to import from overseas, which further substantiates India's import dependence on aluminium products including beverage-grade cans.

Hindalco Industries is an Aluminium and Copper manufacturing company owned by the Aditya Birla Group. It is the world's largest Aluminium company by revenues [15]. The consolidated balance sheet of the Company includes its two major businesses- "Indian Aluminium and Copper Business" and "Novelis Inc." ; the latter being a wholly-owned global subsidiary and the world's leading company in rolling and recycling aluminium into high-value flat products, **especially beverage can sheet** and automotive sheet [16]. Novelis Inc is effectively in partnership accords with beverage companies including Coca-Cola to provide them with Beverage Can Sheets. In 2023, Novelis Inc established a long-term agreement with Coca-Cola Bottlers' Sales & Services Company, which is the contracting agent for The Coca-Cola Company's authorized North American bottlers . It should be emphasised that the deal between the two parties entails an exchange of Beverage Can Sheets to Coca-Cola in **North America** [17] and the trades do not concern the Indian Market.

India on the other hand does not have any publicly disclosed inflow of can sheets from Novelis Inc., and instead relies on domestic/local manufacturers of cans (eg-Ball India, CANPACK India). The same manufactures of cans generally depend on **imports from overseas** due to historically limited domestic beverage can-sheet production. Despite continuous imports of Beverage Can Sheets from nations such as the UAE and Saudi Arabia, it must be noted that local production has increased and planned to be increased in recent years. In 2025, the Ball Corporation (India) announced a USD 60 million expansion of the Sri City plant in Andhra Pradesh to increase can-making capacity. Meanwhile, Hindalco Industries is expanding can sheet production at its Aditya facility in Sambalpur, Odisha. The latter undertaking is expected to add around 50 kilotonnes of capacity. Following this, the CEO/ Managing Director of Hindalco Industries, Satish Pai, has claimed that this further expansion in production will help ease shortages in the consequent years [18].

The aforementioned context about Novelis' success and Indian Aluminium Product Manufacturers' setbacks can be affirmed by three points.

- 1) **Novelis' Capacity Reservation Agreements-** A Capacity Reservation Agreement is a contract between a buyer and a producer wherein a buyer pays a fee to guarantee a constant and specific amount of production from the producer and the producer hence obtains a baseline volume production commitment as well as a baseline revenue. Large companies like Coca-Cola formulate such long-term agreements with producers such as Novelis to ensure long term supply of desired products. This forms, in essence, a contractual lock-in for such producers. Such agreements commit virtually all of Novelis's manufacturing capacity to specific regional markets, leaving negligible unallocated capacity to export sheets to India.
- 2) **Novelis' Take-or-Pay Agreements-** It is the guaranteed monetary remuneration that facilitates such Capacity Reservation Agreements that hence establish the contractual lock-ins. It is when a company (eg- Coca-Cola) guarantees that it will either take delivery of a specified minimum volume of product or pay a fixed fee/penalty regardless of whether it actually accepts delivery.
- 3) **Indian Producers' Absence of Closed-Loop Recycling Infrastructure-** Closed-Loop Recycling (here) is a circular process wherein Used Beverage Cans are collected, melted down

and re-manufactured into the exact same high-grade product without losing its properties/qualities. Re-melting of Used Beverage Cans requires approximately 95% less energy than processing primary aluminium [19]. India currently lacks a formalized, large-scale, automated beverage can collection infrastructure and dedicated Used Beverage Cans sorting facilities. As a result, post-consumer scrap in India is largely handled by informal collection networks where aluminium is often mixed with other scrap metals and downcycled into lower-grade alloys (like utensils) rather than being returned to loops for production again. The absence of such dedicated ecosystems provides Indian Producers with more technical and time costs of production.

Such production commitments by Novelis and legal agreements including Take-or-Pay and Capacity Reservation Agreements bind them to companies for their production. Novelis cannot simply re-route its output from overseas to India simply because Hindalco owns it. Deviations from such supply agreements/obligations would violate commercial contracts and trigger massive penalties, which can cause Novelis to lose its primary revenue sources.

Hence an **ironic paradox** occurs, an Indian company owned subsidiary, which is the one of the world's largest producers of beverage-grade can sheets does not provide any of the same to the country in which its parent company is based, which relies on complemented imports for its regular supply for beverage cans.

An important fact about India's exports is that a large share of its aluminium is exported in primary form as opposed to converting it into specified higher-priced products. This has a large opportunity cost for much larger revenues for the country. The same can be elucidated by the example of statistics of the composition of the aluminium that are exported in India and China respectively.

The focus on India's Aluminium exports is on upstream goods (i.e. materials that are closer to the producer than the consumer in the production cycle and have lesser specificity in production) than on downstream goods (i.e. materials that have further procession on them and are closer to the consumer than the producer in the production cycle). India's composition of Aluminium exports consisted of 76%

Primary Aluminium and 24% being downstream products. Conversely, China's exports were 5% Primary Aluminium and an overwhelming 95% being downstream products. The monetary values of the same reflect the difference in efficiency of utilising resources for exports. In 2023, India and China exported Aluminium and Aluminium goods worth \$7.3 billion and \$35 billion respectively. The composition of China's downstream products exports emphasises the economic benefit of value-added at each stage in the production cycle of goods [20]. This has also helped China to build globally competitive downstream industries, generate larger volumes of exports and generate large-scale manufacturing sector employment.

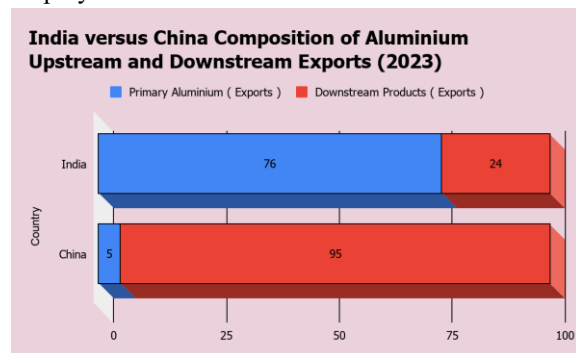


Fig. 3. India-China Aluminium Exports 2023

Global Trade Research Initiative (GTRI) is an economic think tank whose primary purpose is to provide high-quality jargon-free for governments and industry from the perspective of development in subjects concerning trade, climate change, etc. Its founder Mr. Ajay Srivastava reaffirms the issue of India's Aluminium Value Chain and exports issue. He claims that India is not fully capturing the economic benefits of its Aluminium abundance. He said that whilst primary aluminium production has expanded, downstream industries that convert aluminium into higher-value products face rising pressure [21].

4.2 India's Bottleneck in Aluminium Rolling Sheets for Beverage-grade Can Sheets and Reasons

4.2.1 Historically low-demand for canned beverage products

India's limited domestic production of beverage-grade aluminium can sheet can largely be attributed to the historically low demand for canned beverages in the country.

The post-independence Indian beverage market was largely dominated by traditional drinks such as tea, milk, lassi and fresh-fruit juices, leaving carbonated

soft drinks to be considered niche products due to low disposable incomes. The claim of the Indians post-independent low disposable income can be assessed by the Maddison study on "Levels of GDP Per Capita in European Colonial Powers and Former Colonies, 1500-1998 [22]. The same suggested that India's GDP Per Capita in 1950 was 619 (1990 international dollars, adjusted for Purchasing Power Parity- PPP) indicating that average income levels were extremely low by international standards. It is reasonable to infer that a substantial proportion of Indians lived at near subsistence levels [23].

Carbonated soft drinks however did start to scale in operations in the decades that followed, but these were largely sold in Refillable Glass Bottles (RGBs). The use of these containers prolonged significantly till the end of the 20th century when Plastic (PET- Polyethylene Terephthalate) bottles were adopted for usage by a majority of the country. These were lightweight, inexpensive and suitable to carry home. The adoption of PET bottles coincided with the rapid expansion of India's carbonated soft drink market during the 1990s and 2000s, which expanded steadily. Market growth accelerated from approximately 2-3% during the 1980s to 5-6% in the early 1990s, and further to 7-8% per annum in the early 2000s [24]. Despite the growth of the Indian soft drinks industry in the late 20th century, following economic liberalisation, per capita consumption remained among the lowest in the world. In 2003, India consumed only six bottles of soft drinks per person annually, compared with 80 in Thailand and 800 in the United States [25].

There simply wasn't enough market demand for soft-drinks in comparison with the global markets for Indian manufacturers to compete, and producing specialised beverage-grade can sheet was a distant reality.

It is worth noting that generic Rolling Mills had been established in India long before the market for aluminum beverage cans existed. They were primarily established for producing materials concerned with utensils, building, construction and electrical utilities. It is crucial to highlight that these rolling mills cannot simply be diverted to produce beverage-grade can sheets. The reasons for the same include:

- 1) **Strict Specifications:** Beverage cans require highly specialized high-magnesium and high-manganese aluminum alloys for the can body and top end lid. Generic mills typically process

standard commercial alloys and lack mechanical strength to withstand processes undergone by these metallic alloys for production of cans.

- 2) **Massive Volume and Demand Requirements:** Beverage-can sheet production generally operates on very minute margins and requires extreme scale of demand to be profitable. Manufacturers may not be willing to digress their course of operations from something that is stabilised to something riskier and more high-demand elastic.
- 3) **Rigorous Qualification Process and Standards:** Global beverage leaders like Coca-Cola and Pepsi maintain extremely stringent quality control and supplier certification standards. The testing, auditing and granting permit for a new rolling mill to produce cans for them is an effort that can take multiple years, hence standard mills cannot quickly pivot to producing beverage-grade cans.

The usage of cans for beverages however, was not limited universally and the delayed start in aluminium can packaging wasn't common to countries such as the USA and China.

In 1957, the first all-aluminium beverage can was introduced for packaging beer [26] and following this the demand for the can started increasing in the USA. From the 1960s and 1970s, aluminium cans started becoming a major packaging for beer and soft-drinks in the country. The case of cans in China varies notably. During the 60s and 70s the demand for canned beverages was virtually non-existent, but following Deng Xiaoping's economic reforms, Coca-Cola (which resumed operations in China in 1979, shortly after China's "Reform and Opening Up" policy) and Pepsi (which initiated in the country in 1981 through a joint-venture) entered China and the demand for aluminium cans began appearing. This demand prolonged through the 90s and by the 2000s, China had developed one of the world's largest aluminium rolling and downstream manufacturing industries, including beverage can sheet production [27].

In present times the packaging for beverages in the USA and China is dominated by both PET bottles and Aluminium Cans whereas in India the ratio is dominated by the former format.

Reasons for usage of PET bottles over Aluminium Cans:

- 1) India's soft-drink consumption started escalating more prominently post 1991

economic reforms, and by that time PET bottle technology was inexpensive and widely available.

- 2) Indians generally preferred **cost-effective, family-sized** and **take-home** packaging for their beverages as opposed to cans which were more expensive, less travel friendly and tailored for the sole consumer.
- 3) PET bottles were **re-usable** for storing drinking water and other purposes, whereas cans are designed for single consumption.
- 4) **India's retail structure of Kirana stores** (generally refers to family-owned grocery retail shops found in neighbourhoods in South-East Asia) require easily portable inflow goods for sale. Since PET bottles do not dent, are lighter and easier to transport, the same would be preferred by retailers to acquire from manufacturers.

The demand for soft-drinks had largely increased in the USA and China before the invention of the PET plastic bottle by Nathaniel Wyeth in 1973. By this time, **the demand for soft-drinks had forced firms to industrialise and expand their can-manufacturing abilities by investing in and establishing aluminium rolling mills and beverage-filling plants.** These factories kept expanding even after the invention of PET as per consequent demand. In essence, there was no work-around or cheap alternative for countries such as the USA to meet the demands for soft-drinks except via aluminium cans. By the time India's soft-drink consumption habits climbed, a widespread and cheap PET bottle technology had already surfaced, hence India didn't compel a sense of primacy in investing in rolling mills specialising in beverage-grade cans.

As per 2022-25, India's consumption of beverages via cans is at its peak but India struggles with production of cans due to absence of adequate specialised rolling mills for beverage-grade can sheets, something that a country like China had established on a large scale in the previous decades.

Hence it can be concluded that there simply wasn't adequate demand for soft-drinks in the Indian market for manufacturers to expend large amounts of capital in making high-priced rolling mills. Another contributing factor is discussed in the following section.

4.2.2 Opportunity Cost for Manufacturers/ Higher Risk

The inference of inadequacy of demand for canned beverages in India can be extensively understood and applied from the perspective of a large scale Indian Aluminium manufacturer, such as Hindalco.

A beverage can-sheet rolling mill is high-cost, and requires large production volumes to achieve economies of scale. If adequate demand for canned beverages would not be established then the machines would be underutilised and may lead to losses.

There is a notable opportunity cost (cost of the next best alternative foregone) if a manufacturer decides to invest its capital in making rolling mills for producing beverage-grade sheets in the case of unestablished demand. The machines may not be running at full capacity in the same case and may provide a greater risk as opposed to choosing to invest in machines for something that has a larger and more reliable market demand.

The same is a major reason for why the Upstream-section of Aluminium producers in India still consists of Aluminium products that have more diversified and well founded demands, such as items of construction, industrial goods, electrical products and automotive flat-rolled products (FRPs).

4.2.3 First Mover advantage and Lock-In Effect

Countries including the United States of America, Japan, Germany and more recently, China had all established beverage-grade can sheet production decades before India. These early investments created a first-mover advantage, entitling them to more technical expertise, economies of scale and long-term relationships and deals with global beverage companies. As demand would increase, expansion in the manufacturing capabilities in these industries would be done as opposed to initiating new ones in other countries such as India, creating a sort of industrial Lock-In effect and barriers to entry for late entrants in the can manufacturing scene like India. Furthermore, beverage companies like Coca-Cola and Pepsi, once in accord for long-term deals with manufacturers, alongside stringent quality certifications, would tend to derive operations from the same on a long-time basis due to high switching costs, hence making it even more difficult for new industries to emerge.

5. CONCLUSION

The Diet Coke shortage highlighted a broader structural issue in India's Aluminium Value Chain. India's status in the five principal stages of converting bauxite ore into beverage-grade cans varies particularly. Whilst India possesses significant efficiency in the first three stages of Mining bauxite ore, Refining alumina and Smelting into primary aluminium, alongside notable significant reserves and quantities of the same; Stage 4 of Rolling primary aluminium into beverage-grade can sheets is identified as the major bottleneck in the Aluminium Production Process. Stage 5 of converting such sheets into beverage-grade cans is affected by India's inefficiency in the previous stage.

This leads to India importing services on goods for obtaining downstream products, from nations such as the United Arab Emirates, which possess virtually no Bauxite ore yet receive large sums and premiums for their value addition, the same being a large proportion of the total value added in the process. Domestic manufacturers are hence subjected to import/excise duties on the same.

There is an upstream-downstream products export disparity (specifically, aluminium) in India which is also concluded. It helps identify the opportunity costs/economic value foregone and unutilised by the nation due to its importance/investment channelised by the country primarily in upstream aluminium goods production.

We also observe an ironic paradox- Hindalco is the world's leading Aluminium Company by revenues, and its wholly owned subsidiary Novelis is the world's largest beverage-grade can sheet producer, yet India's bottleneck stage in production is incidentally what is produced the most by the same subsidiary. The same cannot simply be re-routed to India due to Novelis' long-term contracts including Capacity Reservation/ Take-or-pay agreements with large companies like Coca-Cola. This paradox is supplemented by India's lack of Closed-loop recycling infrastructure, which provides for higher technical and time costs in production in the country. The reasons for India's bottleneck are multifaceted, majorly due to India's historically low/delayed demand for canned beverage products as opposed to nations such as USA and China causing the latter to establish efficient beverage-grade can sheet rolling mills whilst India still faces major lack in such infrastructure- as only one dedicated beverage-can sheet rolling mill exists in the entire country, i.e. Hindalco's Hirakud Rolling Mill in Odisha. Other

major reasons include India's overall preference of using Plastic (PET) bottles over aluminium cans due to inexpensive and established PET technologies, re-usability, cost effectiveness, family-use suitability, retail structure of Kiranas and easier portability to the same; alongside the inadequate high demand for beverage cans in the country (in the late twentieth century) leading manufacturers to produce goods of more stabilised and less risky/elastic demands such as cookware utensils, building and construction materials.

Ultimately, the Diet Coke shortage did not create India's Aluminium Production/ Aluminium Value Chain weakness, but exposed it. The disruption caused by the West-Asia crisis demonstrated that India's abundance in raw materials/primary aluminium doesn't translate to self-sufficiency of the specialised/ high-value downstream products that are derived from it.

To ameliorate the aluminium weakness, India should invest heavily in downstream capacity including rolling capacity of beverage-grade can sheets and recycling infrastructure so as to enhance economic value realised from produced aluminium products.

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