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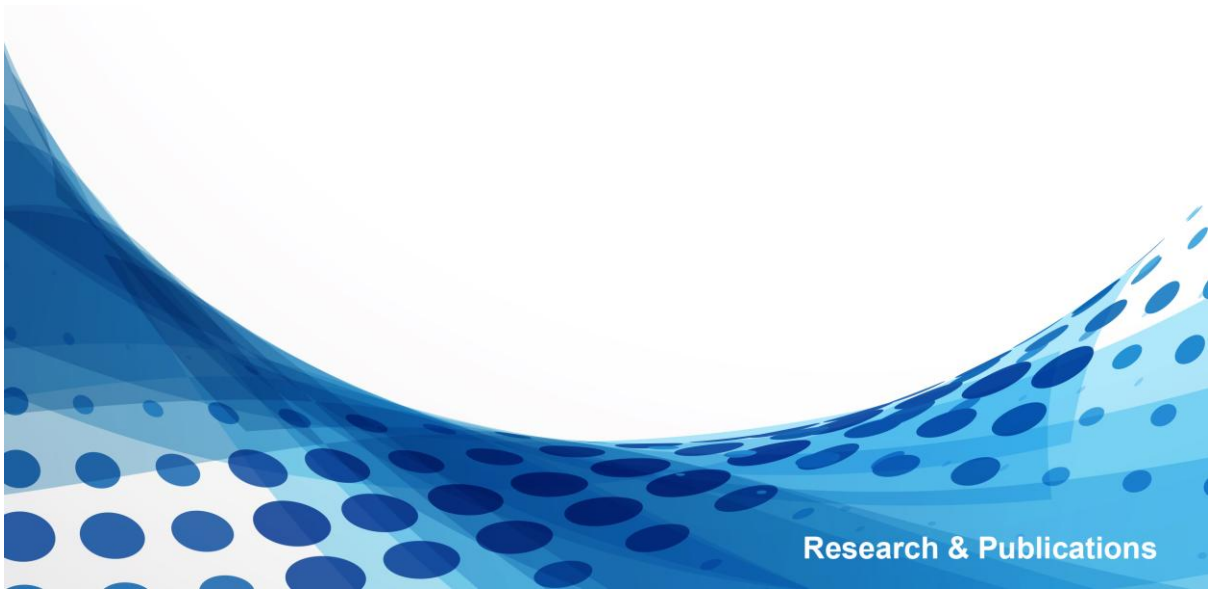
Working Paper

Strategic Acquisition and Value Addition of Gold Resources for India

Sundaravalli Narayanaswami

Anmaya Agarwal



Research &
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W. P. No. 2025-04-02

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Abstract

This paper tries to address India's dependency on imported gold, where annual demand (~800 tonnes) (World Gold Council, 2025) vastly exceeds domestic production (~1.5 tonnes) (Ministry of Mines, 2024), leading to high imports and creating significant current account pressure. Our research identifies countries offering below-average import costs while revealing India's underutilized refining capacity—just one LBMA accredited refinery (London Bullion Market Association, n.d.) within an 1,800-tonne capacity industry competing against unorganized operators for limited raw materials (World Gold Council, 2022-a). Through comparative analysis of international models, we present two strategic pathways. Switzerland demonstrates substantial value addition (~40%) through its refineries, transforming gold doré into finished bullion. Alternatively, Japan achieves remarkable export capacity (200 tonnes) despite minimal mining through complete vertical integration—importing gold ores, recycling 500 tonnes of gold scrap annually, and recovering precious metals from electronic waste through its 11 LBMA accredited refineries (London Bullion Market Association, n.d.). Japanese refineries trade gold in interesting ways like securing supply by acquiring stakes in foreign mines (IAMGOLD Corporation, 2017) or developing premium "green gold" through processes that reduce the amount of carbon emitted (ARE Holding Inc., 2024). This research provides crucial insights for Indian policymakers and industry stakeholders to transition from price takers to price setters in global gold markets.

Introduction

India's relationship with gold transcends mere economic significance, embedding itself deeply within the nation's cultural fabric and financial psychology (World Gold Council, n.d.). With an annual demand of approximately 750 tonnes (World Gold Council, 2025), India stands as one of the world's largest gold consumers, driven by traditions spanning centuries, religious significance, and the metal's perceived security as an investment vehicle. This substantial demand, however, exists in stark contrast to India's domestic production capabilities, a mere 1.5 tonnes annually (Ministry of Mines, 2024), creating one of the country's most persistent macroeconomic challenges.

The resulting import dependency, necessitating roughly 750 tonnes of gold annually with minimal offsetting exports (DGCIS, n.d.), places considerable pressure on India's current account balance. Gold imports represent a significant portion of India's import bill, contributing to the widening Current Account Deficit (CAD) and creating vulnerability in foreign exchange reserves. This imbalance has broader implications for currency stability, inflation management, and overall economic resilience.

Despite these challenges, India's approach to gold management has remained largely unchanged for decades, focusing primarily on demand-side interventions with limited success. Import duty adjustments have inadvertently fueled smuggling and prompted trade diversions through countries with preferential tariff structures, particularly Least Developed Countries (LDCs) (Narayanaswami & Saxena, 2024). Additionally, the Comprehensive Economic Partnership Agreement (CEPA) with the United Arab Emirates (UAE) allows for bullion imports at a 1% lower duty compared to normal imports but excludes doré from the agreement (DGFT, 2022). This creates a situation where bullion can be imported at a lower rate than doré—defeating the original purpose of the duty differential of 0.65% for doré, which was designed to promote domestic value addition (World Gold Council, 2021) (Bhayani, 2024). The GMS, designed to activate India's estimated 25,000 tonnes of household gold holdings (World Gold Council, 2023), has attracted a meagre 30 tonnes as of December 2023 (Ministry of Finance, 2024). Similarly, the SGB program has stalled, with no new tranches issued since February 2024 (Reserve Bank of India, n.d.-b). While conceptually innovative, these policies have failed to address the fundamental structural disconnect between India's robust domestic demand and its underdeveloped supply chain. Consequently, India continues to function as a price taker in global gold markets, wielding minimal influence over pricing mechanisms despite its position as one of the world's largest consumers—a paradox that underscores the need for strategic recalibration of the country's gold management framework.

This research paper examines alternative approaches through detailed analysis of international case studies, particularly Switzerland and Japan, which have developed sophisticated gold management strategies despite limited natural resources. These nations have successfully positioned themselves as value-adding intermediaries in the global gold supply chain through strategic upstream and downstream integration.

Switzerland, with its world-renowned London Bullion Market Association (LBMA) Good Delivery accredited refineries, demonstrates remarkable value addition capabilities (London Bullion Market Association, n.d.). Our analysis reveals that Swiss refineries source gold from countries at prices substantially below global averages suggesting imports of low quality gold doré, subsequently transforming these inputs into high-value products i.e. gold bullion. This process generates approximately 40% value addition—a significant margin for a commodity as valuable as gold. The Swiss model exemplifies how specialized refining capabilities can create substantial economic value beyond the intrinsic worth of the metal itself.

Japan presents an equally compelling but distinctly different approach. Despite negligible domestic mining (approximately 4.5 tonnes annually) (Statista - Statistics Bureau of Japan; METI (Japan), 2024), Japan has established itself as a significant gold exporter (approximately 200 tonnes). This paradoxical achievement stems from Japan's sophisticated vertical integration strategies—importing gold ores and concentrates under specific tariff classifications, recycling approximately 500 tonnes of gold scrap annually, and processing electronic waste to recover precious metals (Ministry of Finance: Japan, n.d.). With 11 LBMA-accredited refineries (London Bullion Market Association, n.d.), the second highest globally

after China, Japan has developed innovative supply security mechanisms, including direct investment in foreign mining operations (IAMGOLD Corporation, 2017) and the development of premium-priced "green gold" through low-carbon processing techniques (ARE Holding Inc., 2024).

India's current refining landscape, characterized by a single LBMA-accredited refinery (London Bullion Market Association, n.d.) within a total capacity of 1,800 tonnes, suggests significant untapped potential. The industry suffers from underutilization and fragmentation, with organized refineries competing against unorganized operators for limited raw materials. This inefficiency represents both a challenge and an opportunity for strategic intervention (World Gold Council, 2022-a).

This paper argues that India stands at a critical juncture, with the potential to transform its position in global gold markets from passive consumer to strategic value creator. By adopting elements from the Swiss and Japanese models—including strategic sourcing from identified lower-cost countries, development of specialized refining capabilities, vertical integration through investment in mining operations, and innovation in recycling technologies—India could significantly reduce its current account vulnerability while creating a more sustainable and profitable domestic gold industry.

The following sections provide detailed analysis of trade data, refining economics, and strategic opportunities, concluding with policy recommendations for government agencies, industry stakeholders, and financial institutions to facilitate this transition from gold dependency to strategic advantage.

Description of Data

This study draws data from multiple authoritative sources. Indian trade data was obtained from the Directorate General of Commercial Intelligence and Statistics (DGCIS). For gold mining statistics—including current production volumes, underground reserves/resources, and ore grades—we referenced the Annual Reports of the Ministry of Mines. Metals Focus provided comparative data on global gold reserves/resources by region and regional production cost benchmarks. Swiss trade information was accessed through the Swiss-Impex dataset maintained by the Federal Office for Customs and Border Security, while Japanese trade statistics were sourced from the Ministry of Finance's Trade Statistics database.

Analysing the Current State of Gold Industry in India

In this section, we analyse the current state of the gold industry in India. We will look at the demand, international trade, gold mining/production, and refinery data to understand the reasons why India is just a price taker for gold even though it is second only after China in terms of gold demand in the world.

Demand for Gold in India

The demand for physical gold in India—comprising bars, coins, and jewelry—has maintained remarkable stability, consistently averaging approximately 750 tonnes annually (with the exception of 2020 during the COVID-19 pandemic) (See Fig. 1). This resilience transcends pure investment rationale, as gold occupies a multidimensional role in Indian society. It serves as a gifting medium for significant life events, particularly weddings, while simultaneously fulfilling deep cultural obligations through ritualistic purchases during auspicious occasions like *Dhanteras* (World Gold Council, n.d.). Notably, this demand has persisted through multiple price cycles and policy interventions, including the unprecedented 15% import duty imposed in 2022 (World Gold Council, 2022-b). This consistent consumption pattern across varying economic conditions demonstrates that gold demand in India exhibits significant price inelasticity, rooted in cultural values that supersede conventional market forces.

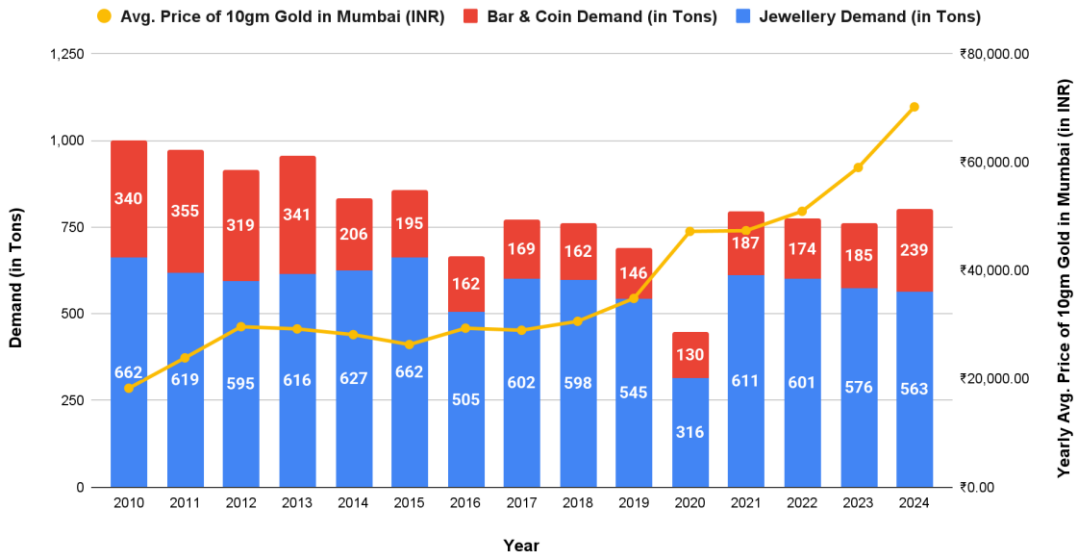

Fig 1. Demand for Gold (Bars, Coins, and Jewellery) in India for Year (in Tons) (World Gold Council, 2025) and Yearly Average Price of 10 grams of Gold in Mumbai (in INR) (Reserve Bank of India, n.d.-a)

Gold Mining in India

Despite India's immense gold demand, domestic mining remains remarkably limited, with the most significant operational Hutti Gold Mine in Karnataka producing approximately a mere 1.5 tonnes annually (see Fig. 2) (World Gold Council, 2022-c). This production gap stems not from operational inefficiency but from fundamental geological constraints. The Geological Survey of India's April 2020 assessment confirmed exceptionally limited economically viable gold reserves nationwide (see Appendix 1). Furthermore, the existing ore deposits exhibit particularly low grades, rendering extraction commercially unviable for mining enterprises (see Appendix 2). While acknowledging that this survey data is approximately five years old and relied on general exploration (G2) methodologies, potentially warranting more comprehensive analysis (detailed exploration (G1)) (Indian Bureau of Mines, n.d.) for definitive grade determination, geological realities make any significant upward revision in either reserve

quantity or quality highly improbable. This fundamental resource constraint underscores the structural nature of India's gold supply challenge.

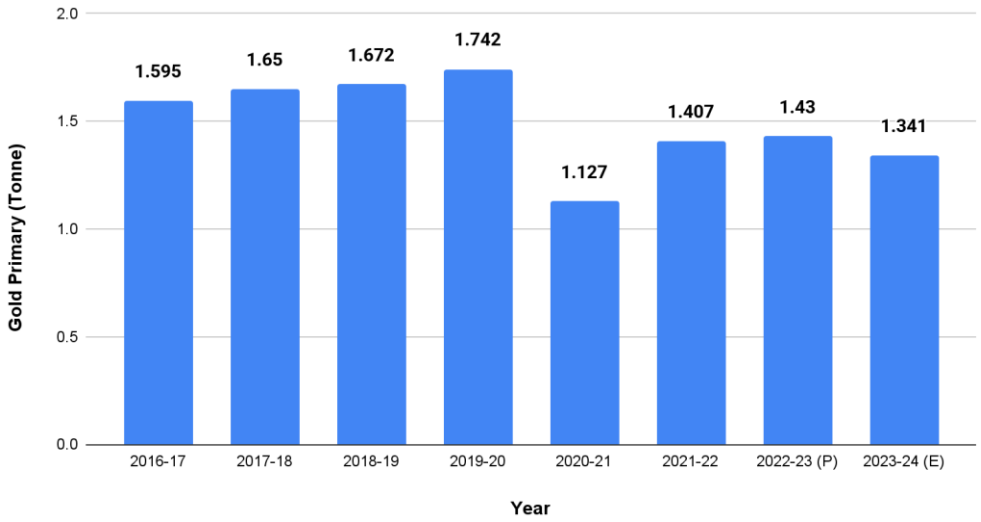

Fig 2. Gold Mining in India (in Tonnes) (Ministry of Mines, 2024)

Import and Export of the Principal Commodity Gold

Given India's severe gold resource deficit, the nation must import approximately 750 tonnes annually to satisfy domestic demand (see Fig. 3). This import portfolio comprises roughly 500 tonnes of refined bullion and 250 tonnes of semi-processed doré (see Fig. 3). While the current Harmonized System Nomenclature (HSN) classification at the 8-digit level does not differentiate between these forms (both falling under HSN subheading 710812: "Gold including gold plated with platinum unwrought or in semi-manufactured forms, or in powder form - Other unwrought forms") (DGFT, n.d.-b), we utilise the country of consignment attribute to differentiate between dore and bullion in the absence of classification at the 8-digit HSN level, countries like Switzerland and UAE predominantly supply finished bullion, while countries like Peru and Argentina primarily export doré. This disproportionate reliance on finished bullion imports significantly reduces domestic value addition opportunities. Furthermore, the CEPA with UAE has inadvertently incentivized trading over refining by creating a 1% tariff advantage for bullion importers, directly undermining domestic refineries (Business Standard, 2024). The resulting market dynamics, perceived doré scarcity coupled with competition from numerous unorganized refineries, has led to chronic underutilization of India's organized refining capacity. This underutilization prevents refineries from achieving the production volumes necessary for LBMA Good Delivery accreditation, perpetuating a vicious cycle of competitive disadvantage in the global gold market.

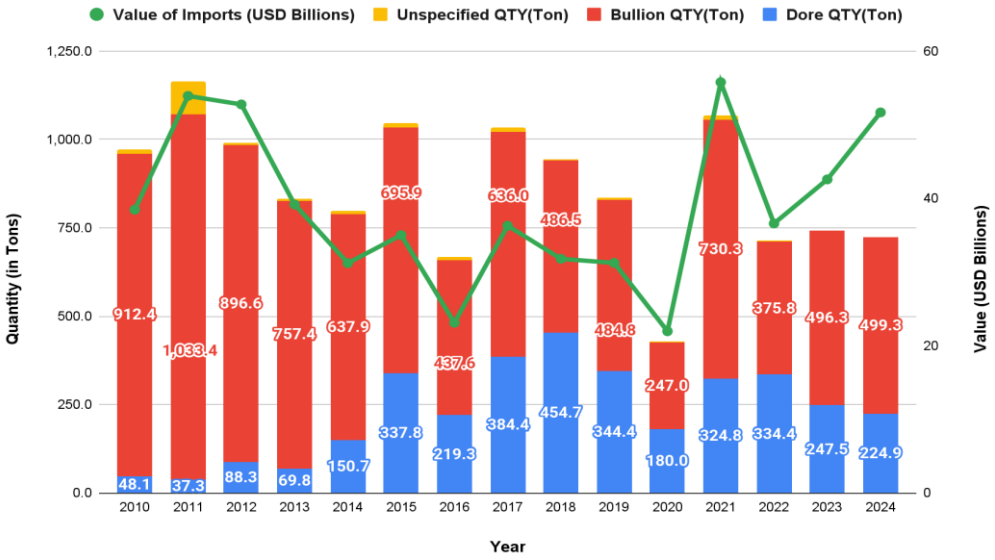

Fig. 3 Imports of Principal Commodity Gold (Contains HSN 71081100, 71081200, 71081300, 71082000, 71189000 (DGCIS, n.d.-c)) by India segregated into bullion and dore as per country of consignment (DGCIS, n.d.)

In stark contrast to its substantial imports, India's gold exports remain negligible—a direct consequence of global market structural constraints. Major international bullion markets only accept gold from refiners listed on the LBMA Good Delivery List, making this accreditation essential for participation in some of the world's most liquid precious metals markets. With India hosting just one LBMA-certified facility creates a formidable barrier to export market access. Consequently, India's gold exports (see Fig. 4) are effectively inconsequential when compared to its massive import volumes, resulting in gold becoming a significant contributor to the country's persistent CAD (see Fig. 5). The briefly implemented 20:80 export rule—which required traders to re-export 20% of all imported gold—temporarily boosted export volumes and moderated CAD pressure. However, this policy intervention was short-lived, underscoring the absence of sustainable, long-term strategies to address India's fundamental gold trade imbalance (Press Information Bureau, 2018).

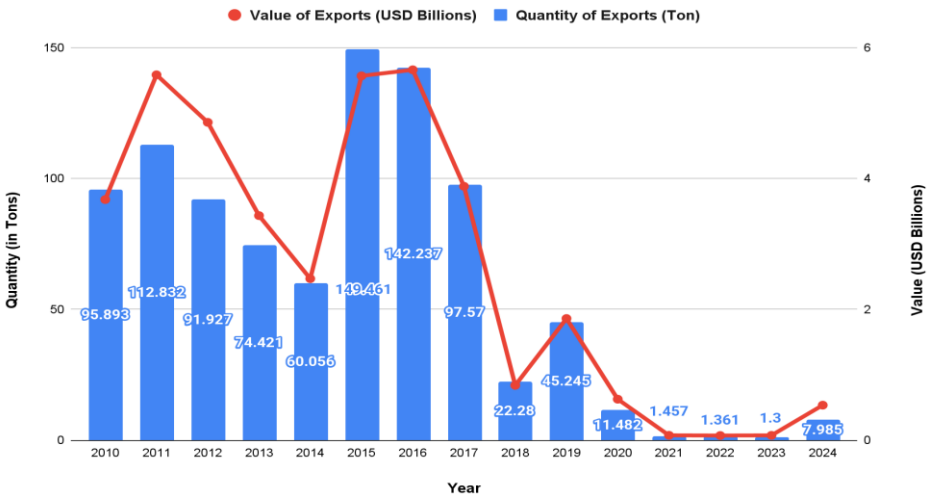

Fig. 4 Exports of Principal Commodity Gold (Contains HSN 71081100, 71081200, 71081300, 71082000, 71189000 (DGCIS, n.d.-c)) by India (DGCIS, n.d.)

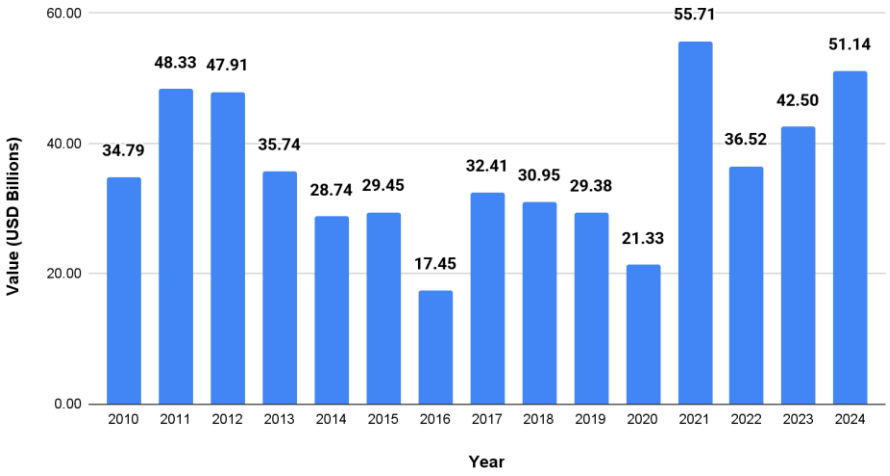

Fig. 5 Trade Deficit (Import - Export) of Principal Commodity Gold (Contains HSN 71081100, 71081200, 71081300, 71082000, 71189000 (DGCIS, n.d.-c)) by India in USD Billions (DGCIS, n.d.)

A granular analysis of import data for HSN 71081200—representing over 95% of India's gold imports of HS heading 7108 in recent years—reveals strategic sourcing opportunities previously underexplored. Several countries consistently supply gold to India at costs below the monthly average import price (see Fig. 6), including Argentina, Peru, and the Dominican Republic. This finding has profound implications for India's value addition potential, as these sources primarily provide doré rather than finished bullion. While Peru contributes the largest volume among these suppliers with only marginally lower costs, the very existence of these trading relationships demonstrates that Indian refineries can successfully engage with these producers. However, these three countries collectively account for merely 15% of India's total gold imports (see Table 1), indicating substantial untapped potential for expanding doré imports and, more significantly, for sourcing even lower-grade doré that offers greater value addition opportunities through domestic processing. This pattern bears striking similarities to Switzerland's highly effective sourcing model seen later in the paper.

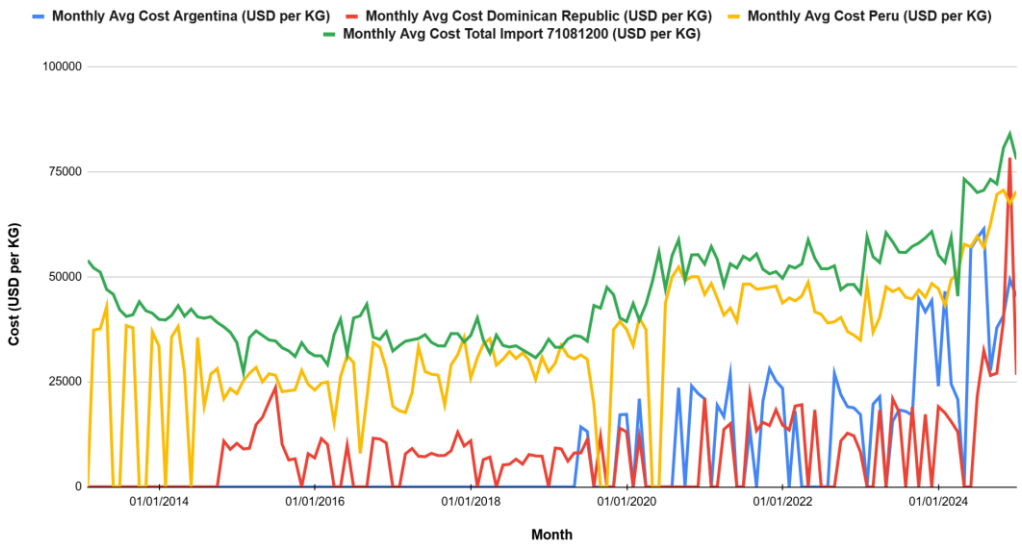

Fig. 6 Average Monthly Cost (USD per KG) for Argentina, Dominican Republic, Peru, and Total Monthly Import of HSN 71081200 by India (DGCIS, n.d.)

Year	Argentina (Ton and %)	Dominican Rep. (Ton and %)	Peru (Ton and %)	Total Import Volume of these nations (approx.) (Ton and %)
2020	11.64	11.92	29.11	**52.66**
	3%	3%	7%	**12%**
2021	24.32	39.66	49.53	**113.5**
	2%	4%	5%	**11%**
2022	11.09	23.55	51.21	**85.84**
	2%	3%	7%	**12%**
2023	15.55	18.01	51.75	**85.31**
	2%	2%	7%	**12%**
2024	14.55	29.23	70.98	**114.77**
	2%	4%	10%	**16%**

Table 1: Yearly Import of HSN 71081200 from Argentina, Dominican Republic, and Peru (in Tons and as Percent of Total Import) by India (DGCIS, n.d.)

Import and Export of Items that can be used for the Recovery of Gold

Examining India's gold sourcing alternatives reveals emerging trends in strategic import diversification. Analysis of HSN 26169000 (Gold ores and concentrates) imports (DGFT, n.d.-c) (see Fig. 7) shows encouraging growth over the past 3-4 years, indicating gradual industry recognition of the Basic Customs Duty (BCD) exemption advantage (India Budget | Ministry of Finance | Government of India, 2024). Notably, the unit cost (USD per KG) has stabilized after historical volatility, with a steady downward trajectory. This pattern suggests several possibilities: a shift from importing higher-value concentrates to lower-grade ores, correction of previous data irregularities, elimination of illicit gold routing, or reduction in logistics expenses. Additionally, an analysis of gold ore and concentrate imports since 2021 (see Table 2), coinciding with the period of accelerated import growth, reveals a highly concentrated sourcing profile. Colombia has emerged as the dominant supplier, with Taiwan and Peru showing increased export volumes to India in 2024. This concentration pattern and recent increase in imports trend warrant deeper investigation, particularly in light of expert assertions regarding the absence of fully vertically integrated players in the Indian market. Industry specialists have highlighted significant capability gaps in the domestic value chain, specifically noting the lack of entities possessing end-to-end processing capabilities from smelting (ore-to-doré conversion) through refining (doré-to-bullion transformation). This apparent contradiction between rising ore imports and limited processing infrastructure raises important questions about the fate of these materials and the nature of India's emerging gold processing ecosystem.

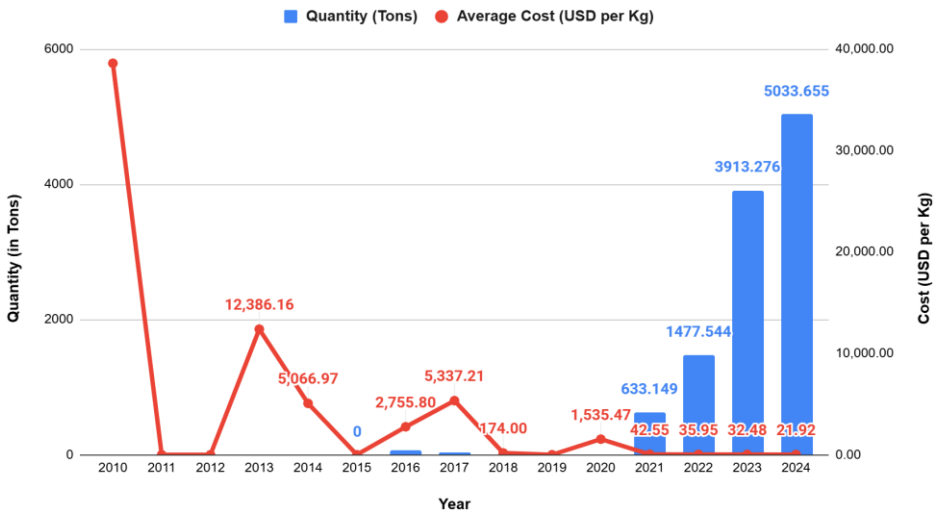

Fig. 7 Import of HSN 26169000 (Gold ores and concentrates) by India in Tons and Yearly average cost of those imports (USD per Kg) (DGCIS, n.d.)

Year	Colombia (Ton and %)	Taiwan (Ton and %)	Total Import Volume of these nations (approx.) (Ton and %)
2021	633	0	**633**
	99.9%	0.0%	**99.9%**
2022	1,476	0	**1,476**
	99.9%	0.0%	**99.9%**
2023	3,897	0	**3,897**
	99.6%	0.0%	**99.6%**
2024	3,796.6	541.1	**4,337.7**
	75.4%	10.7%	**86.2%**

Table 2: Yearly Import of HSN 26169010 from Colombia, and Taiwan (in Tons and as Percent of Total Import) by India (DGCIS, n.d.)

In contrast, imports under HSN 71129100 (waste and scrap of gold and gold-clad metals for precious metal recovery) (DGFT, n.d.-b) remain virtually nonexistent (see Fig. 8), indicating a significant untapped opportunity. Encouragingly, imports of gold compounds and colloidal preparations (see Fig. 9) under HSN 28431010 (Gold Colloidal) and HSN 28433000 (Gold Compound) (DGFT, n.d.-d) show substantial growth—a positive development since these forms typically involve minimal processing losses while enabling significant value addition for refiners. A detailed examination of gold colloidal and compound imports (see Table 3) reveals a significant shift in sourcing patterns. Japan has emerged as the predominant supplier over the past two years, coinciding with the period when import volumes of these specialized gold forms first reached substantial levels. Generally, the import landscape is diversified, with Italy and the UAE serving as key sources. More recently, Australia and Indonesia have also entered this specialized market segment as emerging suppliers.

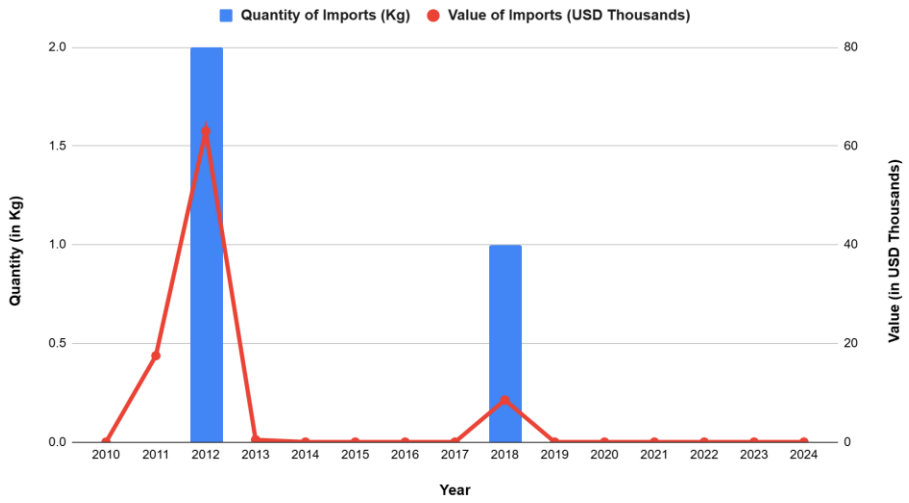

Fig. 8 Import of HSN 71129100 (Waste and Scrap of Gold and gold-clad metals for precious metal recovery) by India in Kg and Value of those imports (USD Thousands) (DGCIS, n.d.)

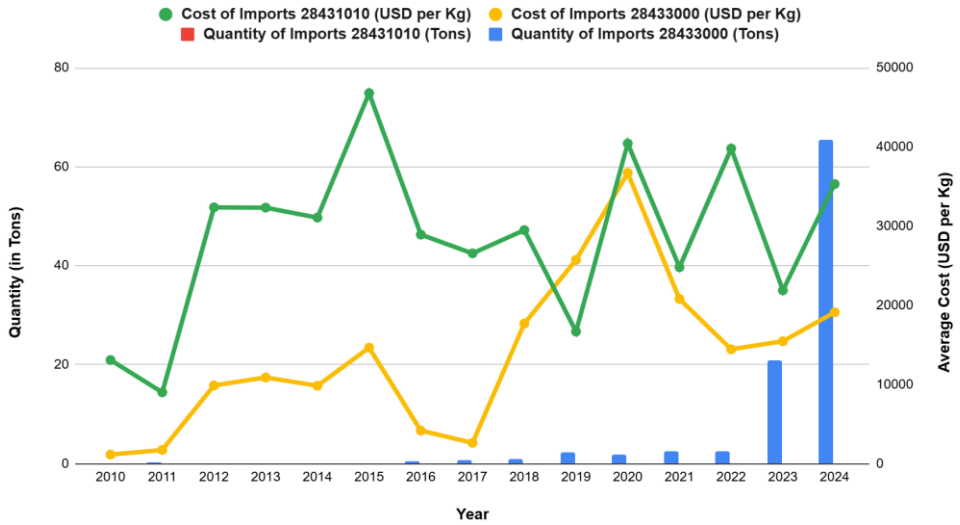

Fig. 9 Import of HSN 28431010 (Gold Colloidal) and HSN 28433000 (Gold Compounds) by India in Tons and Yearly average cost of those imports (USD per Kg) (DGCIS, n.d.)

Year	Italy (Ton and %)	Japan (Ton and %)	UAE (Ton and %)	Total Import Volume of these nations (approx.) (Ton and %)
	0.996	0	0.453	**1.449**
2022	38%	0%	17%	**55%**
	1.961	10.053	7.944	**19.958**
2023	9%	48%	38%	**95%**
	9.367	42.544	1.987	**53.898**
2024	14%	65%	3%	**82%**

Table 3: Yearly Import of HSN 28431010 (Gold Colloidal) and HSN 28433000 (Gold Compounds) from Italy, Japan and UAE (in Tons and as Percent of Total Import) by India (DGCIS, n.d.)

This data suggests that Indian refiners possess both the technical knowledge and processing capabilities to recover gold from diverse feedstock beyond traditional doré. Comparative cost analysis of the following HSN 71081200 (including bullion and dore), 26169000 (gold ores and concentrates), and 28433000 (gold compounds) demonstrates that these alternative material sources offer substantially lower acquisition costs than conventional imports under HS Heading 7108 (see Fig. 10). However, despite these capabilities, the fragmented structure of India's refining sector—characterized by limited formalization and inconsistent adherence to international standards—continues to impede widespread LBMA accreditation, thereby constraining India's ability to fully capitalize on these alternative sourcing opportunities.

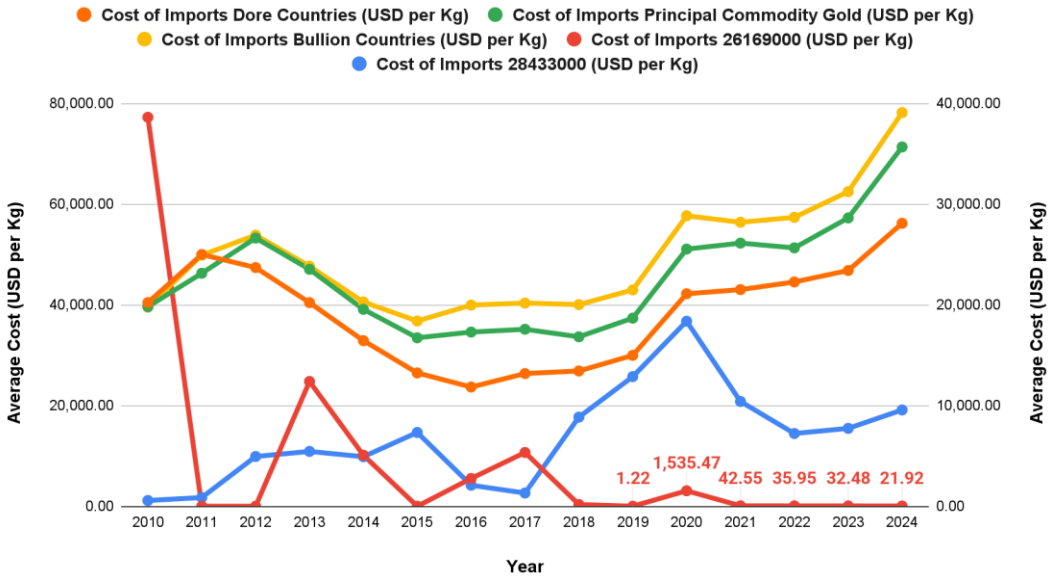

Fig. 10 Yearly average cost (USD per Kg) of HSN 28431010 (Gold Colloidal), HSN 26169000 (Gold ores and concentrates), Total principal commodity gold, gold from dore exporting nations, and gold from bullion exporting nations (DGCIS, n.d.)

Analysis of India's emerging electronic waste (e-waste) sector reveals a significant missed opportunity in domestic precious metal recovery. With 527,131.57 tonnes of e-waste collected and processed during FY 2021-22, India possesses a substantial "urban mine" of valuable materials (Press Information Bureau, 2023). However, rather than capitalizing on this resource domestically, India currently exports this potentially valuable commodity at remarkably low rates under HS Codes 85492100 and 85492900 (E-waste of a kind used principally for the recovery of precious metals) (DGFT, n.d.) (see Fig. 11). This represents a critical strategic oversight, considering that e-waste typically contains between 10-10,000 grams of gold per tonne (Varjani et al., 2020, Pages 307-325)—depending on the specific electronic components—compared to just 3-5 grams per tonne generally found in underground ore deposits (Sumitomo Metal Mining Co. Ltd., 2024, Page 60). Beyond gold, this e-waste contains substantial quantities of other critical minerals (Vuppaladadiyam et al., 2024) essential for India's green energy transition, including copper, silver, palladium, and rare earth elements—resources that India otherwise imports at considerable cost. This concentration differential highlights the need for policy intervention to develop India's e-waste recycling capabilities, which would simultaneously address environmental hazards associated with improper disposal

of e-waste (Ankit et al., 2021) while creating a significant domestic source of precious metals and critical minerals, thereby reducing import dependency across multiple strategic resource categories.

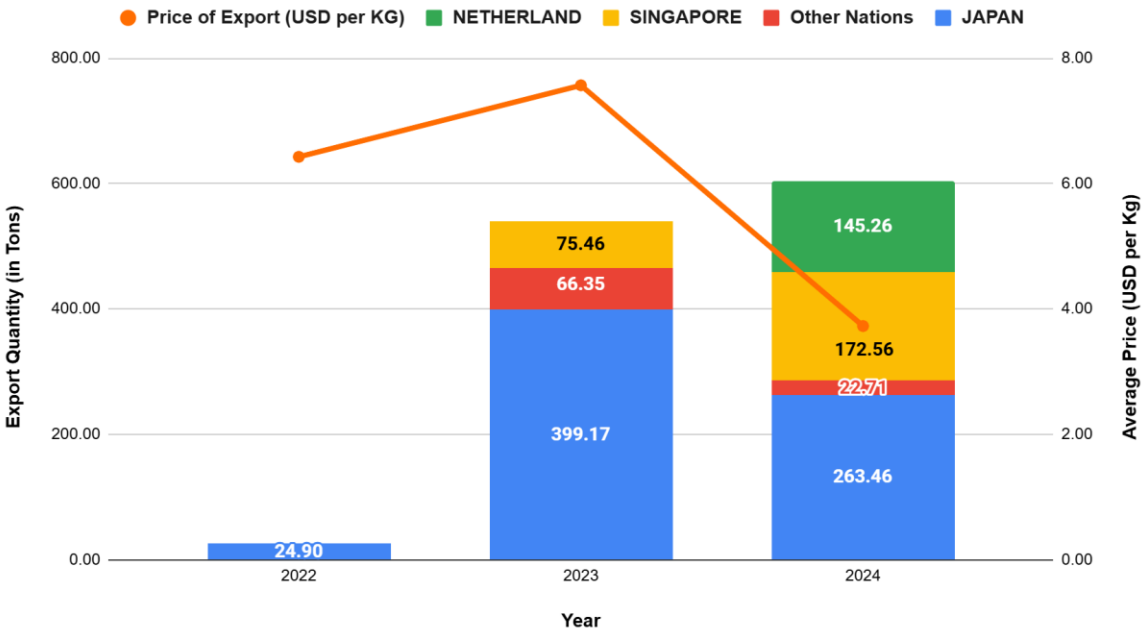

Fig. 11 Export of HSN 85492100 and 85492900 (E-waste for the purpose of recovery of precious metals) by India in Tons (Country Wise) and Yearly average price of those imports (USD per Kg) (DGCIS, n.d.)

A Closer Look at the Trade Deficit due to Gold

While we looked at the trade deficit caused by the HS codes under the principal commodity gold above (see Fig. 6), it might be germane to look at the trade deficit when we include trade due to the other HS codes that act as a source for refining gold that we looked at in the section above. The detailed trade deficit (see Fig. 12) contains the trade deficit due to the following items:

- Gold ores and concentrates (DGFT, n.d.-c)
    - HSN 26169010: Gold ores and concentrates
- Gold colloidal and compound (DGFT, n.d.-d)
    - HSN 28431010: Colloidal precious metals of gold
    - HSN 28433000: Gold compounds
- Principal commodity: Gold (DGCIS, n.d.-c) (DGFT, n.d.-b)
    - HS Heading 7108: Gold (including gold plated with platinum) unwrought or in semi manufactured forms, or in powder form.
        - HSN 71081100: Non-monetary : -- Powder
        - HSN 71081200: Non-monetary : -- Other unwrought forms
        - HSN 71081300: Non-monetary : -- Other semi- manufactured forms
        - HSN 71082000: Monetary
        - HSN 71189000: Other coin
- Gold jewellery

    - HS Heading 7113: Articles of jewellery and parts thereof, of precious metal or of metal clad with precious metal.
    - HS Subheading 711319: Of other precious metal, whether or not plated or clad with precious metal.
    - Pre-April 2023 classification (DGCIS, n.d.-b)
        - HSN 71131910: Of gold, unstudded
        - HSN 71131920: Of gold, set with pearls
        - HSN 71131930: Of gold, set with diamonds
        - HSN 71131940: Of gold, set with other precious and semi-precious stones
    - Post-April 2023 reclassification (DGFT, n.d.-b)
        - HSN 71131911: Of gold: ----Unstudded
        - HSN 71131912: Of gold: ----Studded with pearls
        - HSN 71131913: Of gold: ----Studded with diamonds of heading 7102
        - HSN 71131914: Of gold: ----Studded with diamonds of heading 7104
        - HSN 71131915: Of gold :----Studded with other precious and semi-precious stones
        - HSN 71131919: Of gold :----Other
    - HSN 71131960: Parts (this HSN includes Gold findings as well, whose imports have recently increased from LDCs but the duty parity introduce has since reduced the imports under this HSN (Narayanaswami & Saxena, 2024))
- Scrap Gold (DGFT, n.d.-b)
    - HS Heading 7112: Waste and scrap of precious metal or of metal clad with precious metal; other waste and scrap containing precious metal or precious metal compounds, of a kind used principally for the recovery of precious metal other than goods of heading 8549
        - HSN 71129100: Other : -- Of gold, including metal clad with gold but excluding sweepings containing other precious metals

This holistic approach provides a more accurate representation of India's complete gold-related trade imbalance across the entire value chain. After comparing our principal commodity deficit (see Fig. 5) with our granular trade deficit (see Fig. 11), we observe a significant reduction in the overall trade deficit, primarily attributable to higher gold jewelry exports. The comprehensive analysis reveals deficit reductions ranging from 15 to 40 percent in certain years—a substantial improvement that nonetheless indicates considerable untapped potential, particularly given the renowned quality of Indian jewelry craftsmanship and the underutilized capacity of Indian refineries.

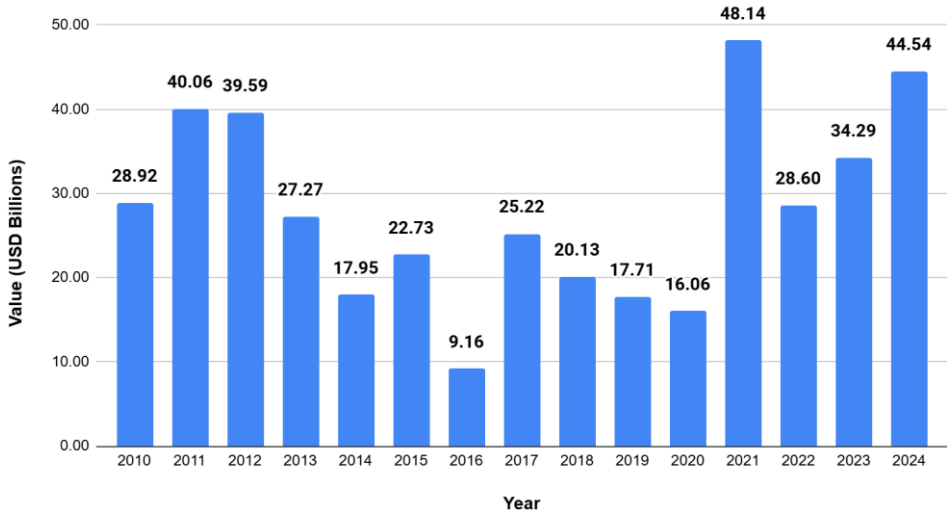

Fig. 12 Granular Trade Deficit (Import - Export) of items related to gold by India in USD Billions (DGCIS, n.d.)

Observations from India

The analysis of India's gold market reveals a complex interplay of cultural demand, resource constraints, and strategic opportunities. India's gold demand remains remarkably inelastic at approximately 750 tonnes annually, deeply embedded in cultural traditions and investment preferences that transcend price fluctuations and policy interventions. This persistent demand contrasts sharply with domestic production capabilities—limited to a single operational mine producing merely 1.5 tonnes annually, with geological surveys confirming the absence of economically viable reserves for significant expansion.

This fundamental supply-demand imbalance necessitates massive imports, predominantly in the form of finished bullion (approximately 500 tonnes) and doré (approximately 250 tonnes), though these proportions remain somewhat fluid. The import structure is heavily skewed toward finished products, significantly limiting domestic value addition opportunities. Policy initiatives have sometimes exacerbated this challenge, as evidenced by the UAE CEPA agreement that inadvertently incentivized bullion imports over doré by creating a more favorable tariff structure for the former.

India's gold exports remain negligible, constrained primarily by the requirement for LBMA accreditation—with only one Indian refinery currently meeting this global standard. This results in gold becoming a major contributor to India's current account deficit. The briefly implemented 20:80 export rule demonstrated potential benefits but was discontinued before establishing lasting impact.

Our granular trade analysis reveals several strategic opportunities. Certain countries—Argentina, Peru, and the Dominican Republic—consistently supply gold at below-average import costs, yet collectively represent only 15% of India's total imports. This suggests significant potential for expanded sourcing relationships. Additionally, alternative gold sources show promising development, with imports of gold ores and concentrates increasing (primarily

from Colombia, with emerging volumes from Taiwan and Peru) and gold colloidal and compounds growing substantially (with Japan emerging as the dominant supplier).

The e-waste sector represents another untapped opportunity. India currently exports substantial volumes of e-waste at low prices, despite containing 10 times more gold per tonne than high-grade ore deposits, along with other critical minerals essential for green energy transition. This represents a missed opportunity for domestic resource recovery.

When examining the comprehensive gold-related trade deficit—including jewelry and alternative forms—we observe deficit reductions of 15-40% compared to considering only the principal commodity. This improvement stems primarily from higher jewelry exports, indicating the value addition potential of India's renowned craftsmanship.

India's refining sector faces structural challenges, including underutilization, fragmentation between organized and unorganized players, and difficulty achieving international accreditation. This creates a vicious cycle: underutilization prevents production volumes necessary for LBMA accreditation, which in turn limits access to global markets.

Recent policy interventions—including import duty adjustments, the Gold Monetization Scheme, and Sovereign Gold Bonds—have demonstrated limited effectiveness. The GMS has mobilized merely 30 tonnes from an estimated 25,000 tonnes of household gold holdings, while SGBs have stalled entirely. The CEPA with UAE has created unintended consequences by inverting the intended duty differential between bullion and doré.

These findings collectively highlight the need for a fundamental recalibration of India's gold management framework—shifting from demand-side interventions toward strategic supply chain development. The strategic acquisition and domestic value addition of gold resources represent a transformative opportunity for India to address its persistent gold-related trade imbalance. By diversifying gold sourcing to prioritize relationships with lower-cost suppliers of doré (like Argentina, Peru, and the Dominican Republic), developing processing capabilities for underutilized alternatives (such as gold ores, concentrates, compounds, and e-waste), and creating an enabling policy environment for refinery accreditation and scale, India could capture significantly greater value within its borders. This strategic pivot would not only reduce the current account deficit by decreasing reliance on high-cost finished bullion imports but would also position India to leverage its manufacturing capabilities, technical expertise, and renowned craftsmanship to move up the value chain. By transforming from a passive price-taker importing finished products to an active participant in global gold markets, India could better insulate its economy from external price shocks while creating domestic employment, developing exportable expertise, and ultimately building a more resilient and balanced gold ecosystem that serves both cultural demand and economic interests.

Analysing the Swiss Model

This section examines Switzerland's trade data related to gold and its processing ecosystem to understand the country's remarkable position as a global gold refining hub. Despite having no domestic gold production, Switzerland has established itself as the world's preeminent center for gold refinement and trade. By analyzing these trade patterns, we can identify strategic approaches that India might adopt to enhance its own position in the global gold value chain.

Import and Export of Gold (HS Heading 7108)

Switzerland occupies a pivotal position in the international gold ecosystem, with its refineries widely recognized as global leaders in quality and technical expertise (Franciolli, 2019). Despite negligible domestic gold mining, Switzerland has masterfully positioned itself as a value-adding intermediary in the global gold supply chain (Swiss Gold Safe, 2024).

The trade data reveals Switzerland's remarkable throughput: annual gold imports consistently exceed 2,100 tonnes—nearly triple India's import volume (Fig. 13). However, unlike India, Switzerland counters potential trade deficit concerns through substantial exports, which regularly surpass 1,500 tonnes annually. The differential between import and export tonnage can be attributed to material loss during the refining process—particularly when converting doré to high-purity bullion—and periodic inventory carryovers.

What makes Switzerland's model especially noteworthy is the value relationship between imports and exports. Historically, export values have closely aligned with import values, effectively neutralizing trade balance concerns. More recently, export values have surpassed import values, a trend partially driven by post-COVID-19 gold price appreciation (Fig. 13). This value addition through refinement demonstrates how Switzerland has transformed a resource dependency into a strategic economic advantage.

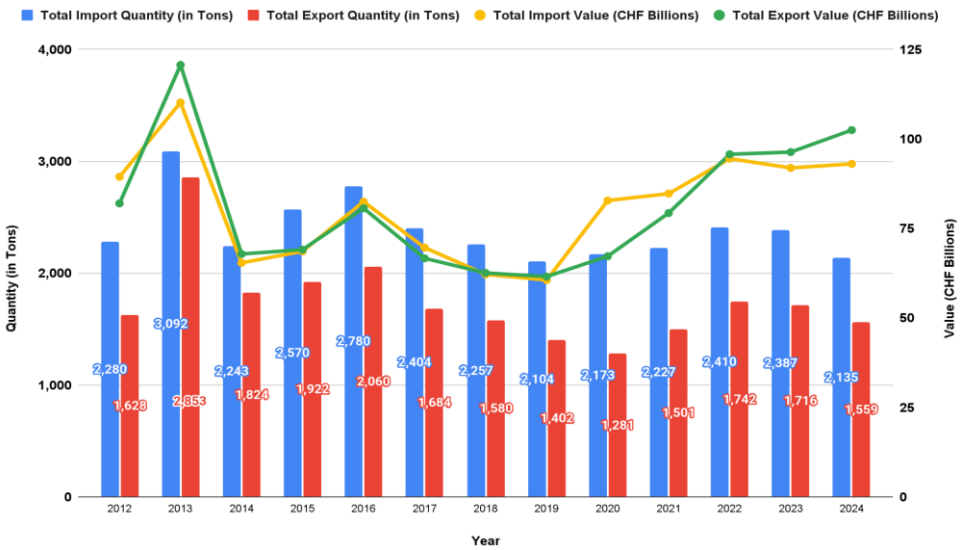

Fig. 13 Trade data (Import and Export) of Gold under HS Heading 7108 (HS 71081100, 71081200, 71081300, 71082000) for Switzerland in Tons and CHF Billions (Swiss Federal Department of Finance, n.d.)

A detailed cost analysis (Fig. 14) examining the average monthly cost (CHF per kg) for gold imports and exports reveals Switzerland's sophisticated value-addition model. The data demonstrates a consistent pattern: from January 2012 through December 2024, export costs have invariably exceeded import costs. This persistent value differential confirms that Switzerland isn't merely functioning as a transit hub or re-melting existing bullion, but rather is engaging in substantial refinement processes—transforming lower-grade doré into high-purity bullion before distribution to global markets.

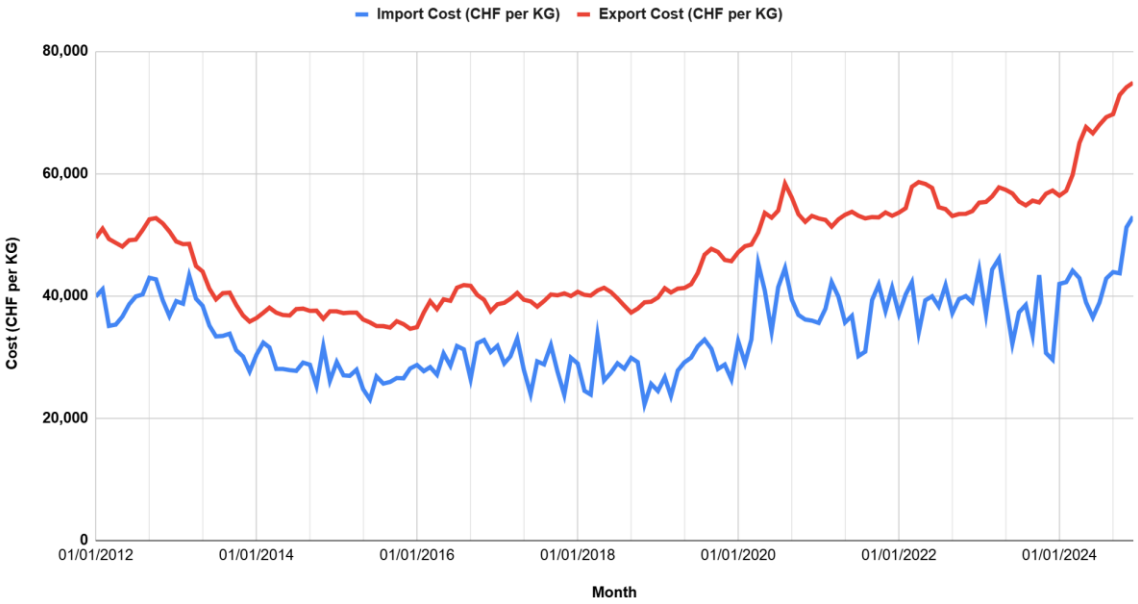

Fig. 14 Average Monthly Cost (CHF per KG) of Gold under HS Heading 7108 (HS 71081100, 71081200, 71081300, 71082000) for Switzerland (Swiss Federal Department of Finance, n.d.)

The magnitude of this value addition, expressed in percentage terms (Fig. 15), shows remarkable growth over time. While the period from 2012-2017 saw average value additions of 20-35%, recent years have witnessed this premium surge to approximately 45%. The notable acceleration following the COVID-19 pandemic likely reflects both Switzerland's enhanced refining capabilities and the unprecedented price appreciation of finished bullion in global markets. This growing value differential underscores Switzerland's ability to maintain and strengthen its competitive advantage in the gold refining sector, even amid volatile market conditions.

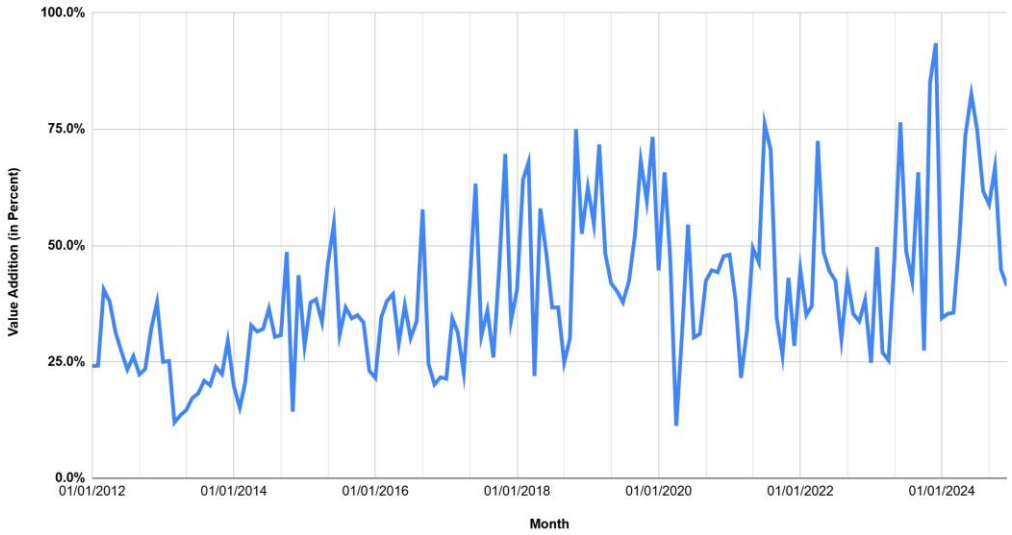

Fig. 15 Value Addition [(Average Monthly Cost Export - Average Monthly Cost Import) / Average Monthly Cost Import] in Percent of Gold under HS Heading 7108 (HS 71081100, 71081200, 71081300, 71082000) for Switzerland (Swiss Federal Department of Finance, n.d.)

The remarkable value addition achieved by Switzerland translates into substantial economic benefits due to gold's inherent high value. Analysis of Switzerland's sourcing patterns reveals a sophisticated procurement strategy that significantly contributes to this success. We have identified five key countries whose gold is supplied to Switzerland at an average monthly import cost (Fig. 16) considerably below the overall monthly average. This finding stands in stark contrast to India's sourcing model (Fig. 6), where cost advantages from similar source countries are only marginally below the monthly average. Switzerland's ability to secure significantly discounted raw materials represents a fundamental competitive advantage. Even more impressive is the volume secured through these advantageous channels—these five countries alone contribute 25% of Switzerland's total gold imports under HS Heading 7108, representing over 550 tonnes annually (Table 4). This combination of substantial volume and significant cost advantage demonstrates Switzerland's strategic approach to raw material sourcing, establishing a foundation for the exceptional value addition witnessed in their export data.

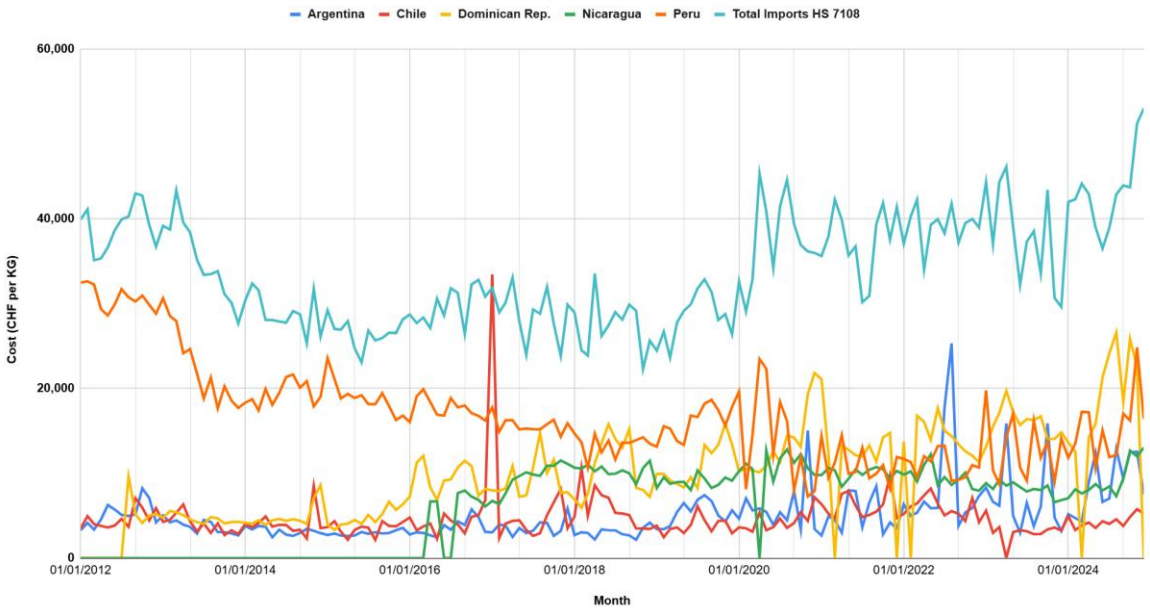

Fig. 16 Average Monthly Cost (CHF per KG) of Gold under HS Heading 7108 (HS 71081100, 71081200, 71081300, 71082000) for Switzerland from Argentina, Chile, Nicaragua, Dominican Republic, and Peru (Swiss Federal Department of Finance, n.d.)

Year	Argentina (Ton and %)	Chile (Ton and %)	Dominican Rep. (Ton and %)	Nicaragua (Ton and %)	Peru (Ton and %)	Total Import Volume of these nations (approx.) (Ton and %)
2020	164.04	176.65	85.35	9.66	136.22	**571.92**
	7.5%	8.1%	3.9%	0.4%	6.3%	**26.3%**
2021	136.20	131.55	60.61	18.20	174.69	**521.25**
	6.1%	5.9%	2.7%	0.8%	7.8%	**26.3%**
2022	149.09	126.49	68.29	21.84	201.26	**566.96**
	6.2%	5.2%	2.8%	0.9%	8.4%	**23.5%**
2023	183.19	163.35	46.80	27.04	164.66	**585.04**
	7.7%	6.8%	2.0%	1.1%	6.9%	**24.5%**
2024	159.78	186.62	31.56	25.65	169.43	**573.05**
	7.5%	8.7%	1.5%	1.2%	7.9%	**26.8%**

Table 4: Yearly Import of Gold under HS Heading 7108 (HS 71081100, 71081200, 71081300, 71082000) from Argentina, Chile, Nicaragua, Dominican Republic, and Peru (in Tons and as Percent of Total Import of Gold) by Switzerland (Swiss Federal Department of Finance, n.d.)

Import and Export of Items that can be used for the Recovery of Gold

Analyzing Switzerland's trade data for items potentially used in gold recovery reveals a nuanced and strategic approach to sourcing and processing precious metals. The trade patterns across multiple HS codes provide insights into their sophisticated metal recovery ecosystem.

The trade data for HS 2616.9000 (Precious metal ores and concentrates, excluding silver) (see Fig. 17) reveals minimal import activity for Switzerland over the past decade. This near-negligible import volume suggests that Swiss refineries have established supply chains that do not rely on direct ore and concentrate imports. The absence of significant imports in this category implies that the refineries obtain their raw materials through alternative channels, potentially through doré imports or other established trade routes.

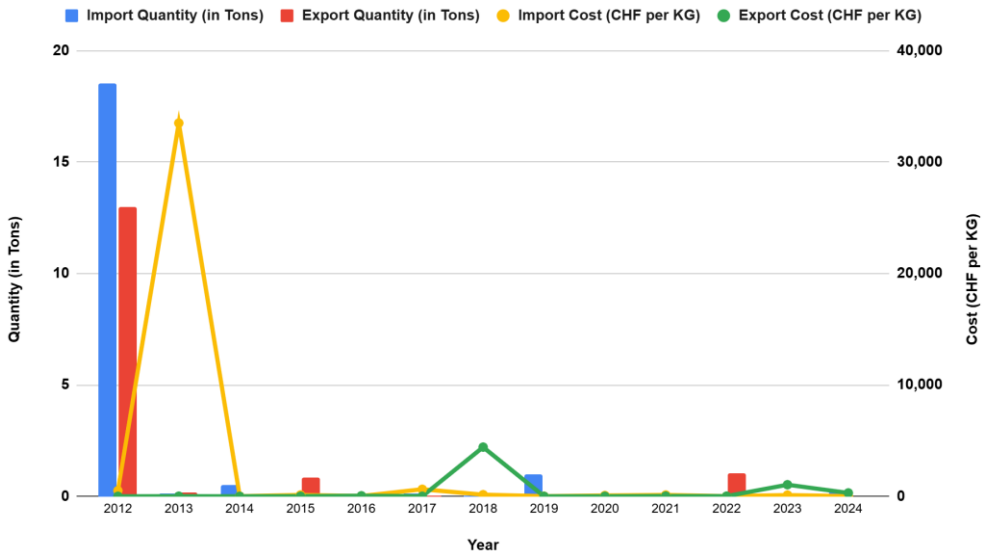

Fig. 17 Trade of HSN 2616.9000 (Precious metal ores and concentrates, excluding silver) by Switzerland in Tons and Yearly average cost of those imports and exports (CHF per Kg) (Swiss Federal Department of Finance, n.d.)

Examining the HS 2843.1000 (colloidal precious metals) and HS 2843.30 (gold compounds) trade reveals a nuanced picture (see Fig. 18 and Fig. 19). The import volumes for colloidal precious metals remain consistently low, hovering around 5 tonnes annually. Interestingly, the export volumes of gold compounds demonstrate a distinct pattern. The exports not only exceed the import volumes but also command a higher average yearly price. This suggests a value-addition process where Switzerland transforms imported or sourced materials into more refined gold compounds, leveraging its expertise in precious metal processing.

Fig. 18 Trade of HSN 2843.1000 (Colloidal precious metals) by Switzerland in Tons and Yearly average cost of those imports and exports (CHF per Kg) (Swiss Federal Department of Finance, n.d.)

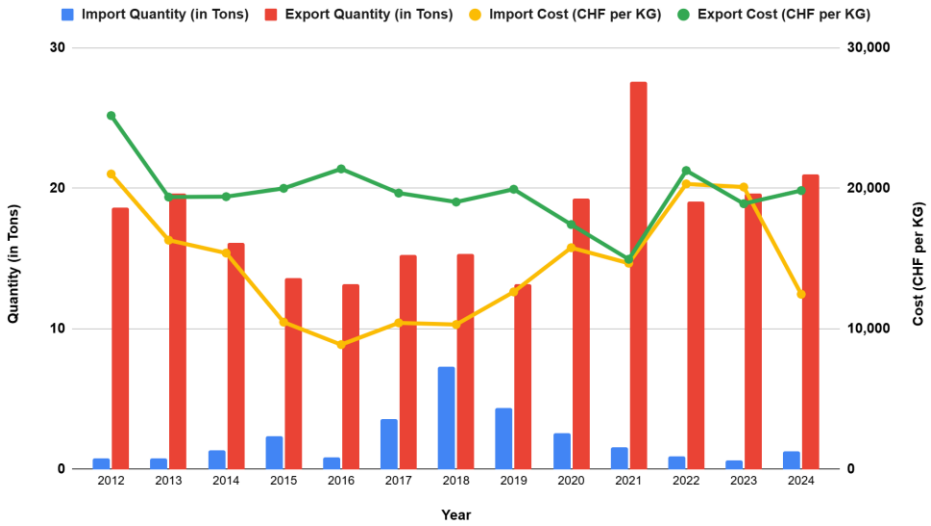

Fig. 19 Trade of HSN 2843.30 (Gold compounds) by Switzerland in Tons and Yearly average cost of those imports and exports (CHF per Kg) (Swiss Federal Department of Finance, n.d.)

The trade data for HS 7112.9100 (Waste and Scrap of Gold) (see Fig. 20) presents a particularly dynamic scenario. Prior to the COVID-19 pandemic, Switzerland consistently exported more gold scrap than it imported. The pandemic marked a significant shift in this pattern, with gold scrap imports increasing relative to exports. A notable observation is the pricing differential: the average yearly export price for gold scrap is substantially lower than the import costs. This could indicate variations in the gold content or quality of the imported and exported scrap materials, reflecting the complexities of the global precious metal recycling market.

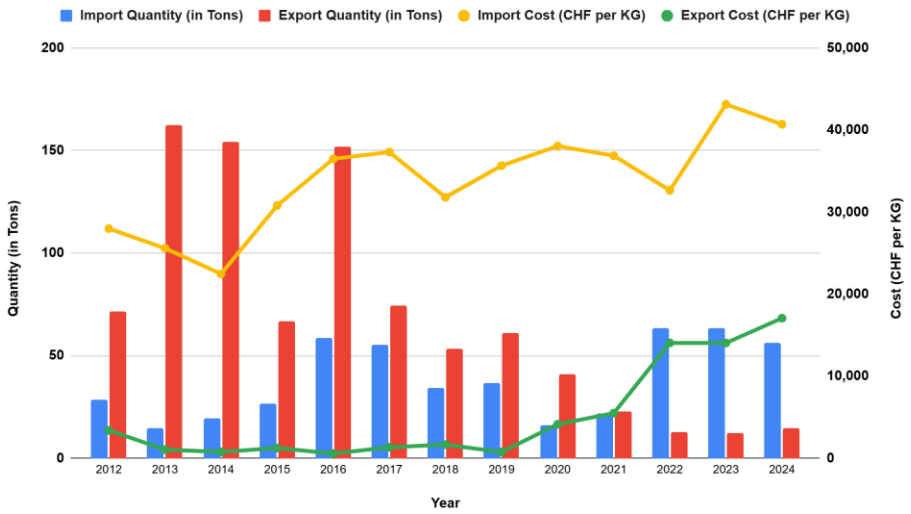

Fig. 20 Trade of HSN 7112.9100 (Waste and Scrap of Gold) by Switzerland in Tons and Yearly average cost of those imports and exports (CHF per Kg) (Swiss Federal Department of Finance, n.d.)

The e-waste recovery sector presents perhaps the most compelling narrative (see Fig. 21). Switzerland exports approximately 600 tonnes of urban mine materials annually through HS 8549.2100 and HS 8549.2900 codes, despite maintaining negligible imports. However, there's a notable downward trend in e-waste exports, declining from 1,000 tonnes in 2022 to 650 tonnes in 2024. This reduction might signal a strategic shift towards domestic e-waste processing technologies, potentially allowing Switzerland to extract precious metals more efficiently and economically.

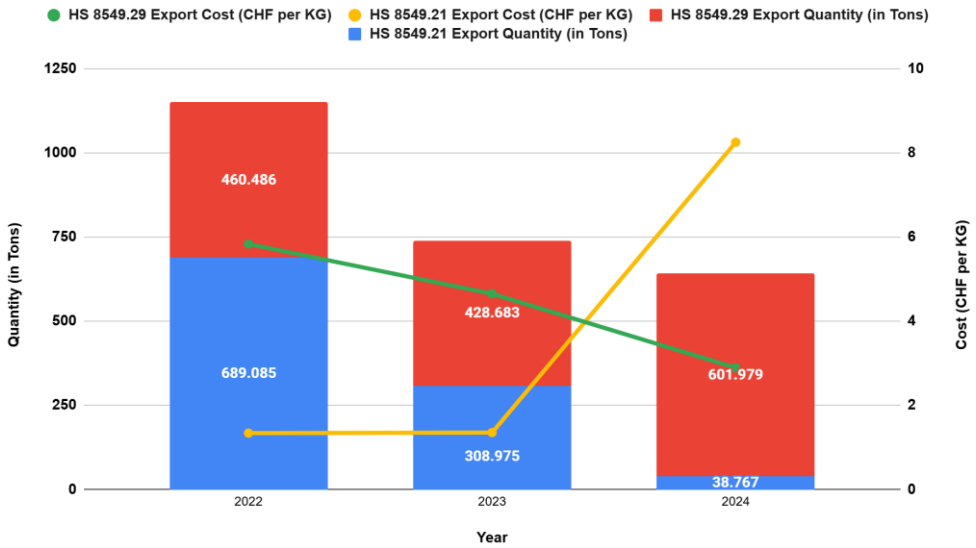

Fig. 21 Export of HSN 8549.2100 and HSN 8549.2900 (E-waste for the purpose of recovery of precious metals) by Switzerland in Tons and Yearly average cost of those exports (CHF per Kg) (Swiss Federal Department of Finance, n.d.)

The Swiss Gold Standard: Strategic Lessons for India

Strategic Sourcing Creates Competitive Advantage: A Holistic Procurement Approach

Switzerland's gold procurement strategy represents a masterclass in strategic sourcing, demonstrating how intelligent market positioning can transform resource constraints into competitive opportunities. The country's approach goes beyond mere transactional purchasing, instead cultivating a sophisticated ecosystem of global supplier relationships that systematically minimize input costs while maximizing quality and reliability.

By identifying and engaging with five key countries that offer gold at prices substantially below the monthly average, Switzerland has developed a nuanced procurement model that fundamentally differs from traditional import strategies. This deliberate sourcing approach allows them to secure raw materials at significantly reduced costs, creating an immediate economic advantage before any value-addition processes begin. The data reveals these strategic sources contribute approximately 25% of Switzerland's total gold imports, representing over 550 tonnes annually—a volume that underscores the effectiveness of targeted sourcing.

For India, replicating this model requires a multifaceted approach. This would involve comprehensive diplomatic and trade engagement with gold-producing nations, developing granular understanding of their production landscapes, and creating mechanisms that provide mutual economic benefits. Potential strategies could include long-term supply contracts, bilateral investment in mining infrastructure, technology transfer agreements, and creating preferential trade corridors that incentivize high-quality, cost-effective gold supply.

Value Chain Position Determines Profitability: Transforming from Consumer to Value Creator

Switzerland's gold trade success fundamentally stems from its strategic positioning in the global value chain. Rather than remaining a passive consumer or simple trading intermediary, the country has positioned itself as a critical value-addition node. By importing lower-grade doré and transforming it into high-purity bullion, Switzerland captures substantially more economic value than traditional trading models would permit.

The trade data reveals a remarkable value addition trajectory. Between 2012-2017, Switzerland achieved value additions of 20-35%, which has impressively escalated to approximately 45% in recent years. This isn't merely a statistical achievement but represents a sophisticated industrial strategy that transforms raw material into a premium product. The post-COVID-19 period particularly highlighted this model's resilience, with export values consistently outpacing import costs.

For India, this presents a transformative opportunity. Currently positioned predominantly as a consumer market, India can strategically reorient its gold ecosystem. This would require significant investments in refining infrastructure, developing world-class technical capabilities,

creating specialized training programs for metallurgical experts, and developing policy frameworks that incentivize domestic value addition. The potential economic impact is substantial—by capturing even a fraction of the value addition currently monopolized by Swiss refineries, India could generate billions in additional economic value.

Accreditation and Infrastructure: Building a World-Class Ecosystem

Switzerland's gold refineries represent more than individual processing facilities; they constitute an interconnected ecosystem of global credibility. LBMA accreditations create a self-reinforcing cycle where institutional reputation enables enhanced raw material access, which in turn further strengthens technical capabilities.

This ecosystem approach transcends mere technical proficiency. It encompasses rigorous quality control, transparent processes, consistent international standards, and a reputation for unimpeachable integrity. Swiss refineries don't just process gold; they provide a global certification that significantly enhances the perceived and actual value of the processed metal.

For India, breaking the current single-refinery constraint requires coordinated, multi-stakeholder interventions. This would involve targeted policy modifications in existing Free Trade Agreements (FTAs) and Comprehensive Economic Partnership Agreements (CEPAs), creating specific provisions that incentivize gold doré imports and domestic refining. Additionally, developing a comprehensive national accreditation framework, investing in cutting-edge refining technologies, and creating specialized academic and industrial training programs would be crucial.

Conclusion: A Roadmap for Transformation

Switzerland's gold trade model offers India a comprehensive blueprint for reimagining its position in the global precious metals ecosystem. By adopting a holistic approach that combines strategic sourcing, value chain optimization, institutional credibility, and technological innovation, India can transition from a passive consumer to an active, value-creating participant in the global gold market.

The journey requires sustained commitment, significant investments, policy innovations, and a long-term perspective. However, the potential economic rewards—enhanced national economic value, technological leadership, and a more robust industrial ecosystem—make this transformation not just desirable, but essential.

Analysing the Japanese Model

In this section, we delve into a comprehensive analysis of Japan's gold trade data, focusing on gold-related commodities and recovery mechanisms. Japan presents a fascinating case study in global gold market dynamics, particularly remarkable for its prominent position in gold refining despite lacking domestic gold production or direct proximity to primary gold-producing regions. While global gold market discussions typically center on major players like

India, China, the United Kingdom, Switzerland, the United States, and various African and Latin American nations, Japan emerges as a strategic and often overlooked participant in the international gold ecosystem. The country's unique position, hosting the second-highest number of LBMA refineries (11) globally, trailing only China (London Bullion Market Association, n.d.), underscores its sophisticated approach to gold sourcing, processing, and value addition, despite the apparent absence of traditional advantages in the gold supply chain.

Import and Export of Gold (HS Heading 7108)

Japan's position in the global gold market is characterized by a unique and intriguing trade pattern, anchored by its 11 LBMA refineries (London Bullion Market Association, n.d.). Each LBMA refinery is required to process a minimum of 10 tonnes of gold annually (London Bullion Market Association, 2021), implying a potential annual refining capacity of at least 110 tonnes. However, a detailed examination of Japan's trade data reveals a counterintuitive narrative that diverges significantly from traditional gold trading models.

The trade statistics for Harmonized System (HS) Heading 7108 present a remarkable anomaly. Over the past decade, Japan's average gold imports have been remarkably low, hovering around just 7 tonnes per annum. In stark contrast, the country's average gold exports during the same period exceed 175 tonnes annually (see Fig. 22). This substantial trade surplus in gold is unprecedented, challenging established paradigms of gold trading observed in major consumption markets like India or refining hubs like Switzerland.

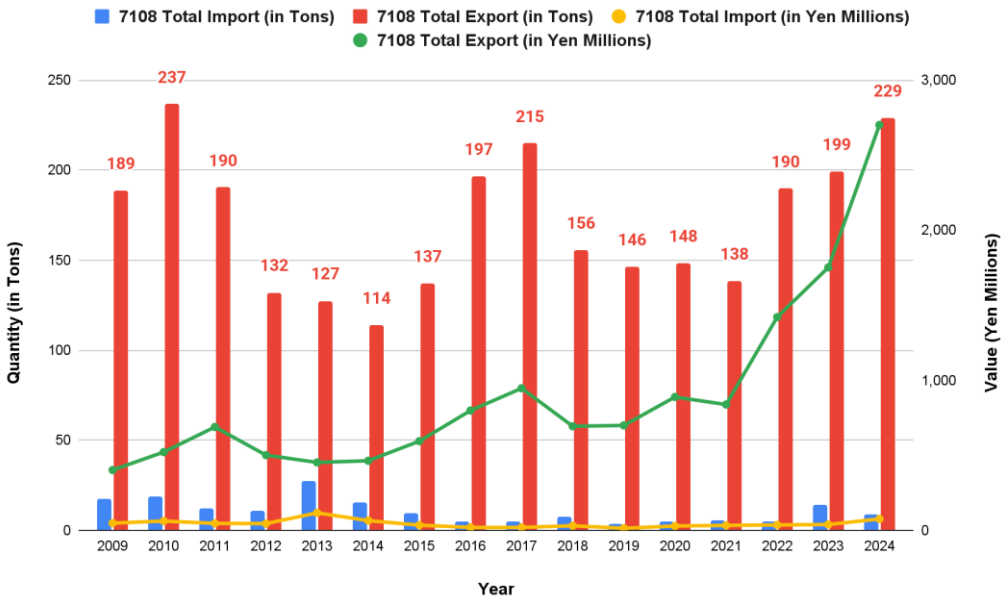

Fig. 22 Trade data (Import and Export) of Gold under HS Heading 7108 (Import HSN: 71081100, 71081200, 71081310, 71081390 and Export HSN: 71081100, 71081200, 71081210, 71081290, 71081300) for Japan in Tons and Yen Millions (Ministry of Finance: Japan, n.d.)

A granular analysis of export data at the 8-digit Harmonized System (HS) level reveals critical insights (see Fig. 23). More than 80% of Japan's gold exports fall under the HSN 71081200 category, representing "Gold in other shapes, unmodified" (Japan Customs, 2025) which

generally includes bullion and doré. The refinement of trade classification from January 2019 introduced two subcategories: HS 710812100 (Gold with refiner's mark, serial number, purity, and weight) and HS 710812900 (Other unmodified gold) (Japan Customs, 2025). This granular classification demonstrates that approximately 50% of total exports constitute bullion under HS 710812100, underscoring Japan's sophisticated refining capabilities. The geographical distribution of these exports is equally telling: five key markets—Hong Kong, Singapore, Switzerland, the United Kingdom, and Taiwan—account for over 80% of export volumes in the past five years (see Table 5), indicating a strategic concentration in Asian markets and established gold trading centers.

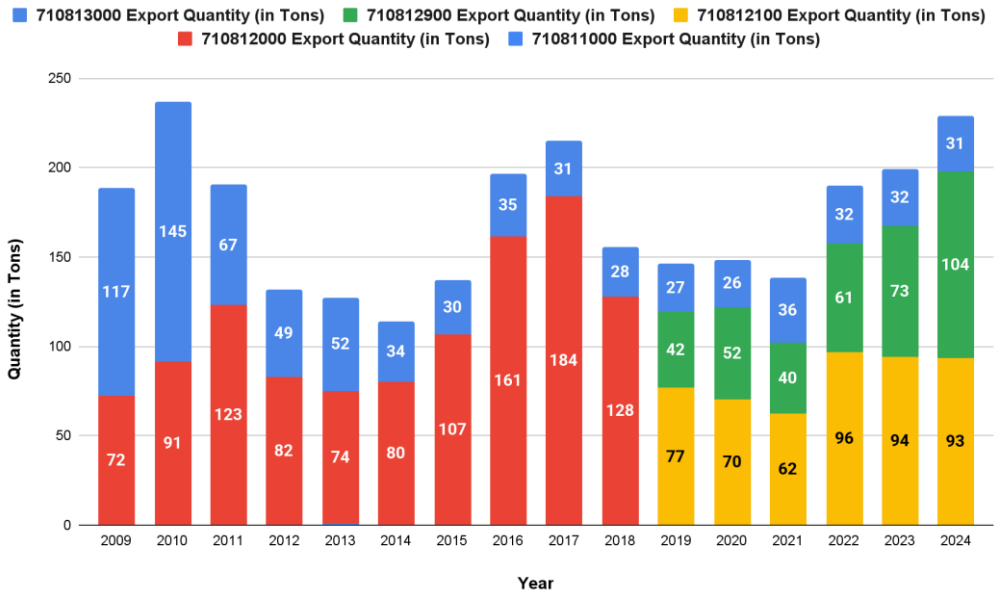

Fig. 23 Export of Gold under HS Heading 7108 (71081100, 71081200, 71081210, 71081290, 71081300) for Japan in Tons and Yen Millions (Ministry of Finance: Japan, n.d.)

Year	Hong Kong (Ton and %)	Singapore (Ton and %)	Switzerland (Ton and %)	United Kingdom (Ton and %)	Taiwan (Ton and %)	Total Import Volume of these nations (approx.) (Ton and %)
2020	39.9	27.6	20.8	30.9	5.5	**124.7**
	27%	19%	14%	21%	4%	**84%**
2021	40.0	32.2	13.7	11.7	14.5	**112.1**
	29%	23%	10%	8%	11%	**81%**
2022	71.0	41.5	14.0	12.6	10.9	**150.0**
	37%	22%	7%	7%	6%	**79%**
2023	84.5	31.1	31.5	8.8	12.6	**168.6**
	42%	16%	16%	4%	6%	**85%**
2024	115.0	26.4	31.8	8.4	13.7	**195.3**
	50%	12%	14%	4%	6%	**85%**

Table 5: Yearly Export of Gold under HS Heading 7108 (71081100, 71081200, 71081210, 71081290, 71081300) from Hong Kong, Singapore, Switzerland, United Kingdom, and Taiwan (in Tons and as Percent of Total Import of Gold) by Japan (Ministry of Finance: Japan, n.d.)

Contrary to expectations, Japan's prodigious refining capacity does not correlate with domestic gold demand. The country's jewelry consumption represents a mere 1% of global demand, remaining stagnant at approximately 15 tonnes over the past decade. Moreover, the bar and coin segment exhibits marginally positive demand or even negative demand for some years (see Fig. 24). The hypothesis that extensive gold mining might explain this phenomenon is equally unfounded; Japan possesses only one active commercial gold mine, Hishikari Mine in Isa City owned by Sumitomo Metal Mining Co. Ltd. (Public Relations Office: Government of Japan, 2023), producing an average of merely 4.5 tonnes annually (see Fig. 25)—insufficient to justify such extensive exports.

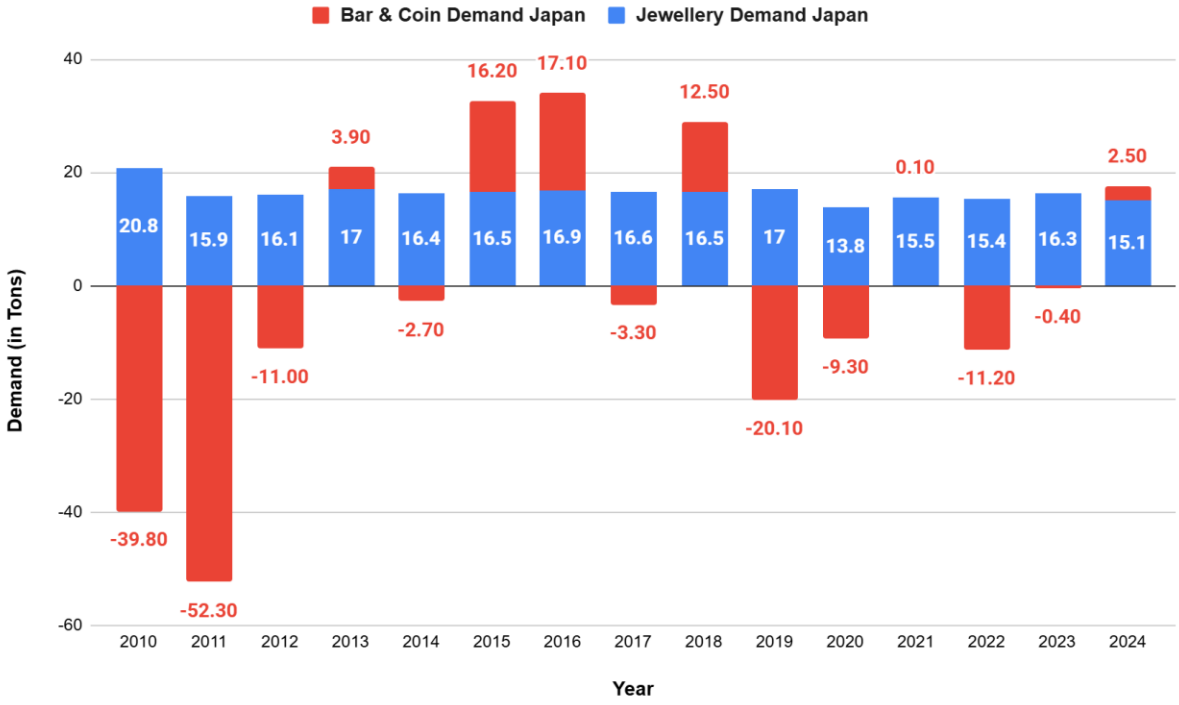

Fig. 24 Demand for Gold (Jewellery, Bar & Coin) in Japan (in Tons) (World Gold Council, 2025)

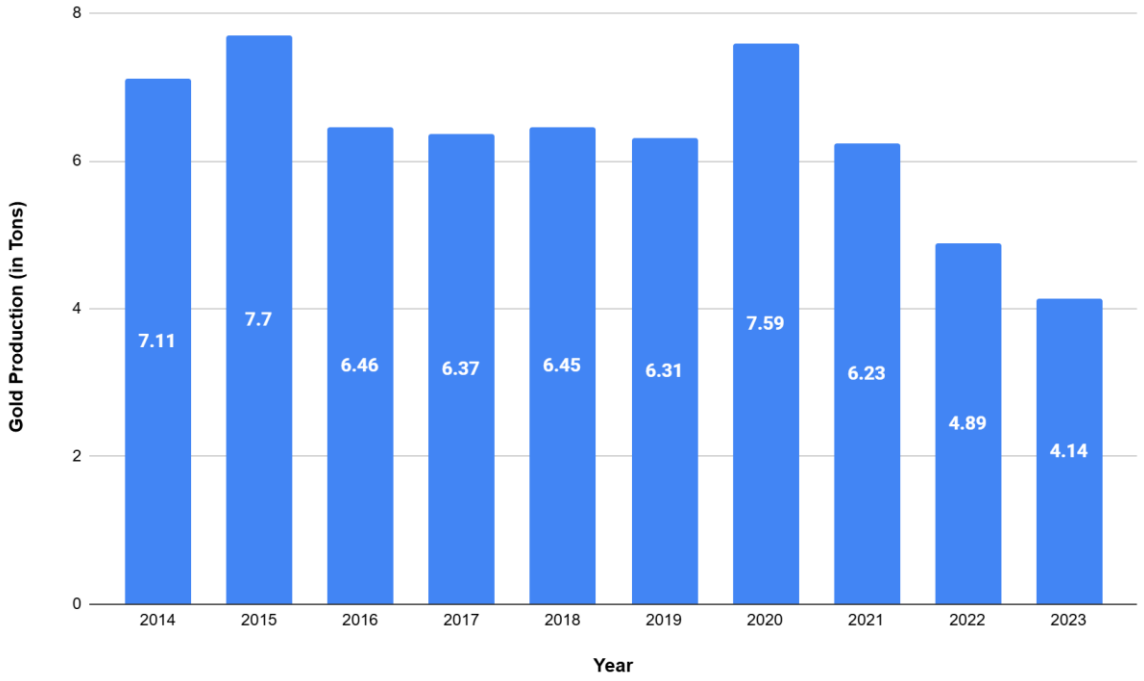

Fig. 25 Gold Production/Mining in Japan (in Tons) (Statista: Statistics Bureau of Japan; METI (Japan), 2024)

This paradoxical trade profile raises fundamental questions about Japan's gold market strategy. The disconnect between minimal imports, limited domestic production, and substantial exports suggests a sophisticated global value-addition model that extends beyond conventional understanding of gold trading and refining.

Import and Export of Items that can be used for the Recovery of Gold

Japan has historically maintained a substantial import profile for HSN 26169000 (Precious metal ores and concentrates excluding silver) (Japan Customs, 2025-b), predominantly comprised of gold (see Fig. 26). Import volumes demonstrated a consistent upward trajectory until 2016, when they peaked at approximately 25,000 tonnes. However, subsequent years have witnessed a significant decline in these imports, potentially attributable to the expiration of long-term trade agreements with mining operations or a strategic pivot toward alternative gold sources. These alternatives likely include gold scrap and electronic waste, which typically offer higher gold concentration (exceeding the average 3-5 grams of gold per tonne found in conventional ore (Sumitomo Metal Mining Co. Ltd., 2024, Page 60)), thereby potentially representing a more economically efficient procurement strategy. The geographical concentration of Japan's ore imports demonstrates remarkable concentration (see Table 6), with the United States emerging as the dominant supplier. By 2024, American exports accounted for approximately 96% of Japan's total imports under HS 261690000, underscoring a critical bilateral dependency in the precious metals supply chain.

Despite the relatively modest gold yield from ore processing, this approach facilitates maximum value addition throughout the supply chain due to the comparatively low cost of raw

ore inputs. Furthermore, these ore imports yield additional economic benefits through the extraction of various associated metals present in the substrate. This advantage is particularly well-leveraged by Japanese refineries, which demonstrate considerable technological versatility in processing multiple metals simultaneously—a stark contrast to their Indian counterparts that typically specialize in single-metal refining operations. This diversified processing capability significantly enhances the economic viability of Japan's precious metal refining ecosystem, enabling more comprehensive resource utilization and value creation from imported raw materials.

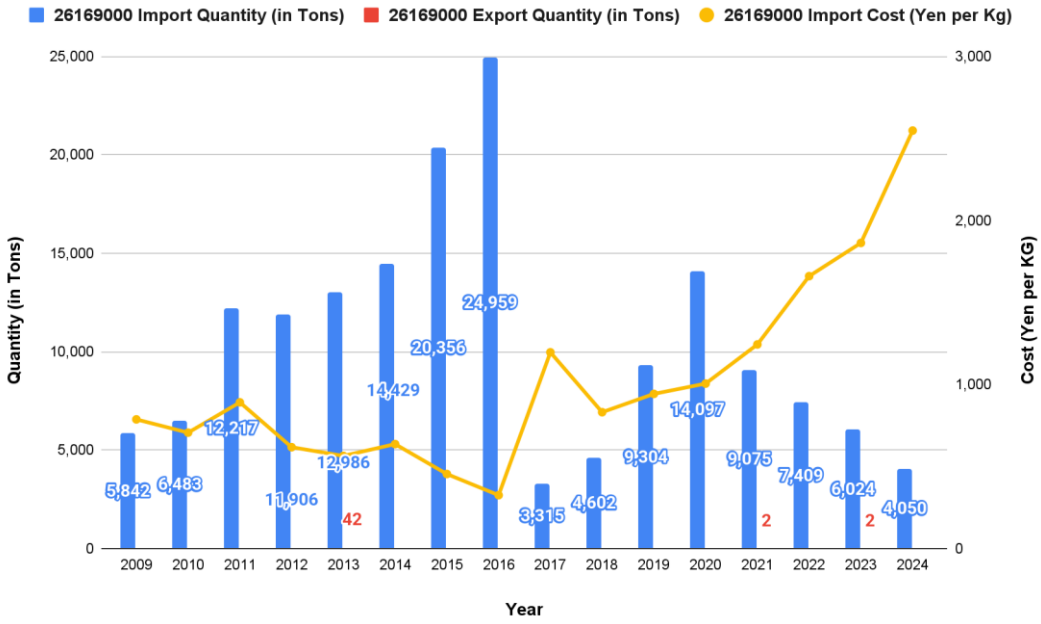

Fig. 26 Trade of HSN 2616.90000 (Precious metal ores and concentrates, excluding silver) by Japan in Tons and Yearly average cost of those imports (Yen per Kg) (Ministry of Finance: Japan, n.d.)

Year	Brazil (Ton and %)	Canada (Ton and %)	Malaysia (Ton and %)	Russia (Ton and %)	United States of America (Ton and %)	Total Import Volume of these Nations (approx.) (Ton and %)
2020	951	2,512		3,072	7,191	**13,726**
	6.75%	17.82%		21.79%	51.01%	**97.37%**
2021	948	2,506			4,662	**8,116**
	10.45%	27.61%			51.37%	**89.43%**
2022	699		46		6,280	**7,025**
	9.43%		0.62%		84.76%	**94.81%**
2023			773		5,088	**5,861**
			12.83%		84.46%	**97.29%**
2024					3,883	**3,883**
					95.95%	**95.95%**

Table 6: Yearly Import of Gold under HSN 261690000 from Brazil, Canada, Malaysia, Russia, and United States of America (in Tons and as Percent of Total Import of Gold) by Japan (Ministry of Finance: Japan, n.d.)

An examination of Japan's trade patterns for HSN 284310000 (Colloidal precious metals) and HSN 284330000 (Gold compounds) reveals another dimension of the country's sophisticated positioning in the global precious metals value chain (Japan Customs, 2025-b). In both categories, Japan maintains its status as a net exporter while importing negligible quantities, suggesting a strategic approach to value addition in these specialized chemical formulations that are subsequently utilized by recipient countries for gold extraction and processing.

The temporal analysis of colloidal precious metals exports demonstrates a notable downward trajectory in recent years, with a particularly pronounced decline in export unit value (Yen per Kg) in 2024 (see Fig. 27). This pricing trend may indicate increased production efficiency, market competition, or strategic pricing to maintain market share in an evolving global landscape for precious metal processing technologies. Conversely, gold compounds present a distinct trade profile characterized by steady volume expansion following the temporary contraction during the COVID-19 pandemic (see Fig. 28). Export prices for these compounds have either remained stable or appreciated at consistent rates, suggesting strong demand fundamentals and potentially higher value-addition capabilities in this product category. The import cost volatility observed in these segments can be attributed to the minimal import volumes, where small absolute changes in quantity or quality can produce disproportionate fluctuations in unit pricing.

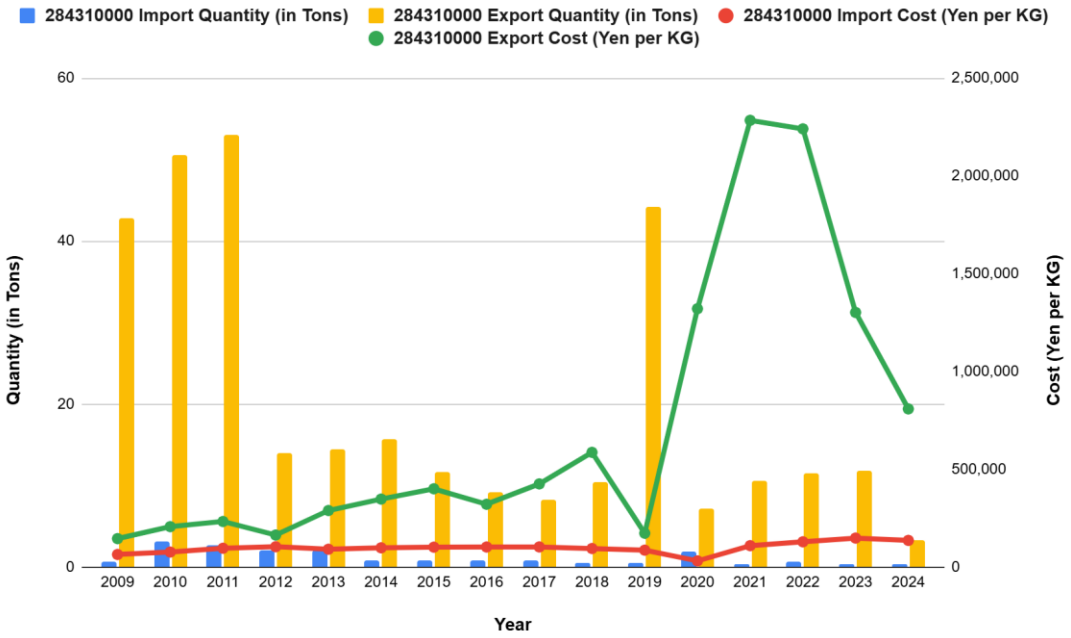

Fig. 27 Trade of HSN 2843.10000 (Colloidal Precious Metals) by Japan in Tons and Yearly average cost of those imports (Yen per Kg) (Ministry of Finance: Japan, n.d.)

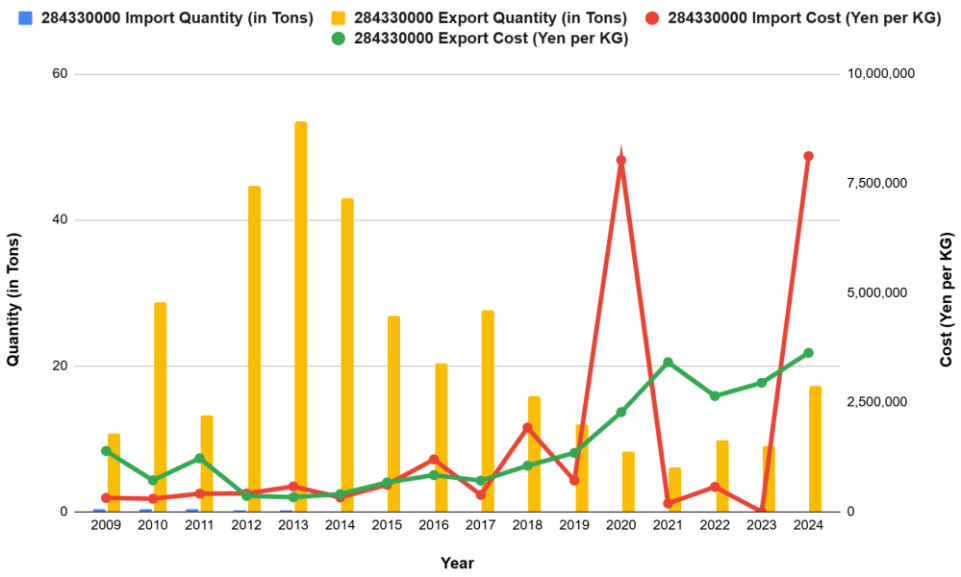

Fig. 28 Trade of HSN 2843.30000 (Gold Compounds) by Japan in Tons and Yearly average cost of those imports (Yen per Kg) (Ministry of Finance: Japan, n.d.)

Examination of trade data for HSN 7112.91000 (Waste and scrap of gold, of a kind used principally for the recovery of precious metal) reveals another critical dimension of Japan's gold ecosystem (Japan Customs, 2025-b). The historical pattern demonstrates Japan's substantial reliance on gold scrap imports; however, a striking inflection point emerges post-2021, when import volumes declined precipitously to approximately one-third of previous levels (see Fig. 29). This quantitative reduction, rather than signaling diminished interest in recycled gold sources, corresponds with a fourfold increase in per-unit cost—suggesting a strategic pivot toward higher-grade scrap materials with elevated gold content or superior recyclability characteristics.

While precise gold content data for these imports remains commercially confidential and technically challenging to estimate, the substantial volume of historical imports strongly indicates that scrap recycling contributes significantly to Japan's gold production capacity. This aligns with the country's broader technological capabilities in efficient metal recovery and explains a portion of the discrepancy between Japan's limited primary gold imports and its substantial gold exports.

The geographic analysis of these imports reveals a pronounced regional concentration, with Southeast Asian nations—notably the Philippines, Republic of Korea, Singapore, Thailand, and Taiwan—accounting for over 90% of gold scrap imports in the most recent three years, compared to 75% in the preceding two-year period (see Table 7). Singapore and Thailand emerge as particularly dominant sources, jointly contributing more than 60% of total scrap imports, a concentration pattern consistent with their established roles as regional gold consumption centers.

This strategic emphasis on high-quality recycled gold also positions Japanese refineries advantageously in premium market segments, where sustainability-focused brands increasingly command price premiums for environmentally conscious sourcing. As will be explored in subsequent sections, several Japanese refineries have developed specialized initiatives centered on recycled gold to capitalize on this growing market preference. Notably, Japan's exports of gold scrap are virtually nonexistent, creating a unidirectional flow that maximizes domestic value capture from these materials. The negligible export quantities consequently produce statistically anomalous cost analyses that should be interpreted with appropriate methodological caution.

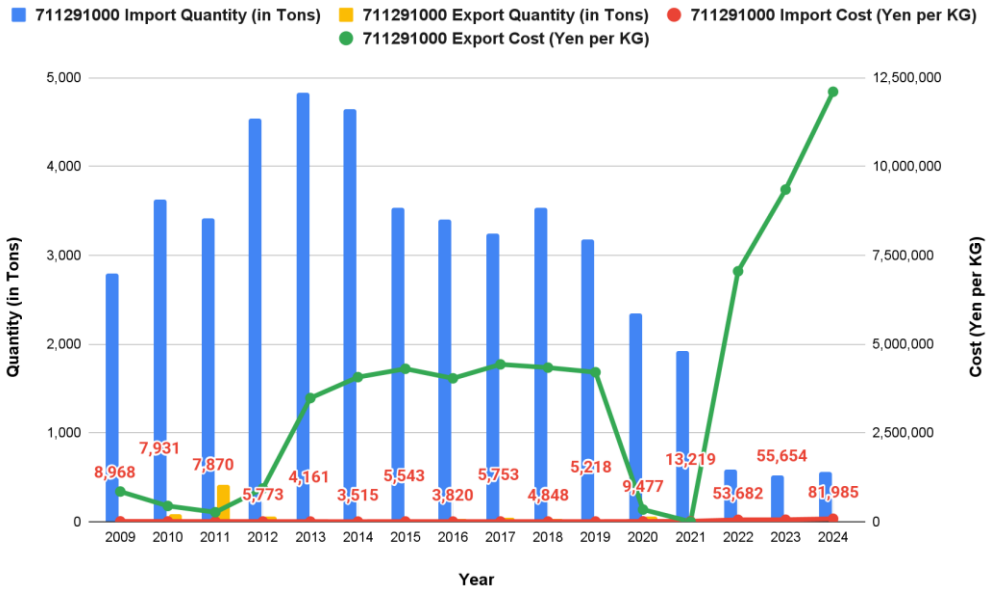

Fig. 29 Trade of HSN 7112.71000 (Waste and scrap of gold, of a kind used principally for the recovery of precious metal) by Japan in Tons and Yearly average cost of those imports (Yen per Kg) (Ministry of Finance: Japan, n.d.)

Year	Philippines (Ton and %)	Republic of Korea (Ton and %)	Singapore (Ton and %)	Taiwan (Ton and %)	Thailand (Ton and %)	Total Import Volume of these Nations (approx.) (Ton and %)
2020	299	675	266	99	422	**1,762**
	13%	29%	11%	4%	18%	**75%**
2021	328	294	228	102	506	**1,457**
	17%	15%	12%	5%	26%	**76%**
2022	160	51	114	15	189	**529**
	28%	9%	20%	3%	32%	**91%**
2023	86	43	218	10	125	**482**
	16%	8%	42%	2%	24%	**92%**
2024	68	73	188	12	182	**524**
	12%	13%	34%	2%	33%	**93%**

Table 7: Yearly Import of Gold under HSN 7112.91000 from Philippines, Republic of Korea, Singapore, Taiwan, and Thailand (in Tons and as Percent of Total Import of Gold) by Japan (Ministry of Finance: Japan, n.d.)

Analysis of Japan's trade in electronic waste offers perhaps the most compelling insight into its innovative gold sourcing strategy. Import data for HSN 8549.21000 and HSN 8549.29000 (Electrical and electronic waste and scrap principally used for precious metal recovery) reveals a steadily increasing trend that aligns with Japanese refineries' established programs for precious metal extraction from e-waste. Though this harmonized system classification was only introduced in 2022, limiting historical data availability, the existing figures present a striking narrative of strategic resource acquisition.

The scale of Japan's commitment to this approach is remarkable, with import volumes exceeding 180,000 tonnes in 2024 alone (see Fig. 30). This strategy exploits a critical metallurgical advantage: e-waste typically contains gold concentrations 10-10,000 times higher than traditional gold ores (Varjani et al., 2020, Pages 307-325). Japan's operational success in this domain challenges the prevailing assumption that e-waste recycling is inherently labor-intensive, requiring extensive manual sorting, and hazardous due to toxic chemical content. This proven model of large-scale precious metals recovery from electronic waste presents a compelling blueprint for countries like India to consider adapting.

The economic efficiency of this approach is further evidenced by the exceptionally low import costs, which remain below 1,000 yen per kilogram—making e-waste substantially more cost-effective than conventional ores while simultaneously delivering environmental benefits by diverting potentially hazardous materials from landfills. Perhaps most noteworthy is Japan's unprecedented diversification of supply sources for e-waste. Unlike its more concentrated trading patterns in other gold-related categories, Japan has established procurement relationships with 81 different countries in just three years since the introduction of these HS codes. While five nations account for approximately 60% of import volumes, the breadth of this supplier network demonstrates Japan's strategic commitment to securing a steady inflow of this valuable resource through an extensive and resilient global supply chain (see Table 8).

Fig. 30 Import of HSN 8549.21000 and HSN 8549.29000 (Electrical and electronic waste and scrap principally used for precious metal recovery) by Japan in Tons and Yearly average cost of those imports (Yen per Kg) (Ministry of Finance: Japan, n.d.)

Year	Canada (Ton and %)	Netherlands (Ton and %)	Taiwan (Ton and %)	United Kingdom (Ton and %)	United States of America (Ton and %)	Total Import Volume of these Nations (approx.) (Ton and %)
2022	6,078	31,394	15,906	5,565	22,818	**81,761**
	5%	24%	12%	4%	17%	**62%**
2023	6,991	43,505	17,206	8,702	25,511	**101,914**
	4%	26%	10%	5%	15%	**61%**
2024	8,301	47,072	18,433	10,833	26,347	**110,987**
	5%	26%	10%	6%	14%	**60%**

Table 8: Yearly Import of Gold under HSN 8549.21000 and HSN 8549.29000 (Electrical and electronic waste and scrap principally used for precious metal recovery) from Canada, Netherlands, Taiwan, United Kingdom, and United States of America (in Tons and as Percent of Total Import of Gold) by Japan (Ministry of Finance: Japan, n.d.)

Japan's Gold Refinement Mastery - Partnerships, Innovation, Sustainability: Strategic Lessons for India

Vertical Integration Through Global Partnerships

Japan's gold refiners have masterfully implemented a strategy of vertical integration through carefully cultivated international partnerships, creating a resilient supply chain that compensates for the country's limited domestic gold resources. Sumitomo Metal Mining exemplifies this approach through its strategic joint ventures with mineral-rich countries, securing consistent access to raw materials for its high-value refining operations. The company's 30% stake in Canada's Côte Gold Mine, developed in partnership with IAMGOLD ((IAMGOLD Corporation, 2022) (IAMGOLD Corporation, 2024)), demonstrates the successful implementation of this model. This partnership-driven strategy typically involves the Japanese providing their technical expertise, capital investment, and refining capabilities in exchange for preferential access to raw materials. The horizon of these partnerships is extremely long-term, often spanning decades, allowing for substantial infrastructure development and technology transfer that benefits both parties.

Asahi Refining represents another distinctive model of vertical integration through its comprehensive approach to securing diverse gold supply streams. The company has established itself as a critical nexus in the global precious metals supply chain by developing strategic relationships across the entire spectrum of mining operations—from large publicly traded mining companies to Artisanal and Small-Scale Mining (ASM) operations. This inclusive approach ensures reliable access to gold and silver feedstock while simultaneously supporting broader industry sustainability. Particularly noteworthy is Asahi's significant engagement with the ASM sector, which the World Gold Council, Inter-Governmental Forum, and planetGOLD estimate employs between 15 and 20 million miners directly, with approximately twice that number deriving their livelihoods from associated activities. With ASM accounting for approximately 20% of global gold production (roughly 726 tonnes of the 3,628 tonnes produced globally in 2022), Asahi's processing of 410,618 ounces of ASM gold and 2,493,289

ounces of ASM silver in fiscal year 2023-24 represents a substantial engagement with this vital but often overlooked sector (Asahi Refining, 2024).

For India, this presents a compelling blueprint for addressing its own gold supply challenges. Rather than competing directly with established players for market-ready gold supplies, Indian entities could prioritize strategic partnerships with emerging gold producers, particularly in the CIS region and Latin America, where competition from Western and Chinese interests may be less intense. By offering integrated packages of financing, technical expertise, and refining capabilities, Indian companies could secure preferential access to gold resources while simultaneously expanding their global footprint. The comprehensive nature of these partnerships—encompassing exploration, extraction, processing, and refining—would represent a significant advancement over India's current predominant focus on downstream gold importing and jewelry manufacturing. Additionally, India could emulate the Japanese model of engagement with the ASM sector, potentially developing specialized programs to formalize and support small-scale mining operations in regions where this activity is prevalent. Such initiatives would not only secure additional gold supply streams but could also address environmental and social challenges associated with informal mining practices while creating economic development opportunities in mining communities. By adopting this multifaceted approach to vertical integration, India could transform its position in the global gold value chain from primarily a consumer to an active participant across multiple stages of production and processing.

Innovative Raw Material Sourcing

Japan's approach to raw material sourcing represents a paradigm shift in gold acquisition strategies, with companies like Mitsubishi Materials Corporation pioneering the development of global e-scrap collection networks that capitalize on urban mining opportunities (Mitsubishi Materials, 2024). This innovative sourcing model recognizes electronic waste as a high-value gold reservoir, with concentrations often exceeding those found in primary ores by factors of 10-10,000 (Varjani et al., 2020, Pages 307-325). Japan's import of over 180,000 tonnes of e-waste in 2024 alone underscores the scale and commitment to this strategy (see Fig. 30), which fundamentally redefines the traditional gold supply chain.

At the core of Mitsubishi Materials' success is its comprehensive "Material Grid" framework, which enables the efficient collection and processing of a wide range of non-ferrous metals, including precious metals like gold and silver, as well as platinum group metals, lead, and tin. This sophisticated system integrates multiple facilities across an international network, including MM Metal Recycling in the Netherlands, specialized plants in Japan (Naoshima Smelter & Refinery, Onahama Smelting & Refining, Ikuno Plant), and partnerships with operations in Indonesia (PT. Smelting). The framework's strength lies in its ability to process diverse inputs—from copper concentrate and copper scrap to complex electronic waste—through an integrated production chain that maximizes recovery of all valuable components (Mitsubishi Materials, 2024, Page 24).

Mitsubishi's advanced recycling technology includes the proprietary Mitsubishi Process for continuous copper smelting, which serves as the foundation for efficient e-scrap processing. This is supplemented by automatic dismantling and sorting processes specifically designed for consumer products like home appliances, enabling the recycling of a wide range of resources that would otherwise be discarded. This integrated system allows Mitsubishi to extract maximum value from each unit of e-waste, producing not only gold but also various other metals and by-products (Mitsubishi Materials, 2024, Page 24).

Matsuda Sangyo Group exemplifies another dimension of Japan's innovative approach through its comprehensive precious metals recycling system. The company has developed an end-to-end solution that spans the entire lifecycle of precious metals—from production and sale of precious metal chemicals and processed products to the recovery and purification of used materials. What distinguishes Matsuda's approach is its extensive sourcing network across multiple industries, including electronics, automotive, chemical, pharmaceutical, photosensitive materials, jewelry, dental, and medical sectors. This diverse sourcing strategy ensures a steady supply of precious metal-containing materials regardless of fluctuations in any single industry (Matsuda Sangyo Co. Ltd., 2024).

The technical sophistication of these Japanese recycling operations is evident in their processing methodologies. Matsuda Sangyo employs both pyrometallurgical and hydrometallurgical smelting technologies, strategically selecting the optimal process based on the specific characteristics of the source material. Pyrometallurgical smelting leverages high-temperature reactions to recover precious metals that respond well to thermal separation, while hydrometallurgical processes utilize acid and alkali chemical treatments for materials better suited to chemical extraction. This dual-technology approach enables the efficient processing of heterogeneous waste streams with varying precious metal content and composition (Matsuda Sangyo Co. Ltd., 2024).

Particularly noteworthy is the emphasis on security and confidentiality throughout the recycling process. Matsuda Sangyo has implemented extraordinary measures to protect proprietary technologies embedded in the electronic components they process, including mobile crusher vehicles that operate on customers' premises, 24-hour security monitoring systems, and X-ray metal detectors at entry and exit points. The company's Iruma Factory has even achieved Evaluation Assurance Level (EAL) 6 of Common Criteria (ISO/IEC 15408), allowing it to destroy confidential materials without customer presence—a critical consideration for manufacturers concerned about intellectual property protection (Matsuda Sangyo Co. Ltd., 2024).

For India, which generated approximately 1.6 million tonnes of e-waste in the Financial Year 2021-22 with only about 30% processed through formal recycling channels (Press Information Bureau, 2023-c), this represents an exceptional opportunity. By establishing comprehensive e-waste collection systems and developing specialized precious metal recovery facilities, India could simultaneously address its environmental challenges, reduce gold import dependency, and create a sustainable domestic supply source. The country's existing informal e-waste

processing sector, while currently problematic from health and environmental perspectives, represents valuable expertise that could be formalized and upgraded through partnerships with Japanese technical providers. Furthermore, India's position as a major global IT hub generates substantial domestic e-waste streams that could form the foundation of a robust urban mining initiative, potentially supplemented by strategic imports from neighboring countries with limited recycling infrastructure.

Sustainability as a Premium Value Proposition

Japanese gold refiners have strategically positioned sustainability not merely as a compliance requirement but as a premium value proposition that commands higher margins in global markets. Asahi Refining exemplifies this approach through its low-emission recycling operations that attract premium pricing from global jewelry brands increasingly conscious of their environmental footprint. With recycled gold producing approximately 90% lower carbon emissions than traditionally mined gold (1,256 kg CO2/kg gold versus 12,621 kg CO2/kg gold), Japanese refiners have created a distinct competitive advantage in markets where sustainability credentials influence purchasing decisions (ARE Holding Inc., 2024).

Asahi Refining's Bando Plant represents the pinnacle of this sustainability-focused approach, operating as a fully integrated facility that handles everything from raw material intake to final product manufacturing. The plant's production process exemplifies Japanese attention to detail and commitment to environmental excellence at every stage. Initial inspection and preprocessing of dental and jewelry scrap incorporates circular wet processing with chemical reuse, minimizing wastewater generation while maintaining rigorous quality standards. High-precision assaying employs equipment and methodologies specifically tailored to different raw materials and compositions, ensuring accuracy while maintaining efficiency. The refining process leverages advanced separation and extraction technologies developed through decades of experience, transforming diverse input materials into high-purity precious metals through automated equipment that ensures both worker safety and operational efficiency (ARE Holding Inc., 2024).

The Bando Plant's melting and molding operations showcase the integration of cutting-edge technology with traditional metallurgical expertise. Dry refining technology removes impurity elements before casting granules and bars into high-quality precious metal bullion. This process is controlled by advanced robotics and IoT technology for operational monitoring, enabling automated nighttime operations that maximize productivity while minimizing energy consumption. The final product manufacturing assigns each item a unique serial number, implementing comprehensive traceability management that documents raw material history, manufacturing processes, weight values, and product purity—information increasingly demanded by environmentally conscious end consumers (ARE Holding Inc., 2024).

What truly distinguishes Asahi Refining's approach is the ongoing evolution of its sustainability initiatives. The second phase of the Bando Plant, scheduled for completion in April 2025, represents the next frontier in sustainable precious metals recycling. The expansion

incorporates a dedicated system for platinum group metals recycling—critical elements for emerging hydrogen technologies—and consolidates processes in the electronics and catalyst sectors to enhance both quality and production capacity. The facility's energy portfolio will integrate hydrogen, green electricity, and natural gas while minimizing fossil fuel consumption. A 350kW solar panel system will support the plant's Net Zero Energy Building (ZEB) certification, effectively reducing energy consumption for non-production activities to zero—a remarkable achievement in the energy-intensive precious metals sector (ARE Holding Inc., 2024).

For India, adopting a similar approach would align with both domestic imperatives and global market trends. The country's jewelry sector, which represents significant cultural and economic importance, could differentiate itself in international markets by emphasizing sustainability credentials. Establishing environmentally advanced refining operations that prioritize recycled gold sources would position Indian manufacturers to meet the growing demand for responsibly sourced precious metals, particularly in premium Western markets and among younger consumers globally. Furthermore, by developing its own sustainability certification standards tailored to Indian conditions while ensuring alignment with international frameworks, India could create a distinctive national brand identity centered on responsible gold processing, potentially commanding premium pricing similar to Japanese refiners. The integration of renewable energy, particularly India's abundant solar resources, could provide both environmental benefits and operational cost advantages in a sector traditionally characterized by high energy consumption.

Conclusion: Japan's Gold Refinement Mastery and Lessons for India

Japan's ascendancy in global gold refining represents a masterclass in strategic positioning, technical innovation, and sustainability leadership that offers profound lessons for India's aspirations in the precious metals sector. Despite limited domestic gold resources and modest internal consumption, Japan has established itself as a preeminent global refining hub through a multifaceted approach that transforms apparent disadvantages into competitive strengths.

The Japanese model demonstrates the power of strategic diversification across multiple dimensions. In raw material sourcing, Japanese refiners have cultivated varied supply streams—from traditional mining partnerships to urban mining of e-waste and precious metal scrap—creating resilience against market fluctuations and supply disruptions. In processing technology, they have developed complementary pyrometallurgical and hydrometallurgical capabilities that enable the efficient extraction of gold from increasingly complex and low-grade materials. In market positioning, they have transcended commodity refining to create premium value propositions centered on sustainability, traceability, and specialized technical applications.

Perhaps most impressively, Japanese refiners have achieved this dominant position while simultaneously advancing environmental sustainability. Their investments in renewable energy, closed-loop processing systems, and advanced emissions controls demonstrate that

profitability and environmental responsibility can be mutually reinforcing rather than competing objectives. The market recognition of these sustainability credentials—and customers' willingness to pay premium prices for them—validates the business case for environmentally advanced refining operations.

For India, Japan's experience offers a roadmap that could transform the country's relationship with gold. By developing sophisticated domestic refining capabilities focused on alternative gold sources like e-waste and scrap, India could significantly reduce its dependence on gold imports that currently strain foreign exchange reserves. By establishing strategic partnerships with gold-producing nations, Indian entities could secure more favorable access to raw materials while expanding their global influence. By investing in technical innovation and sustainability leadership, India's gold sector could differentiate itself in international markets beyond its traditional strengths in jewelry manufacturing.

The implementation of such a strategy would require coordinated action across multiple domains: policy frameworks that incentivize domestic refining and recycling, research and development initiatives focused on refining technologies optimized for Indian conditions, workforce development programs to build technical capabilities, and international diplomatic efforts to establish strategic mining partnerships. While ambitious, such a comprehensive approach could transform India's position in the global gold ecosystem from primarily a consumer to a sophisticated processor and value-adder—following Japan's path to creating prosperity from precious metals without possessing significant natural endowments.

As global precious metal markets continue to evolve, with increasing emphasis on sustainability, transparency, and responsible sourcing, the Japanese model of gold refinement mastery offers India a compelling vision for how technical sophistication, strategic partnerships, and environmental leadership can create competitive advantage in an industry traditionally dominated by resource-rich nations. By adapting and implementing the lessons from Japan's experience, India has the opportunity to forge a new relationship with gold—one characterized by value addition, sustainability, and greater self-sufficiency.

Potential Mining Partnerships for India: Financing Foreign Gold Extraction

Learning from international models, we've observed how both Switzerland and Japan strategically source raw materials for their gold industries despite having negligible domestic mining. Their approaches—whether through establishing joint ventures with mines (as exemplified by Japan's Sumitomo) or by acquiring and processing low-grade materials to maximize value addition (as Switzerland does)—demonstrate viable strategies for countries without significant mining operations. India has shown initial capability in sourcing raw materials from international markets, though typically at higher prices than Swiss competitors due to the established scale and influence of Swiss refineries. The Japanese model of financing mining operations presents a particularly promising opportunity for Indian companies,

provided they receive adequate support from financial institutions and government policies. This section explores specific regions where potential partnerships could be established and analyzes why these regions represent strategic opportunities for India's gold industry.

The Commonwealth of Independent States (CIS) region, emerges as an exceptionally attractive location for developing mining partnerships due to its remarkably low production costs. Analysis of 2023 data reveals the CIS region operating at a total cash cost[1] of $658 per ounce—31% below the global average of $960 and 38% lower than North America's $1,066 (see Fig. 31). Similarly, the all-in sustaining cost (AISC)[2] in the CIS region stands at $998 per ounce, representing a 23% advantage over the global average of $1,295 and 33% below North America's $1,488 (see Fig. 32). These substantial cost differentials are driven by several factors including favorable geology, lower labor costs, currency advantages, and established mining infrastructure. Furthermore, with significant underground reserves yet to be extracted, the region offers long-term supply security. These economic fundamentals make the CIS region an ideal candidate for metal streaming arrangements or joint venture partnerships that could secure preferential access to gold resources while minimizing India's capital expenditure requirements.

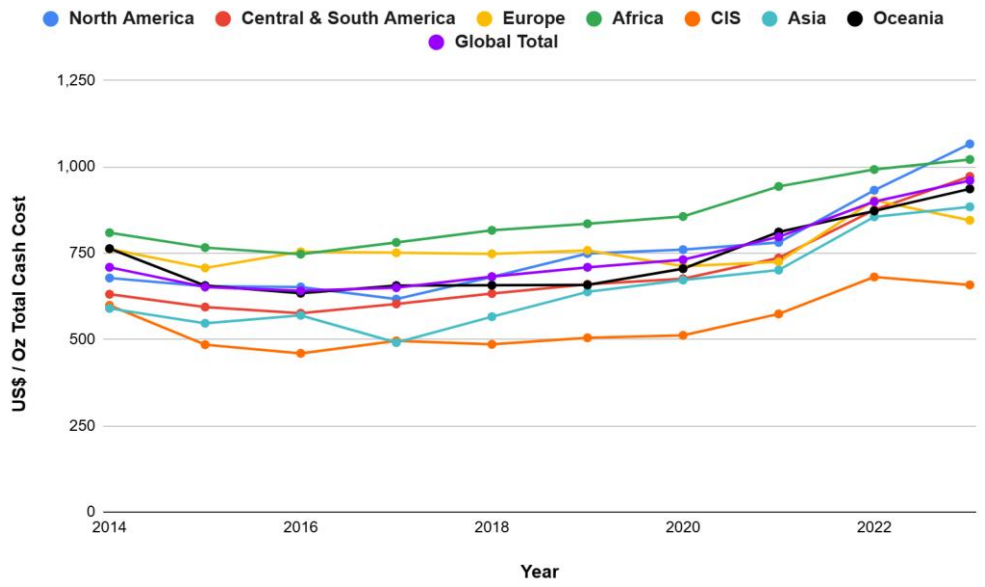

Fig. 31 Yearly Average Gold Production Costs - Total Cash Cost (USD / Oz) from various regions (Metals Focus Ltd., 2024, Appendix 6)

[1] Includes all direct and indirect mine site crash costs related directly to the physical activities of producing metals, including mining, ore processing on-site, general and administrative costs, third-party refining expenses, royalties and production taxes, net of by-product revenue.

[2] The sum of total cash costs plus community costs, sustaining capital expenses, corporate, general and administrative expenses (net of stock option expenses) and exploration expenses.

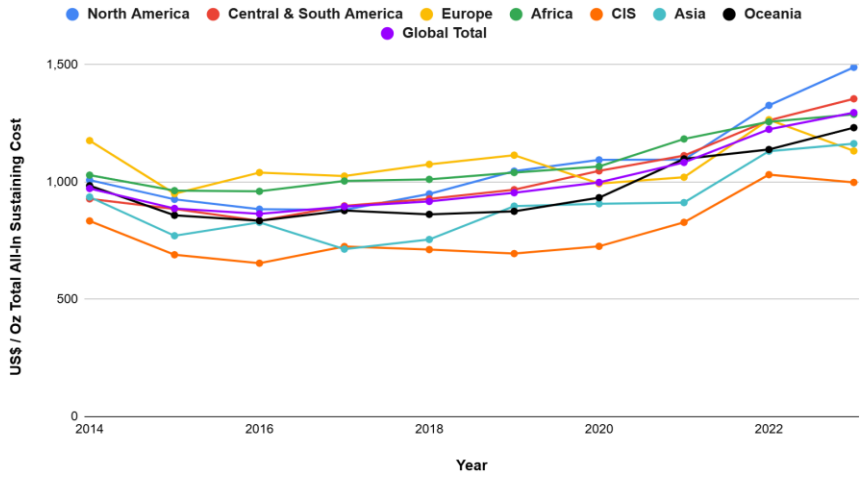

Fig. 32 Yearly Average Gold Production Costs - All-In Sustaining Cost (USD / Oz) from various regions (Metals Focus Ltd., 2024, Appendix 6)

The CIS region commands a formidable position in global gold reserves and resources, serving as a critical repository for future production (see Fig. 33). With 15,010 tonnes of proven reserves, the region ranks second globally—behind only Asia—and represents 27.4% of the world's documented gold reserves. Its resource potential extends even further, with 19,660 tonnes of identified resources placing it third globally after Asia and Africa, constituting 14.9% of global gold resources. Russia dominates this regional landscape as both the CIS's largest producer and the world's second-largest gold producer after China. Russia also controls the majority of these reserves and resources, with its vast territorial expanse—particularly across Siberia and the Far East—hosting numerous world-class gold deposits. A significant portion of these deposits remains either underexplored or only partially developed, indicating substantial untapped potential (Reuters, 2020). This combination of established reserves and undeveloped resources positions the CIS region as an ideal strategic partner for long-term gold acquisition strategies, offering both immediate supply security and future growth potential.

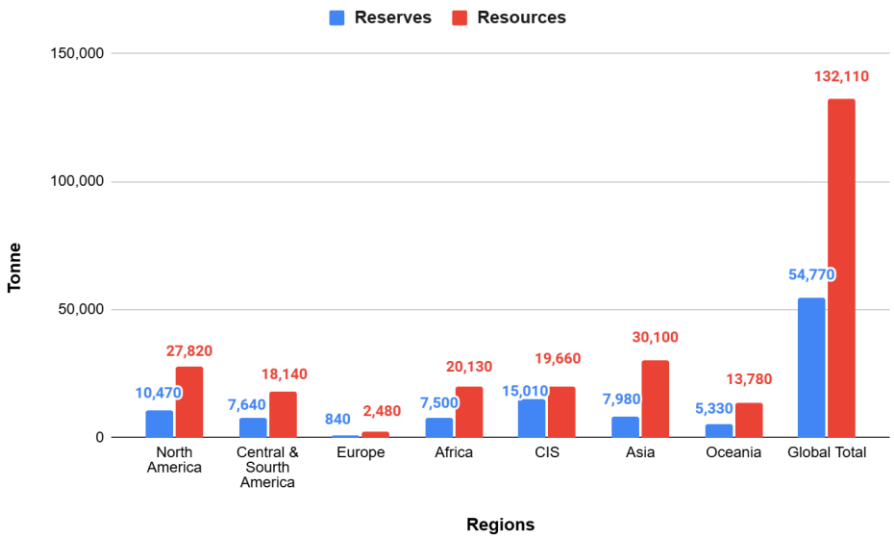

Fig. 33 Gold Reserves and Resources for regions across the world (in Tonne) (Metals Focus Ltd., 2024, Page 32)

An examination of 103 hard rock gold deposits mined in Russia from 1991 to 2021 reveals the exceptional diversity and magnitude of the country's gold endowment (Yakubchuk, 2023). These deposits exhibit remarkable variation in scale—ranging from modest deposits under 1 million tonnes to colossal formations exceeding 1,000 million tonnes of ore (see Fig. 34). Gold concentration similarly varies dramatically, spanning from less than 1 gram per tonne (g/t) to extraordinarily rich deposits exceeding 50 g/t, following the geological principle that larger deposits typically feature lower grades while smaller deposits often compensate with higher concentration. Russia hosts several deposits of global significance, including Sukhoi Log, Olympiada, Natalka, and Nezhdaninskoe—each containing over 1,000 tonnes (33+ million ounces) of gold, positioning them among the world's most substantial gold repositories. This heterogeneity in deposit characteristics creates a diverse portfolio of mining opportunities—from economies-of-scale operations processing vast amounts of lower-grade ore to specialized mining of smaller, higher-grade deposits. Such geological wealth underpins Russia's commanding position in both regional and global gold markets. For India, this presents a strategic opportunity to access a spectrum of gold resources through targeted partnerships or metal streaming arrangements, enabling a sophisticated, diversified approach to securing long-term gold supplies while mitigating concentration risk.

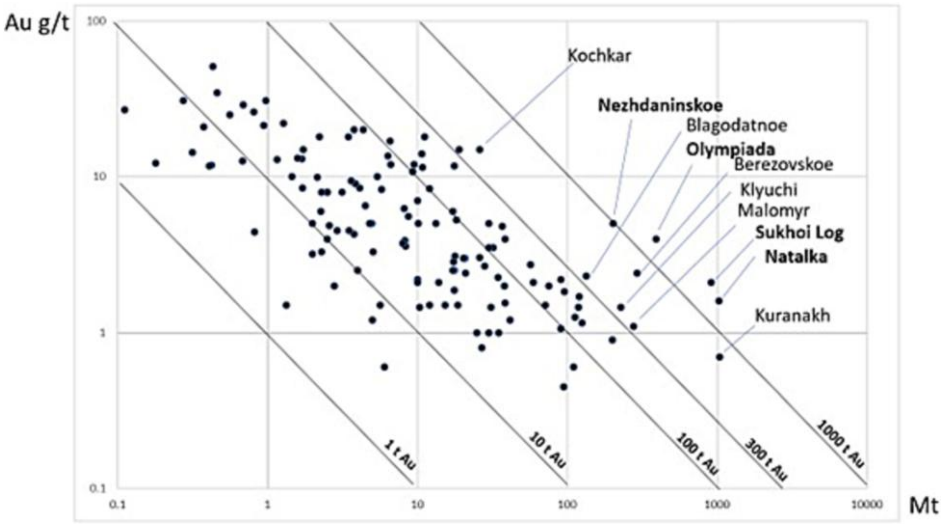

Fig. 34 Endowment and gold grade in 103 hardrock deposits mined in Russia from 1991 to 2021. Four deposits (Sukhoi Log, Olympiada, Natalka and Nezhdaninskoe) have endowments in excess of 1000 t (>33 Moz) gold. (Yakubchuk, 2023)

Conclusion: Transforming India's Gold Ecosystem

India's gold market presents a strategic paradox—culturally inelastic demand of approximately 750 tonnes annually meets negligible domestic production capabilities of just 1.5 tonnes, creating a persistent trade deficit and economic vulnerability. This analysis has identified three primary pathways for transforming India's position from passive consumer to strategic participant in the global gold ecosystem:

First, India must diversify and optimize its sourcing strategy. Currently, low-cost suppliers like Argentina, Peru, and the Dominican Republic currently represent only 15% of imports despite

offering below-average costs. Additionally, strategic mining partnerships, particularly in the cost-efficient CIS region (operating 31% below global average costs), present significant opportunities through joint ventures or metal streaming arrangements.

Second, India should prioritize developing robust domestic value addition capabilities. The current refining sector suffers from underutilization, fragmentation, and accreditation challenges. By investing in technical capabilities for processing alternative gold sources—including ores, concentrates, compounds, and e-waste (which contains on average 10 times more gold per tonne than high-grade ore)—India could substantially increase domestic value capture.

Third, India must create an enabling policy framework that facilitates this transformation. Past initiatives like the Gold Monetization Scheme and UAE CEPA agreement have demonstrated limited effectiveness or created unintended consequences. Future policies should focus on incentivizing domestic refining, supporting international accreditation, and establishing strategic international partnerships.

By implementing these recommendations, India can follow Switzerland's comprehensive blueprint and Japan's technical innovation path to transform its gold ecosystem—reducing import dependence, creating domestic employment, developing exportable expertise, and ultimately building a more resilient and balanced gold market that serves both cultural traditions and economic interests.

Appendix

Appendix 1: Reserves and Resources of Gold in India as of April 01, 2020 (P)

Mineral			Primary Metal (Tonne)	Placer Metal (Tonne)
Reserves	**Proved**	**STD111**	79.26	-
	Probable	**STD121**	13.44	-
		STD122	0.06	-
	Total	**(A)**	**92.76**	**-**
Remaining Resources	**Feasibility**	**STD211**	16.93	-
	Pre-feasibility	**STD221**	9.11	-
		STD222	5.64	-
	Measured	**STD331**	22.05	-
	Indicated	**STD332**	159.41	2.29
	Inferred	**STD333**	236.26	3.57
	Reconnaissance	**STD334**	65.10	-
	Total	**(B)**	**514.50**	**5.86**
Total Resources		**(A+B)**	**607.26**	**5.86**

Reserves and Resources of Gold in India as of April 01, 2020 (P) (Ministry of Mines, 2024-b)

Note:
Mineral reserves are economically mineable parts of measured and/or indicated mineral resources. These include (Indian Bureau of Mines, 2023) -

- ***Proved Mineral Reserves (111):*** Economically mineable part of Measured Mineral Resource.
- ***Probable Mineral Reserves (121 & 122):*** Economically mineable part of indicated or in some cases, a measured mineral resource.

A Mineral Resource (Remaining or Additional Resource) is the balance of the Total Mineral Resources that have not been identified as Mineral Reserve. These include (Indian Bureau of Mines, 2023) -

- ***Feasibility Mineral Resource (211):*** That part of measured mineral resource, which after feasibility study has been found to be economically not mineable.

- ***Prefeasibility Mineral Resource (221 and 222):*** That part of an indicated and in some circumstances measured mineral resource that has been shown by prefeasibility study as not economically mineable or can become economically viable subject to changes in technological, economic, environmental and/or other relevant conditions.
- ***Measured Mineral Resource (331):*** That part of mineral resource for which tonnage, density, shape, physical characteristics, grade and mineral content can be estimated with a high level of confidence, i.e., based on detailed exploration.
- ***Indicated Mineral Resource (332):*** Tonnage, density, shape, physical characteristics grade and mineral content can be estimated with reasonable level of confidence based on exploration, sampling and testing information, location of borehole, pits, etc.
- ***Inferred Mineral Resource (333):*** Tonnage, grade and mineral content can be estimated with low level of confidence inferred from geological evidence.
- ***Reconnaissance Mineral Resource (334):*** Estimates based on regional geological studies and mapping, airborne and indirect methods, preliminary field inspections as well as geological inference and extrapolation.

Appendix 2: Details of resource on Gold augmented by Geological Survey of India

Field Season	State	Block	District	UNFC Stage	Resource in Million Tonne	Grade
2019-20	Karnataka	Machanur Central	Raichur	G2	0.35	0.4 g/t
2015-16	Karnataka	Bangaragatti Central	Dharwar	G3	0.19	0.5 g/t
2015-16	Karnataka	Bangaragatti North	Dharwar	G3	0.17	0.5 g/t
2015-16	Karnataka	North of Maruthipura	Haveri	G3	0.06	0.64 g/t
2017-18	Rajasthan	Khera SE, Mundiyawas- Khera	Alwar	G2	0.16	0.66 g/t
2018-19	Jharkhand	Bhitardari	East Singhbhum	G3	0.34	0.71 g/t
2015-16	Rajasthan	Khera Main	Alwar	G2	3.61	0.77 g/t
2017-18	Maharashtra	Ghanpur - Mudholi - West	Gadchiroli & Chandrapur	G3	0.11	0.82 g/t
2017-18	Karnataka	Ajjanahalli Block-E	Tumkur	G2	1.21	0.87 g/t
2015-16	Rajasthan	Jagpura	Banswara	G2	0.97	1.07 g/t
2019-20	Karnataka	Honnamardi	Davangere	G3	0.26	1.08g/t
2016-17	Madhya Pradesh	Imaliya	Katni	G2	0.35	1.13 g/t
2017-18 2018-19	Rajasthan	Mundiyawas	Alwar	G2	0.42	1.15 g/t
2019-20	Karnataka	Lakkavanahalli	Chitradurga	G3	0.043	1.19g/t
2016-17	Madhya Pradesh	Chakariya	Sidhi	G2	0.13	1.32 g/t
2015-16	Karnataka	Ajjanahalli-Block-G	Tumkur	G3	0.29	1.41 g/t
2020-21	Rajasthan	Jagpura North	Banswara	G3	1.5	1.93 g/t
2015-16	Karnataka	Ajjanahalli-Block-C	Tumkur	G2	0.7	2.47 g/t

Details of resource on Gold augmented by Geological Survey of India (Press Information Bureau, 2023-b)

Note:

UNFC Stage Definitions (Indian Bureau of Mines, n.d.) -

- G4: Reconnaissance
- G3: Prospecting
- G2: General Exploration
- G1: Detailed Exploration

References

Ankit, Saha, L., Kumar, V., Tiwari, J., Sweta, Rawat, S., Singh, J., & Bauddh, K. (2021, November). Electronic waste and their leachates impact on human health and environment: Global ecological threat and management. *Environmental Technology & Innovation*, *24*. https://doi.org/10.1016/j.eti.2021.102049

ARE Holding Inc. (2024). *INTEGRATED REPORT 2024*. ARE Holding Inc. Retrieved April 7, 2025, from https://www.are-holdings.com/Portals/0/images/ir/library/report/IR_2024_E_p.pdf

Asahi Refining. (2024, September 17). *Asahi Refining Sustainability Report 2023-24*. Asahi Refining. Retrieved April 7, 2025, from https://www.asahirefining.com/wp-content/uploads/2024/09/Asahi_Sustainability-Report_2023-24_design_V2.5-final.pdf

Bhayani, R. (2024, July 23). *Union Budget 2024: Sharp import duty cut to burnish gold and silver*. Business Standard. Retrieved March 18, 2025, from https://www.business-standard.com/budget/news/union-budget-2024-sharp-import-duty-cut-to-boost-gold-and-silver-124072301330_1.html

Business Standard. (2024, August 27). *Govt notifies 160 tons of gold import from UAE at concessional rate*. Business Standard. Retrieved March 18, 2025, from https://www.business-standard.com/industry/news/govt-notifies-160-tons-of-gold-import-from-uae-at-concessional-rate-124082700941_1.html

DGCIS. (n.d.-b). *CHAPTER 71: NATURAL OR CULTURED PEARLS, PRECIOUS OR SEMI-PRECIOUS STONES, PRECIOUS METAL, METALS CLAD WITH PRECIOUS METAL, AND ARTICLES THEREOF; IMITATION JEWELLERY; COIN*. Directorate General of Commercial Intelligence and Statistics | Ministry of Commerce and Industry. Retrieved March 19, 2025, from https://www.dgciskol.gov.in/writereaddata/Downloads/20170601184002CHP_71.pdf

DGCIS. (n.d.-c). *Composition of Principal Commodity Groups*. Directorate General of Commercial Intelligence and Statistics | Ministry of Commerce and Industry. Retrieved March 19, 2025, from https://ftddp.dgciskol.gov.in/dgcis/resources/pdfs/PC_composition_HSN2012.pdf

DGCIS. (n.d.). *DGCIS*. Directorate General of Commercial Intelligence and Statistics | Ministry of Commerce and Industry. Retrieved March 18, 2025, from https://ftddp.dgciskol.gov.in/dgcis/login.html

DGFT. (2022, May 1). *Public Notice No. 06/2015-2020*. Directorate General of Foreign Trade | Ministry of Commerce and Industry. Retrieved March 18, 2025, from https://content.dgft.gov.in/Website/dgftprod/dcc80bcb-05fa-4082-8797-fb914ae089ab/English-%20PN%206%20-%20India%20UAE%20CEPA%201May2022.pdf

DGFT. (n.d.-c). *ITC(HS) based Import Policy: Chapter No 26*. Directorate General of Foreign Trade | Ministry of Commerce and Industry. Retrieved March 18, 2025, from https://www.dgft.gov.in/CP/?opt=itchs-import-export

DGFT. (n.d.-b). *ITC(HS) based Import Policy: Chapter No 71*. Directorate General of Foreign Trade | Ministry of Commerce and Industry. Retrieved March 18, 2025, from https://www.dgft.gov.in/CP/?opt=itchs-import-export
DGFT. (n.d.). *ITC(HS) based Import Policy: Chapter No 85:*. Directorate General of Foreign Trade | Ministry of Commerce and Industry. Retrieved March 18, 2025, from https://www.dgft.gov.in/CP/?opt=itchs-import-export
DGFT. (n.d.-d). *TC(HS) based Import Policy: Chapter No 28*. Directorate General of Foreign Trade | Ministry of Commerce and Industry. Retrieved March 18, 2025, from https://www.dgft.gov.in/CP/?opt=itchs-import-export
Franciolli, R. (2019, January 8). *The shady origins of gold refined in Switzerland*. Swissinfo.ch. Retrieved March 24, 2025, from https://www.swissinfo.ch/eng/business/multinationals_the-shady-origins-of-gold-refined-in-switzerland/44621040
IAMGOLD Corporation. (2017, June 5). *IAMGOLD Announces Strategic Agreement with Sumitomo Metal Mining for the Development of Côté Gold*. IAMGOLD Corporation. Retrieved March 18, 2025, from https://www.iamgold.com/English/investors/news-releases/news-releases-details/2017/IAMGOLD-Announces-Strategic-Agreement-with-Sumitomo-Metal-Mining-for-the-Development-of-Ct-Gold/default.aspx
IAMGOLD Corporation. (2022, December 19). *IAMGOLD Announces Transaction with Sumitomo Metal Mining to Provide up to $340 Million in Additional Funding for the Construction of the Côté Gold Project*. IAMGOLD Corporation. Retrieved April 7, 2025, from https://www.iamgold.com/English/investors/news-releases/news-releases-details/2022/IAMGOLD-Announces-Transaction-with-Sumitomo-Metal-Mining-to-Provide-up-to-340-Million-in-Additional-Funding-for-the-Construction-of-the-Ct-Gold-Project/default.aspx
IAMGOLD Corporation. (2024, September 30). *IAMGOLD Submits Formal 60 Days Notice to Sumitomo for Repurchase of 9.7% Côté Gold Mine Interest*. IAMGOLD Corporation. Retrieved April 7, 2025, from https://www.iamgold.com/English/investors/news-releases/news-releases-details/2024/IAMGOLD-Submits-Formal-60-Days-Notice-to-Sumitomo-for-Repurchase-of-9.7-Cote-Gold-Mine-Interest/default.aspx
India Budget | Ministry of Finance | Government of India. (2024, July). *MEMORANDUM EXPLAINING THE PROVISIONS IN THE FINANCE BILL, 2024*. India Budget | Ministry of Finance | Government of India. Retrieved March 18, 2025, from https://www.indiabudget.gov.in/budget2024-25/doc/memo.pdf
Indian Bureau of Mines. (2023). *UNFC System (Concept & terminology) and Resource Summary. In National Mineral Inventory: An Overview As on 01.04.2020. Controller General*. Indian Bureau of Mines. Retrieved March 18, 2025, from https://ibm.gov.in/IBMPortal/pages/national-mineral-inventory--an-overview-as-on-01-04-2020
Indian Bureau of Mines. (n.d.). *GUIDELINES UNDER MCDR FOR UNITED NATIONS FRAMEWORK CLASSIFICATION OF MINERAL RESERVES /*

RESOURCES. Indian Bureau of Mines. Retrieved March 18, 2025, from https://ibm.gov.in/writereaddata/files/07042014175101unfc.pdf
Japan Customs. (2025, January). *Export Statistical Commodity Table (January 2025 Edition): Chapter 71*. Japan Customs. Retrieved March 28, 2025, from https://www.customs.go.jp/yusyutu/2025_01_01/data/j_71.htm
Japan Customs. (2025-b, April 1). *Japan's Tariff Schedule as of April 1 2025: Chapter 26*. Japan Customs. Retrieved April 3, 2025, from https://www.customs.go.jp/english/tariff/2025_04_01/data/e_26.htm
London Bullion Market Association. (2021, January). *GOOD DELIVERY LIST: Rules*. London Bullion Market Association. Retrieved March 28, 2025, from https://cdn.lbma.org.uk/downloads/GDL-Assets/Good-Delivery-List-Rules-Jan-2021-FINAL.pdf
London Bullion Market Association. (n.d.). *Good Delivery Current List - Gold*. London Bullion Market Association. Retrieved March 18, 2025, from https://www.lbma.org.uk/good-delivery/gold-current-list#-
Matsuda Sangyo Co. Ltd. (2024, December 2). *INTEGRATED REPORT 2024*. Matsuda Sangyo Co. Ltd. Retrieved April 7, 2025, from https://www.matsuda-sangyo.co.jp/en/ir/library/report/main/00/teaserItems2/0/linkList/0/link/2024_EN.pdf
Metals Focus Ltd. (2024). *Gold Focus 2024*. Metals Focus Ltd. Retrieved April 8, 2025, from https://www.metalsfocus.com/product/gold-focus/
Ministry of Finance. (2024, July 26). *Ministry of Finance Annual Report 2023-24*. Ministry of Finance. Retrieved March 18, 2025, from https://dea.gov.in/sites/default/files/AR%20English%202023-24%20Final%20%28with%20cover%29.pdf
Ministry of Finance: Japan. (n.d.). *Trade Statistics of Japan*. Trade Statistics of Japan | Ministry of Finance. Retrieved March 18, 2025, from https://www.customs.go.jp/toukei/info/tsdl_e.htm
Ministry of Mines. (2024-b, October 1). *Ministry of Mines* [Annexure 2.1, Page 263]. Ministry of Mines Annual Report 2023-24. Retrieved March 18, 2025, from https://mines.gov.in/admin/download/66acba735b26c1722595955.pdf
Ministry of Mines. (2024, October 1). *Ministry of Mines Annual Report 2023-24* [Annexure 2.4, Page 270]. Ministry of Mines. Retrieved March 18, 2025, from Ministry of Mines Annual Report 2023-24
Mitsubishi Materials. (2024, July 31). *INTEGRATED REPORT 2024*. Mitsubishi Materials. Retrieved April 7, 2025, from https://ssl4.eir-parts.net/doc/5711/ir_material_for_fiscal_ym7/160337/00.pdf
Narayanaswami, S., & Saxena, A. (2024, May). *IIMA Working Paper: Multi-Duty Structures in India's Gold Import Policies: Evidence of blatant flaws using Trade data of 2023-24*. Indian Institute of Management Ahmedabad. Retrieved March 18, 2025, from https://www.iima.ac.in/sites/default/files/2025-01/MultiDuty%20Structures%20in%20India%E2%80%99s%20Gold%20Import%20Policies.pdf

Press Information Bureau. (2018, March 12). *Government Issues Clarification on Gold Imports Scheme*. Press Information Bureau. Retrieved March 18, 2025, from https://pib.gov.in/PressReleasePage.aspx?PRID=1523896
Press Information Bureau. (2023-b, April 5). *State-wise Details of Gold Mines\Reserves*. Press Information Bureau. Retrieved March 18, 2025, from https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1913935
Press Information Bureau. (2023, July 20). *E-Waste Management*. Press Information Bureau. Retrieved March 18, 2025, from https://pib.gov.in/PressReleasePage.aspx?PRID=1941054
Press Information Bureau. (2023-c, July 27). *Ministry of Environment, Forest and Climate Change: Generation of E-waste*. Press Information Bureau. Retrieved April 7, 2025, from https://pib.gov.in/PressReleasePage.aspx?PRID=1943201
Public Relations Office: Government of Japan. (2023, March). *A World-leading Gold Mine in Modern Japan*. Public Relations Office: Government of Japan. Retrieved March 28, 2025, from https://www.gov-online.go.jp/eng/publicity/book/hlj/html/202303/202303_06_en.html
Reserve Bank of India. (n.d.-b). *Data on Outstanding Sovereign Gold Bonds*. Reserve Bank of India. Retrieved March 18, 2025, from https://rbi.org.in/Scripts/BS_SwarnaBharat.aspx
Reserve Bank of India. (n.d.-a). *MONTHLY AVERAGE PRICE OF GOLD AND SILVER IN DOMESTIC AND FOREIGN MARKETS*. Database on Indian Economy - Reserve Bank of India. Retrieved March 18, 2025, from https://data.rbi.org.in/#/dbie/home
Reuters. (2020, October 22). *Russia's Polyus sees reserves at giant Siberian deposit at 40 million oz of gold*. Reuters. Retrieved April 8, 2025, from https://www.reuters.com/article/business/energy/russias-polyus-sees-reserves-at-giant-siberian-deposit-at-40-million-oz-of-gold-idUSKBN2770SG/
Statista - Statistics Bureau of Japan; METI (Japan). (2024, August). *Production volume of gold in Japan from 2014 to 2023*. Statista. Retrieved March 18, 2025, from https://www.statista.com/statistics/707414/japan-gold-production-volume/
Statista: Statistics Bureau of Japan; METI (Japan). (2024, August). *Production volume of gold in Japan from 2014 to 2023*. Statista. Retrieved March 28, 2025, from https://www.statista.com/statistics/707414/japan-gold-production-volume/
Sumitomo Metal Mining Co. Ltd. (2024, September 30). *SUMITOMO METAL MINING CO., LTD. Integrated Report 2024*. Sumitomo Metal Mining Co. Ltd. Retrieved April 4, 2025, from https://www.smm.co.jp/en/ir/library/integrated_report/pdf/2024/2024_All_EN.pdf?241224
Swiss Federal Department of Finance. (n.d.). *Swiss-Impex*. Swiss-Impex: Federal Office for Customs and Border Security. Retrieved March 24, 2025, from https://www.gate.ezv.admin.ch/swissimpex/
Swiss Gold Safe. (2024, June 21). *Gold and Switzerland*. Swiss Gold Safe. Retrieved March 24, 2025, from https://swissgoldsafe.ch/en/additional-

information/fundamentals-precious-metals/gold-switzerland/?srsltid=AfmBOorkrc4-_mCrIz1B8M-eF08K5e2O4s_D4Hcag6QdSpjsvu1XbxZs
Varjani, S., Pandey, A., Gnansounou, E., Khanal, S. K., & Raveendran, S. (Eds.). (2020). *Current Developments in Biotechnology and Bioengineering: Resource Recovery from Wastes*. Elsevier Science. https://doi.org/10.1016/B978-0-444-64321-6.00016-1
Vuppaladadiyam, S. S. V., Thomas, B. S., Kundu, C., Vuppaladadiyam, A. K., Duan, H., & Bhattacharya, S. (2024, May 10). Can e-waste recycling provide a solution to the scarcity of rare earth metals? An overview of e-waste recycling methods. *Science of The Total Environment, 924*. https://doi.org/10.1016/j.scitotenv.2024.171453.
World Gold Council. (2021, December 9). *Bullion trade: India gold market series*. World Gold Council. Retrieved March 18, 2025, from https://www.gold.org/goldhub/research/bullion-trade-india-gold-market-series
World Gold Council. (2022-c, March 17). *World Gold Council*. World Gold Council. Retrieved March 18, 2025, from https://www.gold.org/goldhub/research/gold-mining-in-india-gold-market-series
World Gold Council. (2022-a, June 21). *Gold refining and recycling: India gold market series*. World Gold Council. Retrieved March 18, 2025, from https://www.gold.org/goldhub/research/gold-refining-and-recycling-india-gold-market-series
World Gold Council. (2022-b, July 6). *India's gold import duties hiked*. World Gold Council. Retrieved March 18, 2025, from https://www.gold.org/goldhub/gold-focus/2022/07/indias-gold-import-duties-hiked-world-gold-council
World Gold Council. (2023, July 12). *Gold investment market and financialisation: India gold market series*. World Gold Council. Retrieved March 18, 2025, from https://www.gold.org/goldhub/research/gold-investment-market-and-financialisation-india-gold-market-series
World Gold Council. (2025, February 5). *Gold Demand Trends: Full Year 2024*. World Gold Council. Retrieved March 18, 2025, from https://www.gold.org/goldhub/research/gold-demand-trends/gold-demand-trends-full-year-2024
World Gold Council. (n.d.). *Geographical Diversity: India*. World Gold Council. Retrieved March 18, 2025, from https://www.gold.org/about-gold/gold-demand/geographical-diversity/india
Yakubchuk, A. (2023, February). Russian gold mining: 1991 to 2021 and beyond. *Ore Geology Reviews, 153*, 105287. https://doi.org/10.1016/j.oregeorev.2023.105287