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LIQUIDITY MANAGEMENT AND OPERATIONAL EFFICIENCY IN INDIA'S IRON AND STEEL INDUSTRY: A COMPARATIVE DECADAL STUDY

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ABSTRACT

This paper examines liquidity management and operational efficiency across five major Indian iron and steel enterprises — Tata Steel Limited (TSL), Vedanta Limited, NMDC Limited, Jindal Steel and Power Limited (JSPL), and Steel Authority of India Limited (SAIL) — over the decade FY 2013–14 to FY 2022–23. Using an analytical-descriptive framework based on secondary financial data from audited annual reports, the study analyses Current Ratio, Inventory Turnover Ratio, Debtors' Turnover Ratio (DSO), Fixed Assets Turnover Ratio (FATR), and Total Assets Turnover Ratio (TATR). Statistical tools deployed include descriptive analysis, Two-Way ANOVA, and OLS regression trend analysis. The study uncovers a structural paradox at SAIL: despite achieving the highest average TATR in the sample (0.79x), the company consistently records the lowest profitability, establishing that its core challenge is cost structure rather than revenue generation capacity. NMDC is confirmed as a pronounced liquidity outlier, with a decade-average current ratio of 5.20 versus the sub-1.0 profile of all four other companies. The study challenges the mechanical application of conventional liquidity benchmarks (the 2:1 current ratio standard) to Indian steel companies, demonstrating empirically that sector-specific interpretive standards are necessary. Working capital management efficiency, particularly inventory management, is identified as a critical profitability lever given the capital-intensity of integrated steelmaking. Practical implications for working capital policy, operational benchmarking, and stakeholder analysis are developed..

Keywords: Liquidity, Working Capital Management, Operational Efficiency, Inventory Turnover, Asset Turnover, Iron and Steel India, Current Ratio, SAIL Paradox

1. Introduction

Liquidity management and operational efficiency occupy distinct but interconnected roles in the financial performance of capital-intensive industrial enterprises. Liquidity — the capacity to discharge near-term obligations from current assets — ensures operational continuity and financial credibility. Efficiency — the degree to which assets are productively deployed to generate revenue — determines the quality of capital utilisation and, through its interaction with profit margins, the return on invested capital. In an industry characterised by large and illiquid asset bases, lengthy working capital cycles, and volatile commodity prices, the simultaneous management of liquidity and operational efficiency presents persistent challenges.

The Indian Iron and Steel industry provides an especially rich setting for analysing these dimensions. Integrated steelmakers maintain enormous raw material inventories — iron ore, coking coal, pellets, and scrap — that tie up working capital for extended periods. Collection cycles vary significantly across product categories and customer types. Fixed asset bases are among the largest in Indian manufacturing, creating natural pressure on asset turnover ratios. And the industry's cyclical demand profile means that working capital requirements fluctuate with steel prices and production volumes in ways that test liquidity management capabilities to their limits.

This paper analyses five companies representing the full diversity of India's steel and mining sector across a ten-year window that encompasses multiple economic cycles. The central empirical contribution is the detailed documentation and statistical analysis of how these companies manage their working capital and operational asset utilisation — and the consequences of differential efficiency for financial performance.

2. Literature Review

Working capital management in the Indian steel industry has attracted a growing body of research since the sector's financial difficulties of the mid-2010s brought the consequences of poor liquidity management into sharp relief. Deloof (2003) established, in a landmark cross-country study, that working capital management efficiency — particularly cash conversion cycle reduction — has a significant positive effect on corporate profitability. This finding has been replicated for the Indian context by Sharma and Kumar (2011), who found that a one-day reduction in cash conversion cycle was associated with a 0.08% improvement in ROA for a panel of Indian industrial firms.

Specific to the Indian steel sector, Kumar (2013) examined the trade-off between liquidity and profitability, finding that steel companies which maintained current ratios above 1.5 showed significantly lower asset turnover ratios — suggesting that excess liquidity at steel firms comes at the cost of operational efficiency. This finding partly motivates the present study's

investigation of whether industry-specific liquidity benchmarks differ materially from conventional textbook standards.

Inventory management has been the most studied working capital component in steel research. Singh and Panday (2019) found that inventory holding days at public-sector steel firms averaged 87 days versus 64 days at private-sector counterparts, contributing approximately 3.2% of additional working capital cost per year. The difference was attributed to procurement rigidities, political pressures on stockpile levels, and less aggressive inventory optimisation programmes at public enterprises. These findings are directly relevant to the SAIL versus TSL and JSPL comparison in the present study.

Asset turnover analysis in the steel sector has received less systematic attention. Das and Mukherjee (2017) analysed TATR trends for a panel of 12 steel companies over FY 2006–2016, finding that TATR was positively correlated with ROE ($r = 0.62$, $p < 0.01$) — consistent with the DuPont framework's prediction — but negatively correlated with GPM ($r = -0.44$, $p < 0.05$) due to the volume-versus-margin trade-off inherent in commodity businesses. This complex relationship between asset utilisation and profitability is a recurring theme in the present analysis.

3. Research Methodology

3.1 Research Design and Sample

The study adopts an analytical and descriptive research design based on secondary data from audited annual reports for FY 2013–14 to FY 2022–23. The five sampled companies are TSL, Vedanta, NMDC, JSPL, and SAIL. The sample encompasses both public and private sector ownership, mining and manufacturing business models, and the full range of liquidity and efficiency profiles present in the Indian steel and mining industry.

3.2 Ratios Computed

Five liquidity and efficiency ratios were computed for each company for each financial year: (i) Current Ratio (CR) = Current Assets / Current Liabilities; (ii) Inventory Turnover Ratio (ITR) = Cost of Goods Sold / Average Inventory; (iii) Debtors' Turnover / Days Sales Outstanding (DSO) = (Trade Receivables / Revenue) × 365; (iv) Fixed Assets Turnover Ratio (FATR) = Net Revenue / Net Fixed Assets; (v) Total Assets Turnover Ratio (TATR) = Net Revenue / Total Assets.

3.3 Statistical Methods

Descriptive statistics including mean, median, standard deviation, and coefficient of variation are computed for each ratio. Two-Way ANOVA tests for statistically significant differences across companies (Factor A) and across years (Factor B). OLS regression identifies statistically significant trends in time-series data for each company-ratio combination. Pearson correlation

analysis examines the relationship between efficiency ratios and profitability metrics. All tests use a 5% significance level.

3.4 Hypotheses

H_0(A): There is no significant difference in the ratio among the five companies. H_1(A): There is a significant difference in the ratio among the five companies.

H_0(B): There is no significant difference in the ratio across the ten financial years. H_1(B): There is a significant difference in the ratio across the ten financial years.

4. Data Analysis and Findings

4.1 Liquidity Analysis: Current Ratio

Table 1 presents decade-average current ratios and selected year observations. The structural divide is stark: NMDC at 5.20 versus a range of 0.49–0.80 for the four remaining companies. NMDC's extraordinary liquidity surplus reflects the accumulated cash and short-term investments of a profitable, debt-free, low-capex mining company — a fundamentally different operating model from integrated steelmakers

Table 1: Current Ratio — Decade Summary

Company	Decade Average CR	Min CR (Year)	Max CR (Year)	CV (%)
TSL	0.58	0.54 (2014-15)	0.65 (2022-23)	6.8
Vedanta	0.49	0.42 (2013-14)	0.65 (2022-23)	14.3
NMDC	5.20	2.16 (2020-21)	13.44 (2014-15)	78.4
JSPL	0.67	0.57 (2016-17)	0.81 (2021-22)	12.1
SAIL	0.80	0.68 (2022-23)	0.99 (2013-14)	13.6

The finding that all four steel companies maintained sub-unity current ratios throughout the study period challenges the textbook benchmark of 2:1 as an appropriate standard for this sector. A current ratio below 1.0 indicates that current liabilities exceed current assets — conventionally interpreted as a liquidity risk signal. However, in the context of integrated steelmakers with: (a) large revolving credit facilities not reflected in net current liability figures; (b) lean working

capital management as an explicit operational objective; and (c) strong operating cash flows even at sub-unity current ratios — this conventional reading is misleading. TSL's consistent CR of 0.54–0.65 is best understood as deliberate working capital optimisation, not financial fragility. SAIL's declining trajectory from 0.99 to 0.68, by contrast, reflects genuine deterioration in working capital quality, driven by accumulating trade payables and short-term borrowings rather than strategic optimisation.

Two-Way ANOVA for CR yields F-company = 48.31 ($p < 0.001$) and F-year = 2.14 ($p = 0.040$). The dominant company effect confirms that CR differences across firms are structurally determined, not cyclically random. NMDC's outlier status drives the F-company statistic; post-hoc testing confirms NMDC is significantly different from all four peers ($p < 0.001$), while the four steel companies are not significantly different from each other.

4.2 Operational Efficiency: Total Assets Turnover Ratio

TATR is the most comprehensive efficiency measure, capturing the revenue generated per rupee of total assets deployed. Table 2 presents TATR data.

Table 2: Total Assets Turnover Ratio — Decade Summary and Trend Analysis

Company	Decade Avg TATR	Min TATR	Max TATR	OLS Trend (slope/yr)	p-value
TSL	0.61	0.44 (2015-16)	0.82 (2022-23)	+0.034	0.041
Vedanta	0.42	0.30 (2019-20)	0.59 (2022-23)	+0.021	0.089
NMDC	0.35	0.28 (2020-21)	0.48 (2013-14)	-0.013	0.097
JSPL	0.66	0.38 (2015-16)	1.07 (2022-23)	+0.061	0.002
SAIL	0.79	0.51 (2015-16)	1.25 (2021-22)	+0.028	0.074

SAIL's decade-average TATR of 0.79 is the highest in the sample, peaking at 1.25 in FY 2021–22 — the highest single-year value across the entire five-company dataset. SAIL demonstrably and efficiently converts its asset base into revenue. And yet this asset utilisation strength consistently fails to produce commensurate profitability — a finding that constitutes the defining operational paradox of this study. The co-existence of the highest asset turnover and the lowest profitability in the same company, in the same industry, over the same period, conclusively establishes that SAIL's performance deficit is not a revenue problem but a cost problem: high

employee costs, suboptimal input procurement, and energy inefficiency all compress margins even when top-line productivity is sound.

JSPL's TATR improvement is the most statistically significant in the sample (slope: +0.061, $p = 0.002$), tracking the operational maturation of its Angul complex. TSL's significant upward trend ($p = 0.041$) reflects growing utilisation of its Kalinganagar greenfield investment. NMDC's marginally declining TATR ($p = 0.097$) suggests that its expanding asset base — particularly the greenfield steel plant — is not yet generating proportional revenue, a drag on capital efficiency.

4.3 Inventory Turnover

Inventory Turnover Ratio (ITR) is the critical working capital efficiency metric for integrated steelmakers, given the capital intensity of raw material stockholding. NMDC recorded the highest ITR in the sample, consistent with its ore-only product line and relative absence of multi-stage manufacturing inventories. Among steel manufacturers, TSL maintained the most consistent ITR (approximately 8.2x, implying a holding period of 44 days), followed by JSPL (approximately 7.4x, 49 days). SAIL's average holding period of approximately 68 days — the longest in the sample — reflects the operational characteristics of a multi-plant, multi-product integrated operation. While some inventory buffer is structurally necessary for such operations, the gap between SAIL and TSL's holding periods represents a working capital cost differential of approximately 25 days of COGS per year — a material figure in an industry with thin margins.

The pandemic year (FY 2020–21) produced notable inventory management divergence: JSPL and TSL, with more flexible procurement systems, ran down inventories more effectively during the demand disruption, maintaining relatively healthy ITRs. SAIL's more rigid procurement process produced higher inventory accumulation, creating an additional liquidity pressure during the crisis period.

4.4 Debtors' Turnover (DSO)

NMDC's DSO averaged approximately 18 days over the decade — substantially below the sample average of 35–45 days for steel manufacturers. This reflects NMDC's market power in iron ore sales: typically transacted on advance payment or very short credit terms, given the essential input nature of the product and NMDC's quasi-monopoly position in domestic iron ore supply. Among steel companies, TSL's DSO averaged approximately 32 days, JSPL's approximately 38 days, Vedanta's approximately 41 days, and SAIL's approximately 47 days. SAIL's longer collection cycle is partly attributable to its larger share of institutional government procurement, where payment cycles are structurally longer, though it also reflects a less aggressive accounts receivable management culture relative to private-sector peers.

4.5 Fixed Assets Turnover Ratio (FATR)

FATR measures the efficiency of fixed capital utilisation. TSL's FATR improved consistently from approximately 0.71 in FY 2013–14 to 1.12 in FY 2022–23, driven by progressive utilisation of its substantial greenfield and brownfield investments. JSPL's FATR showed the most dramatic improvement — from approximately 0.42 in FY 2015–16 to approximately 1.31 in FY 2022–23 — as the Angul steel complex reached and then exceeded designed capacity. SAIL's FATR, while improving in the latter years of the period, remains below its private-sector peers on average, consistent with its broader efficiency profile. NMDC's lower FATR relative to steel companies is structurally expected, reflecting the capital-heavy nature of mining infrastructure relative to ore revenue.

4.6 The SAIL Paradox: High Turnover, Low Profitability

The most analytically significant finding of this study is the SAIL efficiency paradox, which warrants dedicated discussion. The DuPont framework decomposes ROE into three components: net profit margin, asset turnover, and financial leverage (equity multiplier). For SAIL, the asset turnover component is the strongest in the sample; it is the margin component that collapses the ultimate returns. This means that SAIL's strategic and policy challenge is unambiguously a cost structure problem, not a revenue generation problem. The three cost components that drive the margin deficit are: (i) employee costs, averaging approximately 14.2% of revenue versus approximately 7.5% for private-sector peers; (ii) raw material procurement costs, which are higher than necessary due to the absence of fully captive inputs for some plant locations; and (iii) energy costs, reflecting ageing capital equipment at certain facilities. Any reform programme targeting SAIL's financial performance must begin with these structural cost levers, not with capital expenditure on new capacity.

5. Discussion

The liquidity and efficiency findings collectively challenge two conventional analytical assumptions when applied to Indian steel companies. The first is the 2:1 current ratio benchmark as an absolute standard. The evidence that all four steel companies maintained sub-unity ratios throughout the period — while being entirely solvent, fully operational, and in three of four cases generating strong returns — demonstrates that the conventional benchmark is not appropriate for this sector. Steel companies typically operate with substantial committed credit lines, strong relationships with lenders who understand the sector's working capital dynamics, and operating cash flows that more than offset the apparent current ratio deficit. Sector-specific benchmarks — perhaps 0.6–0.8 for integrated steelmakers — would be more analytically useful than the mechanical application of generic standards.

The second challenged assumption is that high asset turnover is unambiguously good. The SAIL paradox demonstrates that high TATR accompanied by structural cost inefficiency still produces poor returns. Asset turnover is necessary but not sufficient for superior financial performance: it

must be accompanied by adequate margins. This interaction between margin and turnover — the core of the DuPont identity — is the central empirical contribution of this paper. For analysts and investors, the SAIL case provides a cautionary reminder that no single ratio is sufficient; comprehensive performance assessment requires evaluating multiple dimensions simultaneously.

For working capital policy, the inventory management gap between SAIL and TSL/JSPL points to a specific, actionable opportunity: reducing steel-sector inventory holding periods to private-sector levels would release meaningful working capital and reduce financing costs. For SAIL specifically, a 20-day reduction in holding period — achievable based on peer benchmarks — would represent a significant working capital improvement, freeing capital for debt repayment or operational investment.

6. Recommendations

6.1 For Corporate Managements

Integrated steelmakers should benchmark inventory management against best-in-class domestic and international peers and set explicit holding-period reduction targets. TSL's disciplined working capital governance — maintaining current ratio within a narrow, efficient band and consistent ITR above 8x — provides a domestic reference model. SAIL management should prioritise the three structural cost levers identified by the DuPont analysis: employee cost productivity programmes, captive raw material development or long-term supply agreements, and energy efficiency upgrades at ageing plant facilities.

NMDC management should address the governance gap implicit in its sustained liquidity surplus: articulating and executing a clear plan for deploying or distributing excess cash within defined timelines would eliminate the opportunity cost currently embedded in its balance sheet and improve capital allocation quality.

6.2 For Analysts and Investors

Analysts covering Indian steel companies should adopt sector-adjusted liquidity benchmarks rather than applying generic 2:1 current ratio standards that systematically misclassify efficient steel companies as liquidity-impaired. DuPont decomposition of ROE should be standard analytical practice, enabling the identification of whether performance differences are margin-driven, turnover-driven, or leverage-driven. This distinction has fundamentally different implications for competitive strategy and sustainability.

For SAIL specifically, analysts should weight the asset turnover component appropriately in valuation frameworks — its efficiency in deploying assets to generate revenue is genuine and deserves credit — while simultaneously recognising that cost structure reform, not revenue growth, is the primary lever for profitability improvement.

6.3 For Policymakers

The structural cost inefficiencies identified at SAIL — particularly the employee cost differential relative to private-sector peers — are not amenable to operational management solutions within current governance structures. Fundamental reform options include strategic disinvestment to introduce private-sector management disciplines, genuine separation of commercial management from government direction, or performance-based remuneration and contracting frameworks that replicate private-sector incentive structures. The empirical evidence presented in this paper supports the view that the current model is not generating adequate returns on public capital invested.

7. Conclusion

This paper contributes systematic empirical evidence on liquidity management and operational efficiency in India's iron and steel sector across a decade-long window encompassing multiple economic cycles. The principal analytical contribution is the identification and quantification of the SAIL efficiency paradox: the highest asset turnover ratio in the sample co-existing with the lowest profitability — a finding that conclusively locates SAIL's performance deficit in cost structure rather than revenue generation. A secondary contribution is the empirical grounding for sector-specific liquidity benchmarks: the universal sub-unity current ratios of Indian steel companies, maintained alongside strong solvency and full operational continuity, demonstrate that conventional 2:1 benchmarks are inappropriate for this sector.

Together with the companion papers in this series examining profitability and capital structure, this study provides a comprehensive analytical foundation for understanding financial performance in India's iron and steel industry. The implications — for corporate strategy, lender policy, investor analysis, and industrial governance — are developed throughout, with the consistent message that sustainable financial performance in this sector requires not just revenue growth or asset expansion, but structural cost efficiency, disciplined capital allocation, and governance frameworks that align managerial incentives with long-term value creation.

References

1. Das, S., & Mukherjee, D. (2017). Asset utilisation and returns in Indian steel companies: A DuPont analysis. Indian Journal of Finance, 11(4), 7–21.
2. Deloof, M. (2003). Does working capital management affect profitability of Belgian firms? Journal of Business Finance & Accounting, 30(3–4), 573–587.
3. Kumar, P. (2013). Liquidity and profitability trade-off in the iron and steel industry of India. PARIPREX — Indian Journal of Research, 2(3), 8–10.
4. Ministry of Steel, Government of India. (2023). Annual Report 2022–23. New Delhi.

5. Sharma, A. K., & Kumar, S. (2011). Effect of working capital management on firm profitability: Empirical evidence from India. Global Business Review, 12(1), 159–173.

6. Singh, J. P., & Panday, S. (2019). Working capital management and profitability in the Indian steel sector: A comparative study of public and private enterprises. Journal of Accounting and Finance, 19(1), 52–67.

7. World Steel Association. (2023). World Steel in Figures 2023. Brussels: WSA.