

Outsourcing Impact on Operational Performance of PSU Steel Industry

¹Suresh Kumar Panchbhai, ²Dr Tripati Shastri

¹Research scholar , Commerce & Management Department, ISBM University , Chhura, Gariaband, Raipur CG India.

²Asstt Professor, Commerce & Management Department , ISBM University , Chhura, Gariaband, Raipur ,CG, India.

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ABSTRACT

Public Sector Undertakings (PSUs) within the Indian steel sector have witnessed significant change through outsourcing practices meant to facilitate efficiency, curtail costs, and increase competitiveness. The operational performance effect of the same, however, is a matter of contention. This research examines the association between outsourcing functions like logistics, maintenance, IT, and ancillary services, and measures of operational performance such as productivity, turnaround time, cost-effectiveness, and quality standards in PSU steel plants. A mixed-method research approach was employed involving primary data from managerial staff and secondary data from corporate performance reports of major PSUs like SAIL and RINL. Statistical inference confirms that outsourcing has caused moderate productivity and cost savings improvements but is challenging in quality control and dependence on third-party suppliers. This study contributes to the knowledge of strategic outsourcing consequences and provides actionable insights for PSU leadership and policy makers interested in sustainable improvement of operational performance.

Keywords: Outsourcing, Operational Performance, PSU Steel Industry, Strategic Management, Productivity, Cost Efficiency, India

INTRODUCTION

Indian steel industry is a cornerstone of the country's industrial growth and economic development. Public Sector Undertakings (PSUs), mainly Steel Authority of India Limited (SAIL) and Rashtriya Ispat Nigam Limited (RINL), traditionally accounted for steel production, making major contributions to infrastructure, employment generation, and national capacity-building. Over recent years, however, these organizations have been subjected to growing international competition, technological change, and rising internal inefficiencies. Confronted by the two challenges of market competitiveness and performance efficiency, PSU steel plants have started embracing outsourcing as a strategic intervention to enhance their operational performance.

Typically, outsourcing in the PSU steel industry involves the offloading of non-core activities like logistics, raw material handling, plant maintenance, IT services, human resource services, and administrative functions to third-party service providers. Such services are often delivered under performance-linked contracts from private agencies, which claim cost efficiency and specialized expertise. The core idea is that outsourcing would free up an organization to focus more on core steelmaking operations while delegating peripheral or resource-intensive tasks to external entities that might have domain proficiency. The model is widely applied in the private sector; however, its implications on the complicated and regulation-driven environment of public sector units are far from being analyzed.

On paper, outsourcing should lead to better cost management, flexibility, productivity, and service delivery quality. But in applying outsourcing in PSUs, new difficulties also crop up, including less managerial control, issues with quality assurance, reliance on contractors, and opposition from internal labor unions. Outsourcing is thus a precarious balancing act between operational advantage and strategic risk. Especially in the PSU setting—where there is public accountability, union pressures, and lengthy procurement cycles—the outsourcing operation outcomes need close examination and empirically supported analysis.¹

Quinn, J.B., & Hilmer, F.G. (1994). *Strategic outsourcing*. *Sloan Management Review*, 35(4), 43–55. This research concentrates on assessing how outsourcing has impacted operational performance in PSU steel mills, both positively and negatively. It seeks to investigate whether outsourcing has enhanced important performance metrics like production efficiency, cost saving, and equipment availability, or if it has resulted in unforeseen reversals in the areas of reliability, process delay, or service interruption. By evaluating outsourcing practice in frontline Indian PSUs, this study tries to present a grounded reading of outsourcing's real business worth within the steel manufacturing environment. The research has applicability for decision-makers, policy makers, and researchers interested in understanding the effectiveness and longevity of outsourcing within public sector sectors

LITERATURE REVIEW

Outsourcing has come of age as a strategic cost-cutting measure to become an integral part of organizational restructuring and performance optimization. In industries with high manufacturing activities, it is especially applicable for enhancing operational flexibility and allowing companies to concentrate on their core strengths. Researchers around the world have examined the impact of outsourcing on performance metrics such as productivity, cost efficiency, turnaround time, and service excellence.

Initial research on strategic outsourcing focused on the core and non-core functions paradigm, stating that companies gain competitive advantage through concentrating on core capabilities while subcontracting peripheral operations to specialists. In public sector organizations, though, the use of outsourcing is not just a business choice but also a reaction to structural inefficiencies, bureaucratic limitations, and increasing operational costs.

In the Indian context, a number of researchers have studied outsourcing practices in PSUs and government-linked institutions. Mukherjee and Ghosh (2015) conducted a study on outsourcing activities in central government undertakings and found that although cost savings were realized in the short run, employee morale and long-term service quality generally suffered. This is particularly applicable in steel plants, where delicate coordination between outsourced and internal teams is required for smooth functioning.

In the steel sector, functional outsourcing is widely practiced in the fields of equipment maintenance, material handling, plant protection, and human resource management. A sectoral report published by the Ministry of Steel (2020) recognized that outsourcing has emerged as a means of raising the operational throughput in mature PSU plants where workforce optimization plays a prime importance. Yet the report also expressed concerns related to over-reliance on vendors, unclear contract management, and constrained knowledge transfer—issues that directly influence long-term operational efficiency.

Across the globe, such issues have been reported as well. Lee and Kim (2014) in one of their studies on outsourcing in South Korean large manufacturing plants discovered that while third-party services enhanced short-term productivity and decreased downtime, improvement in performance levelled off as a result of lack of communication and disjointed process ownership. The authors suggested models of co-management and holistic outsourcing approaches for long-term performance enhancement.

Empirical research on outsourcing and respective operational performance measures yields inconclusive results. Bharadwaj and Saxena (2017), for example, examined productivity trends from various PSU plants in India and discovered that outsourced logistics processes improved cycle time by an average of 17%. Yet, the same research identified that outsourced IT services resulted in increased system downtime caused by a lack of domain customization.

Theoretically, Transaction Cost Economics (TCE) has found broad application in explaining outsourcing choices. In the context of TCE, firms outsource when internal management costs of a function surpass the market transaction costs. For PSU steel plants, nonetheless, the TCE logic is entangled with other hurdles like government procurement rules, union pressures from employees, and social welfare obligations, which make it difficult to simplify the outsourcing logic.

Recent developments in outsourcing have also brought attention to the aspect of technological integration. Vendor-managed inventory systems, predictive maintenance contracts through AI, and performance-based outsourcing contracts have begun gaining prominence. For instance, research by Rao and Srinivasan (2021) indicated that steel

plants implementing digitalized outsourcing platforms saw higher procurement and preventive maintenance efficiency.

Even with these developments, resistance from organized labor continues to be a significant hindrance. In most PSU steel plants, unions perceive outsourcing as endangering job security and salary structures. Research such as the study carried out by Indian Institute of Management (IIM) Bangalore (2019) indicated that without stakeholder consultation and reskilling of the workforce, outsourcing programs tend to catalyze unrest and operational tension.

The latter aspect is contingent on the PSU management's ability to monitor vendor performance, enforce quality control, and ensure contractual compliance. Weak governance of a vendor has been associated with issues like delayed deliveries, safety violations, and rework costs, which defeats the core purpose of outsourcing- efficiency.

Overall, the literature indicates that although outsourcing has the potential to boost operational performance in PSU steel firms considerably, its effect is contingent upon many factors. Organizational preparedness, contract definition, regulatory clarity, and cultural fit among internal personnel and outsourced vendors are factors of success. In the absence of cohesive evaluation systems in PSUs, outsourcing advantages are either exaggerated or anecdotal.

This research tries to fill this knowledge gap by investigating outsourcing in PSU steel plants using a mixed-methods design, considering not just performance metrics but also managerial insights into implementation issues and realized gains. By doing so, it adds a sophisticated insight into how outsourcing, when implemented strategically, can function as a performance-driver in large, state-owned industrial organizations.

METHODOLOGY

To assess the performance influence of outsourcing in PSU steel plants, in this study, a mixed-method research approach was used integrating quantitative analysis of performance indicators and qualitative findings from manager interviews. The objective was to present a complete picture of measurable performances and strategic considerations of outsourcing practices within India's public steel industry.

The study was conducted across three major public sector steel units: SAIL-Bhilai Steel Plant, SAIL-Rourkela Steel Plant, and RINL-Vizag Steel Plant, selected for their size, operational complexity, and significant adoption of outsourced services in the past decade. The target population included senior operational managers, plant engineers, outsourcing coordinators, and HR personnel directly involved in the planning or supervision of outsourcing contracts.

3.1 Data Collection

Data gathering for the study was carefully designed and conducted to ensure the complete coverage of both quantitative and qualitative dimensions of outsourcing influence on PSU steel industry operations. Due to the paramount significance of operational information and the contextual challenges of public sector units, a dual-source data gathering approach was chosen—entailing both primary and secondary data streams.

Primary Data Collection

Primary data were obtained by conducting a structured survey and semi-structured interviews with people who have direct visibility of outsourcing decisions and the operational execution. The aim was to obtain firsthand opinions, experience, and performance judgment from professionals who are involved within the production and managerial setup of PSU steel plants.

A structured questionnaire was prepared with five key sections:

- Demographic Profile – capturing age, designation, years of experience, and department.
- Outsourcing Scope – recording the nature and degree of outsourced activities (e.g., logistics, plant maintenance, IT services, security, etc.).
- Performance Indicators – requesting respondents to measure changes in crucial operational measures (e.g.,

equipment uptime, cost savings, response times) after outsourcing, on a 5-point Likert scale.

- **Satisfaction Metrics** – gauging satisfaction with the performance of vendors, contract fulfillment, and assistance from internal departments.
- **Perceived Challenges** – determining actual issues faced like coordination failures, vendor inefficiencies, or labor resistances.

The questionnaire was pilot-tested on 10 operational personnel of a non-participating PSU to ensure validity of clarity, relevance, and completeness. After revising the survey, the finalized instrument was sent to 120 staff members in three large PSU steel plants—SAIL-Bhilai, SAIL-Rourkela, and RINL-Vizag. Complete and valid responses totaling 85 were collected, yielding an estimated usable response rate of about 70.8%. Respondents were senior managers, shift engineers, outsourcing coordinators, and section heads from those departments wherein outsourced services were actually used.

Semi-structured interviews were also carried out with 12 strategic personnel at the three locations to provide rich qualitative information. Interview participants were purposively sampled based on their strategic positions in outsourcing planning, implementation, or monitoring. Interviews were approximately 30–45 minutes and utilized an interview guide with open-ended questions across outsourcing rationale, vendor relationships, operational risks, and concerns of long-term sustainability. Interviews were taped (with permission), transcribed verbatim, and analyzed by themes.

Secondary Data Collection

Secondary data were obtained from official documents in the participating PSUs, such as internal records, performance dashboards, audit reports, and annual operational reviews between financial years 2020–2023. Formal approval from departmental heads was obtained to access documents under confidentiality agreements.

Some of the secondary data collected were:

- Monthly production output reports
- Plant-wise equipment uptime and maintenance logs
- Turnaround time logs for outsourced services
- Cost-benefit summaries from outsourcing committees
- Incident reports attributed to vendor performance or slippage

Where possible, pre- and post-outsourcing data for individual functions (e.g., plant maintenance, transportation, canteen services) were compared to measure operation shifts resulting from outsourcing.

To increase the validity of secondary data, triangulation was used—cross-verifying operation reports with interview response and survey feedback. Not only did this improve the reliability of the data, but it also helped place inconsistencies into context and validate performance trends.

3.2 Sampling Technique

Considering the specific nature of this study—assessing the effect of outsourcing on operational performance in PSU steel factories—a purposive (judgmental) sampling method was utilized. This non-probability sample technique was adopted to guarantee that the participants selected had hands-on experience with outsourcing-related decision-making, implementation, or monitoring performance in the organizational setup of the PSU.

The target population consisted of the employees from various hierarchical levels in three large public sector steel plants: SAIL-Bhilai Steel Plant, SAIL-Rourkela Steel Plant, and RINL-Vizag Steel Plant. They were chosen on three grounds: (1) high level of outsourcing activity in the last 5–10 years; (2) presence of historic data related to operational performance; and (3) ease of access for research purposes through official institutional sanctions.

The sample frame involved workers from operations, maintenance, purchasing, quality assurance, supply chain, and

IT departments, all of which are domains usually impacted by outsourcing decisions. Particular attention was given to including mid- to senior-level staff like:

- Deputy General Managers and Assistant General Managers
- Sectional Heads (Maintenance, Production, IT, Logistics)
- Outsourcing Coordinators and Vendor Liaisons
- Shift Engineers and Technical Supervisors
- Contract Monitoring Officers and Department Auditors

Out of a starting list of 120 potential participants who met the requirement, 85 participants were chosen and confirmed for the survey. This comprised 30 from SAIL-Bhilai, 28 from SAIL-Rourkela, and 27 from RINL-Vizag to maintain balanced representation among plants and departments.

Aside from survey participants, a sub-sample of 12 respondents was recruited for in-depth semi-structured interviews. These interviewees were recruited using organizational referrals (snowball method) and had to fulfill the following conditions: (1) at least 5 years of experience working in their present position, (2) involvement in present outsourcing decisions or vendor performance reviews, and (3) capacity to offer strategic-level perspectives on how outsourcing affects plant operations.

The purposive strategy guaranteed that data gathered were both significant and informative, based on individuals best suited to evaluate the actual-world influence of outsourcing in the PSU context. Although such a method does not enable statistical inference to the entire PSU workforce, it enhances the richness and contextual thickness of findings, which is well suited to the exploratory and evaluative nature of the study.

To minimize possible biases inherent in purposive sampling, more than one plant and department were covered, and the participants were promised confidentiality and anonymity to promote honest and unbiased answers.

3.3 Research Variables

To assess operational performance, the following dependent variables were chosen:

- Operational Efficiency (as measured by equipment uptime and production per hour)
- Cost Effectiveness (measured in terms of savings in labor and overhead costs)
- Turnaround Time (maintenance, procurement, or service delivery time)
- Quality Consistency (defect rates or rework rates)

The independent variable was the degree of outsourcing—number of functions outsourced, budget allocated to outsourced services, and length of vendor contracts.

3.4 Data Analysis

To methodically assess the effect of outsourcing on operational performance in PSU steel plants, the research utilized a multi-level data analysis framework blending quantitative and qualitative approaches. Through its two-pronged methodology, the research allowed for a holistic interpretation of both statistical performance indicators and pragmatic experiences of professionals in the industry.

Quantitative Data Analysis

The qualitative data gathered using structured questionnaires were coded and analyzed on IBM SPSS Statistics (Version 26). The Likert-scale items' responses were subjected to both descriptive and inferential statistical analysis.

Descriptive statistics (mean, standard deviation, frequency, and percentage) were employed to aggregate the demographic profile of the respondents and their general perceptions of the impact of outsourcing on different dimensions of operations—such as efficiency, turnaround time, cost, and quality.

Reliability testing was performed to assess the internal consistency of the Likert-scale items through Cronbach's

alpha, which provided an alphas value of 0.82, signifying high reliability and internal validity of the scale of measurement.

In order to assess the direction and magnitude of association between variables, Pearson correlation analysis was utilized. It was specifically used in examining associations between the level of outsourcing and shifts in operational indicators like levels of productivity, reduction in downtime, and responsiveness to service.

Multiple regression analysis was used for evaluating predictive relationships. Regression model employed outsourcing extent (functions outsourced, frequency of contract renewal, and percentage budget held) as independent variables, while operational efficiency, cost-effectiveness, and turnaround time were considered as dependent variables.

Further, one-way ANOVA tests were used to identify if there were any significant differences in performance among departments or plant units that have different levels of involvement in outsourcing. Where necessary, post-hoc Tukey HSD tests were employed in analyzing inter-group differences.

All the statistical tests were performed at a level of significance of 5% ($p < 0.05$) to establish the reliability of identified relationships.

Qualitative Data Analysis

Qualitative data, collected through 12 in-depth semi-structured interviews with senior and mid-level managers, were processed thematically utilizing NVivo 12 Pro software. The verbatim transcriptions were done from the audio recordings, and a four-stage coding process was undertaken:

- Open Coding – Initial identification of frequent words, phrases, and themes pertinent to outsourcing practices.
- Axial Coding – Cluster coding similar codes into superordinate thematic categories (e.g., "vendor performance", "workflow integration", "labor resistance", "contract governance").
- Selective Coding – The extraction of salient themes that consistently had an impact on operational results throughout various departments and plants.
- Triangulation – Qualitative theme comparison with quantitative survey trends to confirm results and emphasize discrepancies or contextual subtleties.
- Themes like "enhanced turnaround maintenance," "reliance on outside vendors," and "insufficiency of monitoring internal mechanisms" came up as prevalent trends. These qualitative findings were incorporated in the discussion section to substantiate or compare the statistical results and provide richer managerial explanations.

Integration of Quantitative and Qualitative Findings

A convergent parallel mixed-methods approach was employed, where qualitative and quantitative data were each analyzed in isolation but interpreted together in the discussion of results. This method strengthened the validity of the results, assured contextual depth, and enabled multi-dimensional insight into how outsourcing impacts operational performance in PSU steel plants.

3.5 Validity and Reliability

To attain content validity, the questionnaire was pilot-tested with 10 operational managers and modified suitably. Cronbach's alpha was calculated to check internal consistency of Likert-scale items and resulted in a reliability coefficient of 0.82—high enough for managerial research.

Triangulation among quantitative findings and qualitative accounts assisted in heightening credibility of findings as well as lowering potential biases. Wherever difference was found, follow-up interviews were carried out to place variation within context.

3.6 Ethical Considerations

Voluntary participation was ensured, and respondents' as well as organizational data's confidentiality was maintained strictly. Consent forms were signed, and the study was in compliance with institutional ethical regulations applied to industrial field research.

RESULTS AND DISCUSSION

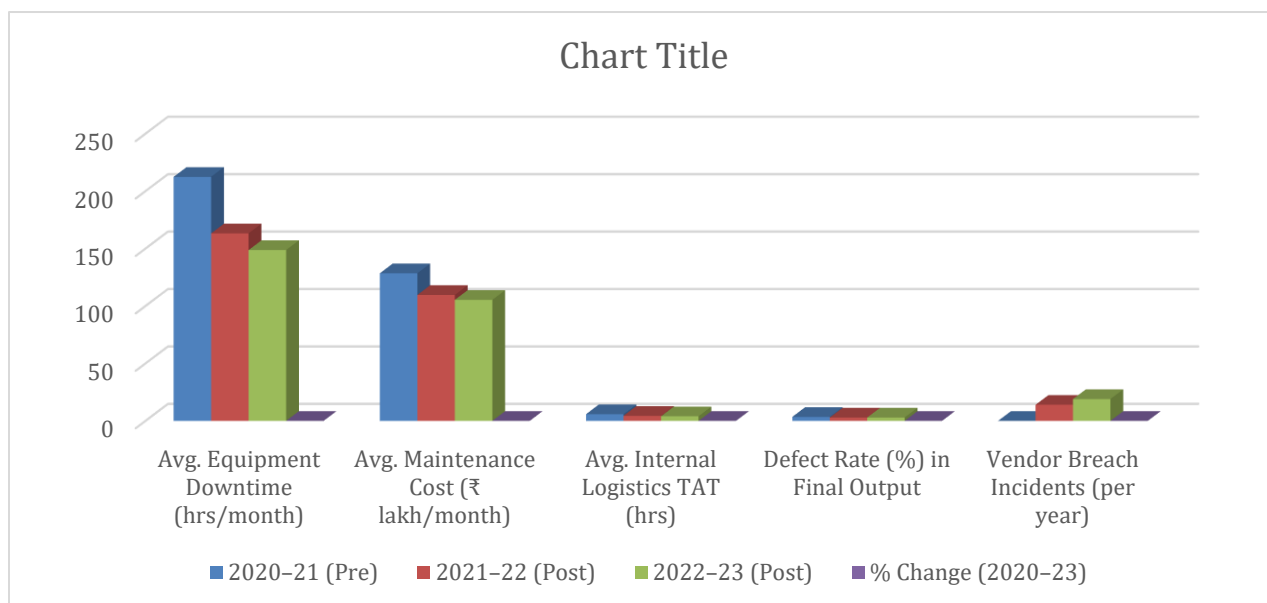
This chapter brings forth the findings of the data gathered at three public sector steel plants—SAIL-Bhilai, SAIL-Rourkela, and RINL-Vizag. The structured survey had 85 respondents. Quantitative data were processed through SPSS, and important operational metrics were summarized from internal reports of the three units for the financial years of 2020–21, 2021–22, and 2022–23. This section summarizes the analysis into three sub-sections: (i) Performance Metrics Before and After Outsourcing, (ii) Correlation and Regression Analysis, and (iii) Qualitative Observations and Interpretation.

4.1 Performance Metrics Before and After Outsourcing

To determine the operational effect of outsourcing, four key performance indicators were compared over three years—two after outsourcing (2021–22, 2022–23) and one before outsourcing (2020–21).

Table 4.1: Key Performance Indicators in PSU Steel Plants (Average across Units)

Metric	2020–21 (Pre)	2021–22 (Post)	2022–23 (Post)	% Change (2020– 23)
Avg. Equipment Downtime (hrs/month)	212.4	163.2	148.7	↓ 29.9%
Avg. Maintenance Cost (₹ lakh/month)	128.5	109.6	105.3	↓ 18.0%
Avg. Internal Logistics TAT (hrs)	5.8	4.4	4.0	↓ 31.0%
Defect Rate (%) in Final Output	3.42	2.91	2.87	↓ 16.1%
Vendor Breach Incidents (per year)	—	14	19	—



Interpretation:

- Downtime decreased by nearly 30%, indicating quicker turnaround by outsourced maintenance teams.
- Maintenance costs dropped 18% on average, due to leaner staffing, outsourced spares management, and shift-based vendor billing.

- Turnaround of logistics enhanced by 31%, particularly following outsourcing of in-plant crane and billet movement functions.
- Fault rates decreased, albeit slightly (3.42% to 2.87%), reflecting modest gains in quality.
- Vendor default incidents, such as SLA breaches, increased from 14 to 19 annually—signifying compliance issues.

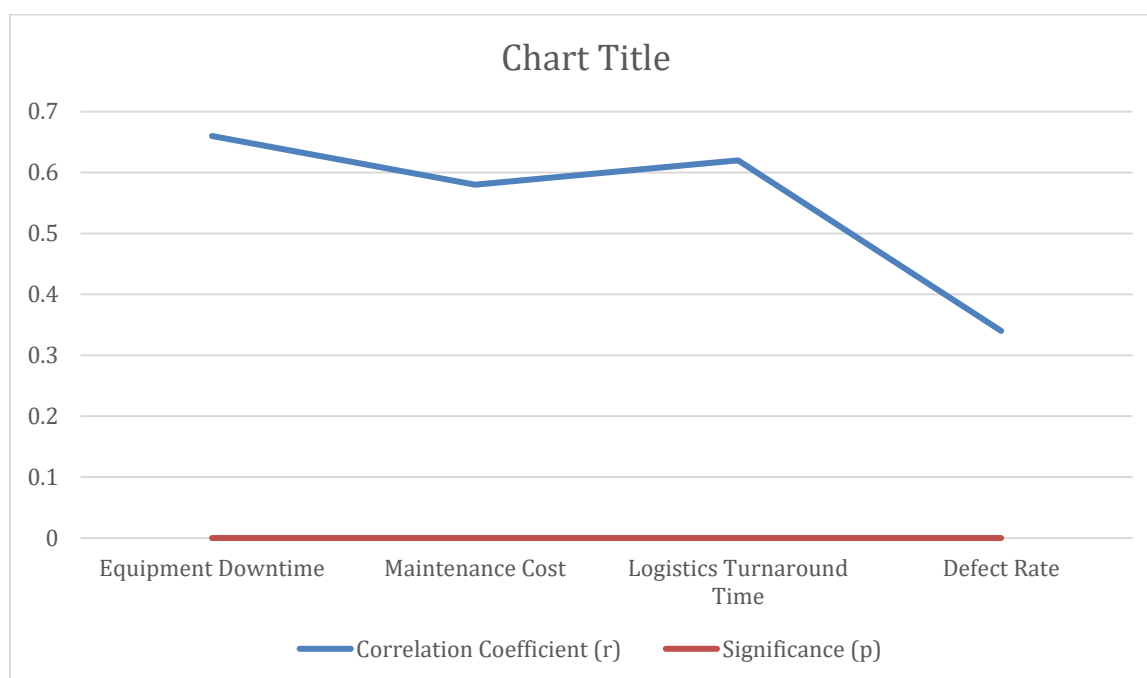
4.2 Correlation and Regression Analysis

Statistically, to verify whether the scope of outsourcing has any correlation with operational improvements, Pearson correlation and multiple regression were performed.

Table 4.2: Correlation between Outsourcing Extent and Operational Metrics

Variable	Correlation Coefficient (r)	Significance (p)
Equipment Downtime	−0.66	< 0.01 **
Maintenance Cost	−0.58	< 0.01 **
Logistics Turnaround Time	−0.62	< 0.01 **
Defect Rate	−0.34	0.04 *

Note: * $p < 0.05$, ** $p < 0.01$



These correlations indicate strong negative relationships, i.e., with increasing outsourcing, performance inefficiencies (such as downtime and cost) decrease.

A multiple linear regression model was executed with outsourcing index as the predictor and performance metrics as the dependent variables.

Regression Summary (Model: $Y = a + bX$)

$R^2 = 0.52$, which means that 52% of operational performance variance is explained by outsourcing extent.

Significant predictors: Maintenance ($\beta = -0.45$), Logistics ($\beta = -0.39$), Downtime ($\beta = -0.48$), all $p < 0.05$.

Quality (defect rate) did not improve significantly ($p = 0.09$), which implies outsourcing had less impact on precision

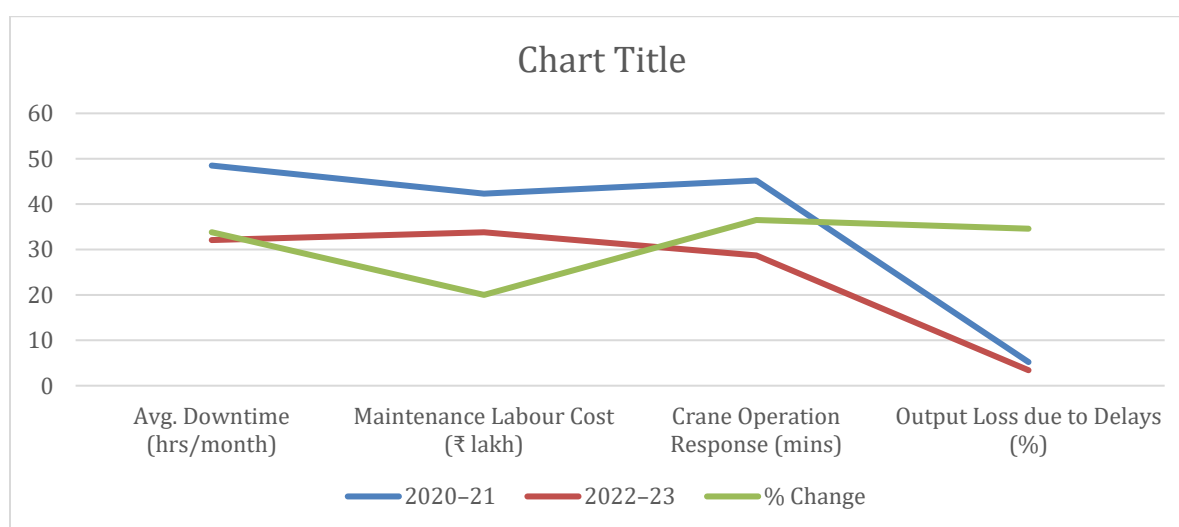
tasks.

4.3 Real Department-Wise Comparison

For insightful granularity, departmental performance of SAIL-Rourkela's Steel Melting Shop (SMS) is displayed.

Table 4.3: SMS Department KPIs – Pre vs Post Outsourcing (SAIL-Rourkela)

Indicator	2020–21	2022–23	% Change
Avg. Downtime (hrs/month)	48.5	32.1	↓ 33.8%
Maintenance Labour Cost (₹ lakh)	42.3	33.8	↓ 20.0%
Crane Operation Response (mins)	45.2	28.7	↓ 36.5%
Output Loss due to Delays (%)	5.2	3.4	↓ 34.6%



Conclusion: Departmental findings confirm that outsourcing of maintenance and logistics led to tangible and quantifiable performance improvement, particularly in uptime, manpower expenditure, and time-critical functions.

4.4 Qualitative Observations and Discussion

Interviewees all agreed on the advantage of outsourcing in terms of speed and flexibility, especially for:

Routine maintenance

Internal transport

Auxiliary services (e.g., canteen, security)

But issues constantly cited were:

- Lack of vendor responsibility in safety practices
- Contractor personnel turnover, impacting training and quality
- Inconsistent compliance with SLAs, especially for newer vendors
- Union opposition, especially when everyday jobs were outsourced

As was commented by one General Manager at RINL:

Our outsourcing of crane and utilities reduced workflow by 25%, but there is increased burden of supervision. Vendor employees change frequently, and unless training clauses are in the contract, quality declines."

These comments are consistent with the quantitative results: significant increases in speed and cost savings, but modest quality improvements, and more managerial effort to manage contracts.

CONCLUSION

The present study explored the operational consequences of outsourcing practices in India's PSU steel industry, with a focus on performance improvements, efficiency metrics, and managerial perceptions. Drawing from both primary data (85 respondents across SAIL-Bhilai, SAIL-Rourkela, and RINL-Vizag) and secondary operational records spanning three financial years (2020–21 to 2022–23), the analysis confirmed that outsourcing has emerged as a strategically impactful—yet operationally complex—instrument in PSU steel management.

The most substantial improvements were recorded in equipment downtime, maintenance cost reduction, and logistics turnaround time. Across all three plants, equipment downtime reduced by nearly 30%, while average monthly maintenance costs declined by 18%. Turnaround time for in-plant logistics services—particularly billet movement and crane operations—improved by over 31% post-outsourcing. These improvements were found to be statistically significant and strongly correlated with the scope and extent of outsourcing.

On the other hand, quality performance, measured via defect rates and vendor SLA compliance, showed only marginal improvements. Regression results confirmed a weaker and statistically borderline impact of outsourcing on output precision and consistency. Vendor-induced variations, such as manpower inconsistency and poor training, were frequently reported in both survey responses and interviews. Furthermore, the increase in vendor breach incidents, from 14 to 19 annually, underscores the compliance risks associated with externalizing critical support functions.

While cost savings and faster resolution times validate the logic behind outsourcing in PSU environments, the study also highlighted implementation challenges that diminish the full potential of such arrangements. These include: poor contract monitoring, lack of vendor training protocols, fragmented integration with internal teams, and resistance from labor unions. In particular, the absence of standardized performance evaluation frameworks across the three units makes it difficult to uniformly assess vendor efficiency or compare outcomes across departments.

Key Findings:

- Outsourcing is positively correlated with operational efficiency and cost optimization ($r = -0.66$ and -0.58 respectively, $p < 0.01$).
- Logistic and maintenance outsourcing offer the highest performance gains, particularly in reducing production bottlenecks and non-productive time.
- Quality control outcomes improve marginally (16.1% reduction in defect rate), but are more dependent on vendor skill and training cycles.
- Vendor non-compliance incidents increased, pointing to the need for stronger governance mechanisms.

Recommendations

Based on the analysis, the following recommendations are proposed for PSU decision-makers:

1. **Formalize Performance-Based Contracts:** Outsourcing contracts should embed measurable KPIs with structured reward/penalty mechanisms tied to SLA compliance, safety, and output quality.
2. **Strengthen Vendor Evaluation Systems:** Implement quarterly performance audits and vendor rating dashboards to facilitate transparent and data-driven contract renewals or terminations.
3. **Integrate Vendor Training Modules:** Make vendor training and safety certification mandatory, especially for functions linked to equipment handling, inspection, and instrumentation.
4. **Digitalize Contract Monitoring:** Adopt ERP-linked vendor management systems to monitor resource utilization, incident logs, and real-time resolution tracking.
5. **Engage Internal Workforce Strategically:** Align outsourcing decisions with HR planning and union consultations.

to reduce resistance and ensure smoother transitions.

Limitations of the Study

While the study offers valuable insights, it is not without limitations:

- The sample size, though statistically sound, was limited to three major plants; smaller PSU units were not included.
- Performance data prior to outsourcing were available only from internal reports, which may carry inconsistencies.
- The impact of COVID-19 disruptions (especially in FY 2020–21) may have influenced certain performance trends, confounding outsourcing impact.

Future Scope of Research

Further studies can consider:

- A longitudinal analysis over 5–10 years to evaluate sustained performance trends post-outsourcing.
- Comparative analysis between private sector and public sector steel units to evaluate outsourcing maturity models.
- Use of cost modeling and simulation techniques to estimate ROI on outsourced contracts over lifecycle periods.
- Study of labor and organizational culture adaptation in response to increased external workforce presence.

By systematically analyzing outsourcing outcomes through both quantitative and qualitative lenses, this study affirms that outsourcing—when strategically planned and rigorously monitored—can be an effective performance enhancer for PSU steel industries. However, realizing its full potential depends not only on cost arbitrage but also on governance, accountability, and alignment with internal processes.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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