

# KPI-based Performance Measurement Framework/Approach for Lean Implementation in Mining Industry

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**Abstract:- Mining industry forms the backbone of a nation's economy. It contributes significantly towards growth of a nation. With continuous increase in demand for mineral resources, the mining industry is expected to witness a decent growth in the coming years. This growth will bring many more challenges for the industry. In an industry where safety, efficiency and productivity are crucial to profitability, even small incremental changes in key parameters (KPIs) using new system / process & framework can make a big impact. Lean is one of the most important process improvement initiatives taken up by many mining organizations. Many of the initiatives have failed because of multiple reason. One of the principle causes of failure for many process improvement initiative is the inability of the organizations to assess, evaluate and present significant metrics or Key Performance Indicator (KPIs). KPI-based frameworks play very important role in monitoring & tracking of businesses and process improvement initiatives. This paper evaluates the importance of KPI-based measurement framework for lean implementation in mining.**

**Keywords:-** Lean, KPI, Metrics, Productivity, Safety.

## I. INTRODUCTION

India produces nearly 95 minerals, including fuel, metallic, non-metallic, and minor minerals, which serve as raw materials to various industries. As an important economic segment, the mining sector facilitates economic growth. The mining industry has been a significant contributor to the Indian economy.<sup>1</sup>

The mining industry is one of the core industries in India. Mining industry provides basic raw materials to many major industries such as power, steel, cement, capital goods and petroleum as well as the service sector which requires computing gadgets made of quartz, lithium, lead, zinc, silver, etc. The metals and mining sector is critical for economic growth in a developing country like India. The sectoral share of mining and quarrying in Gross Value Added (GVA) is estimated to be around 2.2% in FY22. India being well-endowed in minerals, the sector still has a huge opportunity for the development as the country needs to explore its untapped potential. The mining sector in India has huge growth potential. The growth in mining also has a strong correlation with the growth in the overall manufacturing sector. Mining activity is expected to grow in the range of 6-7% over the next five years.<sup>2</sup>

The future growth will bring more challenges to mining industry where safety, productivity, cost and environment are the key concerns. There is an urgent need for an innovative process improvement framework which can help the industry in facing the future challenges. Lean is one of the most widely used framework in the mining and other allied industries. Lean has helped mining industry in achieving some key milestones and ensured sizable & qualitative benefits. However, there is a lack of structured measurement framework to assess the benefits of lean, which are linked to organizational goals & objectives. As with any other industry mining also requires a metrics measurement framework for monitoring & tracking and evaluation of lean implementation. KPI-based system is one of the most widely used measurement framework and helped immensely to the organizations. This paper explores the possibility of using KPI-based measurement framework for lean implementation in Mining industry.

## II. KPI AND ITS USAGE

KPI is an acronym for key performance indicator. KPIs measure performance and progress toward a specific goal over time. They help keep the primary goals of a business at the forefront. Organizations operate in environments defined by their key stakeholders and measured by KPIs defined by the management keeping in goals & objectives in mind. Businesses use KPIs to figure out whether they are reaching their top goals. These KPIs usually track the overall health and performance of the organization. Departments use KPIs to show the value of their efforts to the business. These performance indicators help teams work toward set outcomes and solve issues that stand in the way of those goals. KPIs can also help track the effectiveness of: Projects, Processes, Campaigns, Strategic changes. A KPI is also useful for cross-departmental collaboration, as it makes it simple to see what other teams are working toward at a glance. KPIs tell companies if their hunches are right and if what they are doing is working. A KPI is more than a number. It's a message, a story that quickly shows the team whether they are moving toward the goals they have set together. Key performance indicators can help, keep high-level goals top of mind, convert abstract ideas into manageable targets. Strong KPIs can help the business save time, get critical insights, guide management, and keep the business on a long-term path of growth. One of the important type of KPIs is Process KPI. Process KPIs track how well a new process is working and help target potential changes. Process KPIs show whether the improvement initiative is hitting its targets. They are often called process metrics as they tell the team, how the company is doing to meet a process improvement objective set by the management. With every business, growth is the goal. KPIs

help company track the progress and scale progressively to grow in whichever way that matters to the organization. Powerful KPI creation and tracking can give business a strategic advantage. They can help company to prioritize, focus, and scale processes toward the set of goals.<sup>3</sup>

Key Performance Indicators (KPI) are defined as a representation of a set of measures focusing on those aspects of organizational performance that are the most critical for the current and future success of the organization. KPI are one tool used to convey the relative health of the business or one portion of that business and is a specific metric (a quantitative, periodic measurement of one or more processes), chosen from all of the collected or possible metrics within a business in such a manner as to convey the most amount of information in a single measurement – the “key” measurement. KPI help the enterprise to define and measure business progress towards achieving business goals. Business goals detail what the business is striving to achieve for and business objectives quantify the business goals by means of a performance measure and a metric. When the metric associated with the objectives are tracked for understanding the progress, it becomes a Performance Indicator and performance indicators which are important to report at regular intervals and indicate ‘key’ business information qualifies as Key Performance Indicators. So, KPI indicates us whether the business objectives are getting fulfilled and in turn the business goals are getting accomplished.<sup>4</sup>

KPI can be classified generically into two broad categories: Strategic KPI and Operational KPI on basis of the associated management level (top/middle/line managers) and time interval (long term/short term)

### III. IMPORTANCE OF KPIS BASED FRAMEWORK IN BUSINESS ORGANIZATIONS AND ITS CYCLE

Monitoring business objectives has become a challenge for enterprises. Business Strategies and the underlying Business Objectives has to be tracked and monitored for performance so that business stakeholders can make informed decisions. The challenge is to create a framework to identify, define, associate and track Key Performance Indicators (KPI) for effective monitoring of strategy to process linkage. Monitoring strategy execution is one of the critical phases in defining Enterprise Business Architecture and KPI framework is an approach to address the phase effectively.<sup>4</sup>

KPI can be ‘leading’ indicators which directly impacts performance or ‘lagging’ indicators which are mostly financial indicators that are industry standards and are lagging as they represent the result of the action that is already taken. The general characteristics of KPI shall include: reflect organization vision and strategy, easy to interpret and actionable, decided by management and tied to roles, processes, system capabilities, products/services and programs/initiatives of the enterprise. Measurement mechanisms are essential for feedback and evaluation of organization’s vision and strategy success. KPI definition and measurement as a mechanism can help communicate strategy to everyone in the organization and bind them for complying with objectives. Strategy execution when measured and

monitored using a KPI framework shall lead to process improvement as well organization effectiveness.<sup>4</sup>

KPI Cycle includes four phase approach: identify, define, associate and track for effective management.<sup>4</sup>

The key phases are-

- The initial phase is to identify exactly what to measure – identify goals through goal modeling techniques. define related performance measures and objectives.
- The define phase utilizes the KPI Classification framework and define characteristics of the KPI including the metrics, target range for the metrics and benchmark levels, if any.
- In the associate phase, KPI are associated to processes, business participants (organization, department, role and system), business offerings (products/services) and programs/initiatives that affect objectives and goals.
- In the final phase, one track KPI through data collection, data interpretation, reporting as well performing a trend analysis

Mining organizations have implemented new process improvement frameworks like Lean and reaped significant benefits. However, there is a lack of a structured measurement framework to measure the effectiveness of lean implementation in mining departments and companies.

KPI-based approach & cycle can be used for measurement of lean implementation in mining industry. It will help the management in continuous monitoring of the effectiveness of lean processes in the organization. Such a KPI framework shall enhance value for business wherein one can monitor and track strategy to process linkage and make informed decisions. The KPI-based framework also act as a much-required feedback and evaluation mechanism for mining enterprises as it advocates a structured approach for tracking and reporting KPI.<sup>4</sup>

### IV. LEAN IMPLEMENTATION IN MINING

Lean Manufacturing in mining is the production of mineral using less of everything compared to traditional mass production: less waste, human effort, manufacturing space, investment in tools, inventory, and engineering time to develop a new product.<sup>6</sup>

The adoption of Lean concepts beyond the manufacturing sector has been increasing recently. In this line, its scope has been expanded to the mining industry under the realisation of the need for productivity improvements and a leverage for efficient operations. As per the available research, Lean manufacturing has been greatly appraised and adopted in a wide range of different businesses and industries. With its scope not being limited to the automotive industry only and the potential to be contextualised in other sectors, it can greatly benefit the mining sector. Although Lean adaptation in the mining industry is recent, its positive impact has been observed in the form of production capacity, workflow improvements, time utilisation, reducing production costs, overall safety improvements, resource utilisation, cycle completion times, employee availability, process capability index and shipping time improvements, cost savings etc. Despite the fact that the mining industry has

benefited from Lean principles, the industry still lacks a coherent and general framework to initiate Lean in this sector. Also, there are challenges in getting the clear status and benefits of lean implementation in mining. <sup>5</sup>

There are other challenges like measuring the effectiveness of the implementation and ensuring that the progress reports are provided to management using some key metrics / KPIs which are linked to organizational goals & objectives.

To address the above challenges of implementing lean in mining and making it more successful & objective, KPI-based measurement framework can be used.

### V. THE PROPOSED KPI-BASED PERFORMANCE MEASUREMENT FRAMEWORK FOR LEAN IMPLEMENTATION IN MINING

The KPI-based measurement framework can be developed in the following steps <sup>7</sup>:

- Develop and establish an indicator / KPI to determine the potential benefits of lean techniques in mining industry.
- Develop a framework of appropriate performance measurement model that is applicable to the lean practices in mining.
- Apply the indicator and the framework of performance measurement model developed and to monitor the performance improvements of specific companies as a result of applications of lean practices.

The proposed framework can be based on, the following categories of KPIs:

Type of KPIs	For: Level in the Organization
Org Level KPIs	For Top Management
Department / Managerial Level KPIs	For Middle Level Management
Operational KPIs	For Operational Managers

Table 1: Categories KPIs



Fig. 1: KPIs at different levels of the Organization

The proposed KPI-based measurement system can be used to:

- Monitor and record actual performance of lean implementation in mining / departments.
- Identify and close the gap between expected performance and actual performance.
- Identify performance improvement opportunities in the mining departments and company
- Provide information in making a strategic decision to the management of the mining company
- Enable internal communication across processes and stakeholders involved in lean implementation
- Encourage continuous improvement on the existing lean processes / system followed in the mining organization

The proposed measurement framework & KPIs can be customized as per the organizational requirements and based on the level of lean's awareness & understanding among the employees. The framework can be further refined and integrated with other measurement systems like Balanced Score Card (BSC), Performance Measurement Model (PMM) etc.

## VI. SUGGESTIONS AND CONCLUSION

- Mining industry needs an innovate process framework like Lean for improvements
- Lean can be used very effectively if duly supported by a structured measurement framework which is linked to Org level objectives & goals
- KPI-based framework for measurement of effectiveness of Lean implementation in mining will provide insights to the management of the company about the status of Key Metrics related to Mining operations & Lean practices in the organization

As a next step, more innovative framework shall be integrated with the proposed KPI-based measurement system, which will provide a clear direction to the lean practitioners and the management.

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