IMPLEMENTATION ENGINEERS
Dynamic Solutions in Action

Operational Excellence in Mining

Iron Ore Mining and Processing

Situation

Our client, the largest producer of iron ore pellets in North America, sought to partner with Implementation Engineers to determine how they could increase throughput and reduce cost per ton of their the largest mining operation. This operation, consisting of two separate pit mines and plants, had been struggling for the past several years to meet financial and production expectations.

The management staff tracked numerous performance measures, but the site did not have an integrated system to Define, Measure, Analyze, Improve and Control (DMAIC) the fundamental forces at work in their business. It was evident that the lack of visibility into their day-to-day processes had contributed to the past and current operational performance problems. These problems culminated in a $65 million shortfall against the previous year's production commitments.

Approach

At the conclusion of the eight week Long Term Planning phase, Implementation Engineers provided our client with an assessment of the leadership and organizational culture climate. This assessment illustrated the barriers in communication, lack of accountability and performance feedback, and the underlying issues for the poor performance.

Secondly, a Value Stream Analysis of both mine operations was developed, including a business case in excess of $250 million dollars in opportunity over the course of the next five years (see Figure 1: Value Stream Analysis). This included a project list of opportunities by each functional area from drilling, blasting, hauling, crushing, concentrating, balling, pelletizing, stockpiling, on through shipping to the customer.

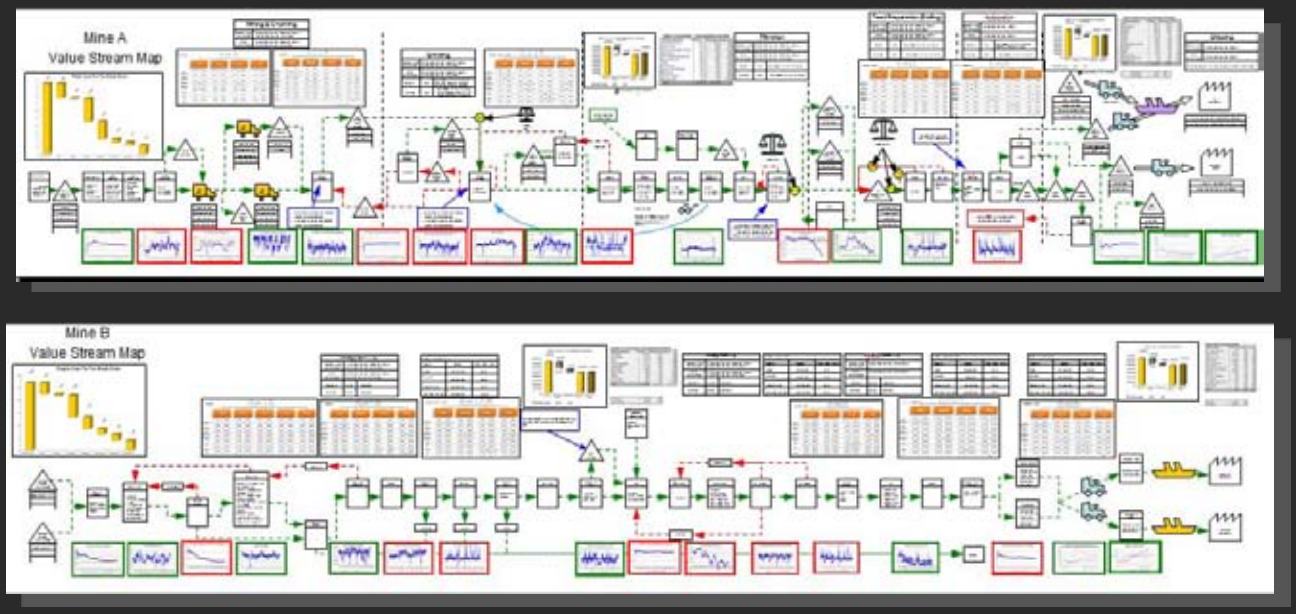


Figure 1: Value Stream Analysis: Cost, Quality, Throughput & On-time Delivery

Third, preliminary Performance Analytix℠ process was utilized to illustrate the types of tools required by managers and supervisors to monitor and analyze the operation on a real time basis. Our client then required assistance in implementing the Improvement Operating System to drive the execution of continuous improvement efforts to achieve the benefit opportunity. This involved development of Performance Analytix℠, establishment of a manager operating review, a continuous improvement Steering Team, and a tollgate process to mentor and review on-going Six Sigma projects.

In their annual report, it was cited that three issues contributed to missing the operating plan and earnings estimates: stripping ratio, fuel costs, and unscheduled maintenance downtime.

Performance Analytix℠

In the next phase of implementation, which was a further refinement using Performance Analytix℠, Implementation Engineers took inputs from the Value Stream Analysis and worked closely with the management team to develop the vital few Key Performance Indicators (KPI's), and then build a Digital Cockpit to reveal the gaps between performance and the operating plan. These tools provided insight to the trends and root causes of underperformance on a real time basis – providing quantum advancement in their managerial capabilities.

At the onset of Performance Analytix℠ Phase, the two operations at this location had slipped behind their operating plan right out of the gate. The stripping ratio of the first operation continued to be three times higher than the operating plan. In Plant A, it was discovered that due to accounting procedures, stripping costs were also hidden in "Labor Usage" and "Plant Spending" making it approximately 80% of the root cause of Cost per Ton variance (see Figure 2). The second operation had a four week unscheduled downtime event in March in the pellet plant that put production behind a month at the end of the first quarter (see Figure 3). The run rate at the end of the first quarter was worse than the previous year, so the joint team had to move rapidly to implement the new processes to bring the operations under control.

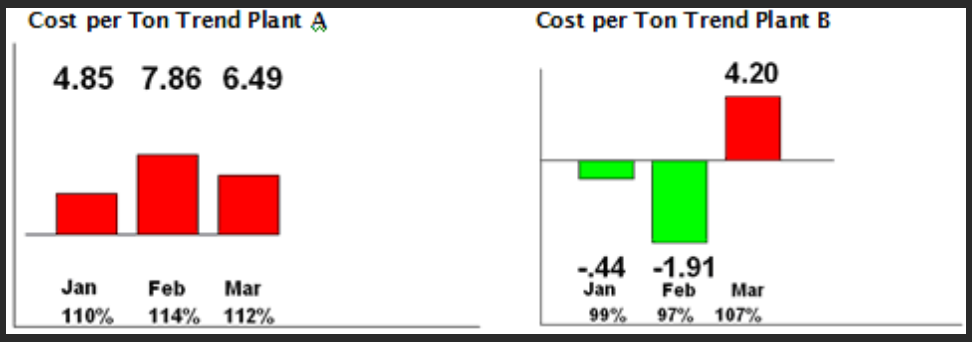


Figure 2: Cost Per Ton Variance to Plan

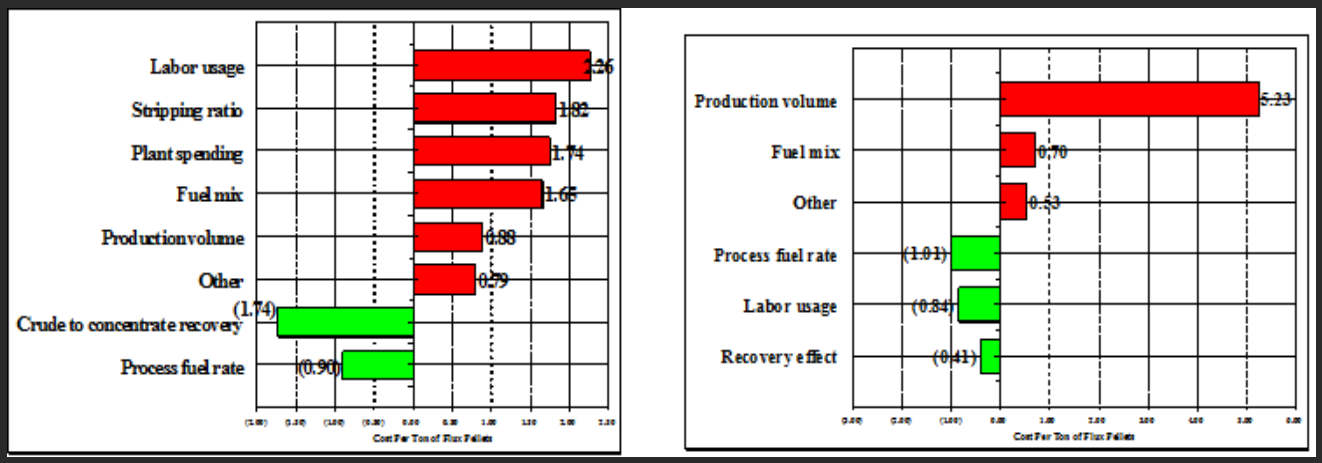


Figure 3: Cost Per Ton Variance By Contribution Factor (Plant A Left, Plant B Right)

Implementation Engineers led the effort to:

- Determine the vital few Key Performance Indicators (KPI) or "X's" that drive the business "Y's,"
- Develop a score card that summarizes the overall plant performance in seven categories (Safety, Operations, Maintenance, Cost, Product Quality, Environment, and Human Resources),
- Create a digital cockpit with time series KPI graphs by each category (see Figure 4), and
- Build graphical analysis tools that explain variances to the operating plan and lost production (see Figure 5). In addition, three critical managerial processes were implemented as the engine to drive performance improvement.

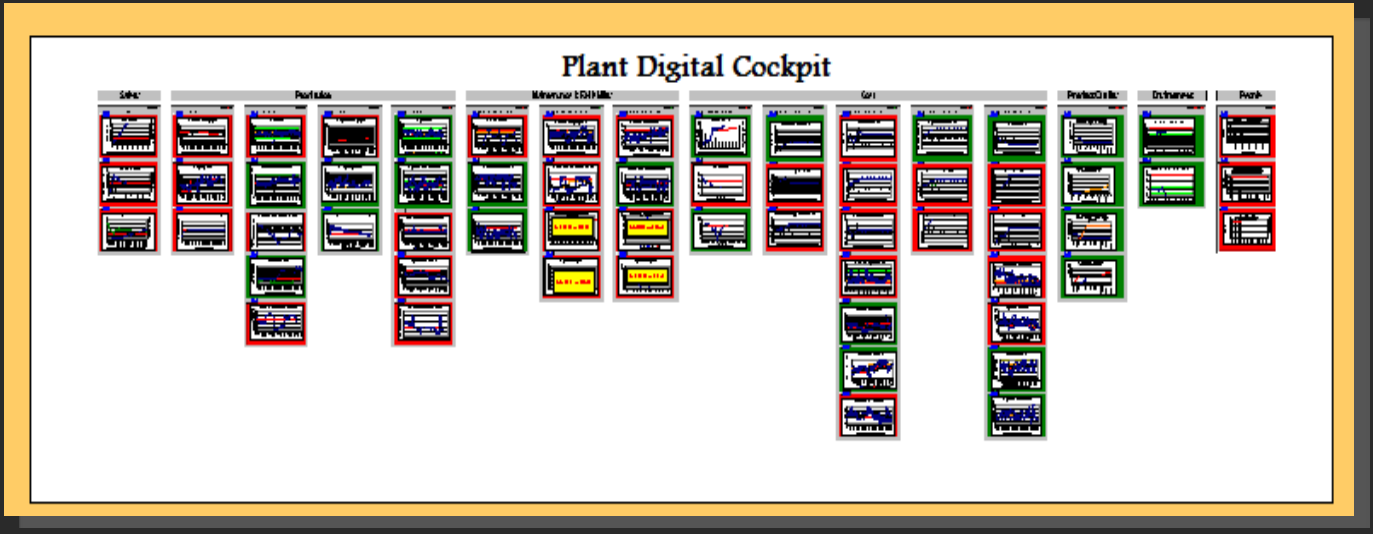


Figure 4: Digital Cockpit (Safety, Production, Cost, Product Quality, Environment, HR)

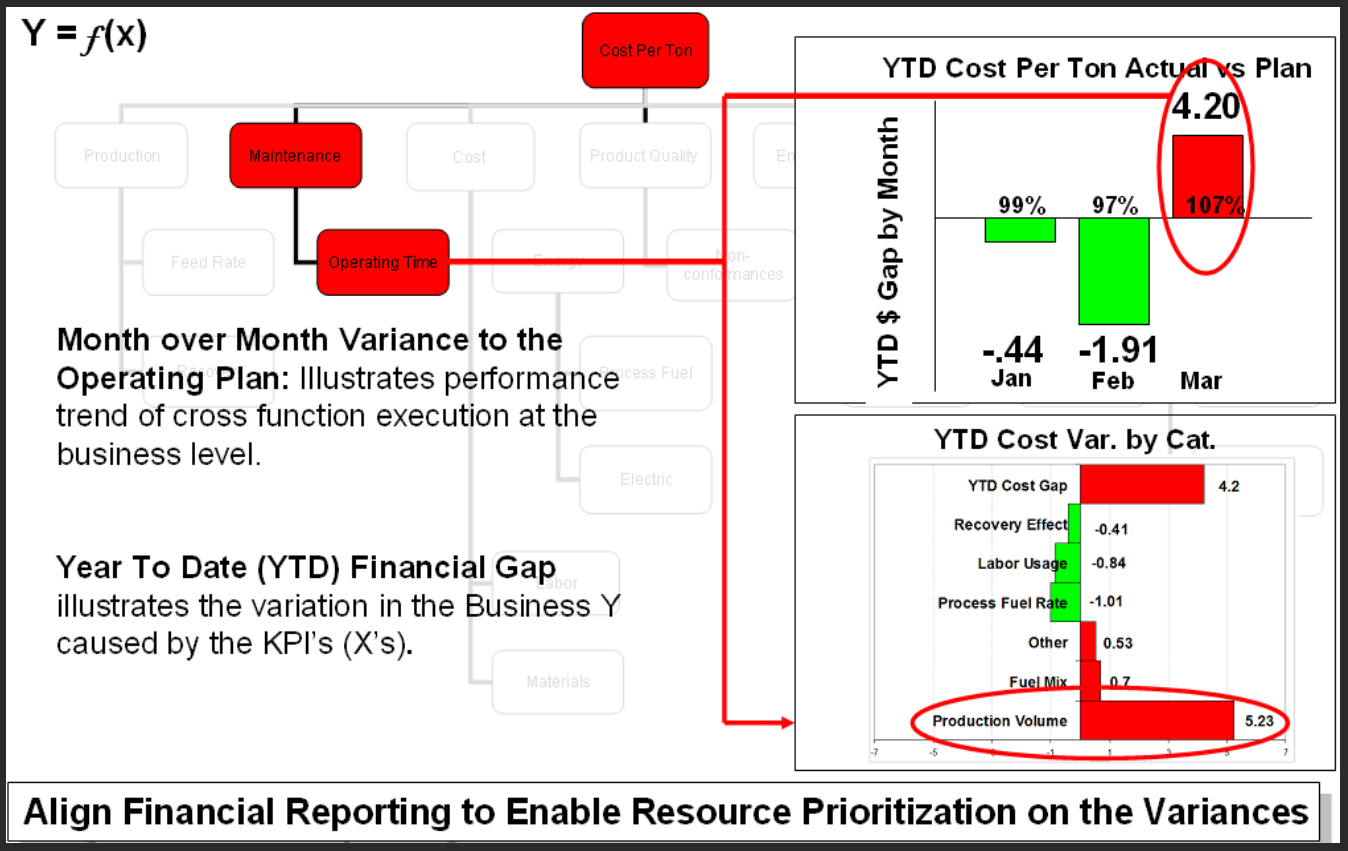


Figure 5: Example of Graphical Analysis Tools to Explain Variances to Plan

Improvement Operating System (see Figure 6)

- **Improvement Operating Review Process**

  Implementation Engineers mentored the management team on how to analyze KPI data, create contingency and recovery plans, and report performance in a bi-weekly Operating Meeting. The objective being to identify the time bound action plans that will drive the most significant gains and identify the resources needed to achieve the goals.

- **Steering Committee**

  Consisting of the core plant leadership team, the Committee reviews business needs from the results of the Management Operating Review and project ideas brought forth by the Department Champions, then they rationalize the ideas, prioritize them, and align the resources with the activities and projects that will deliver the most value. Implementation Engineers developed the roles and responsibilities, the process and structure to quantify, rationalize, and prioritize the business needs for the Steering Committee to act upon.

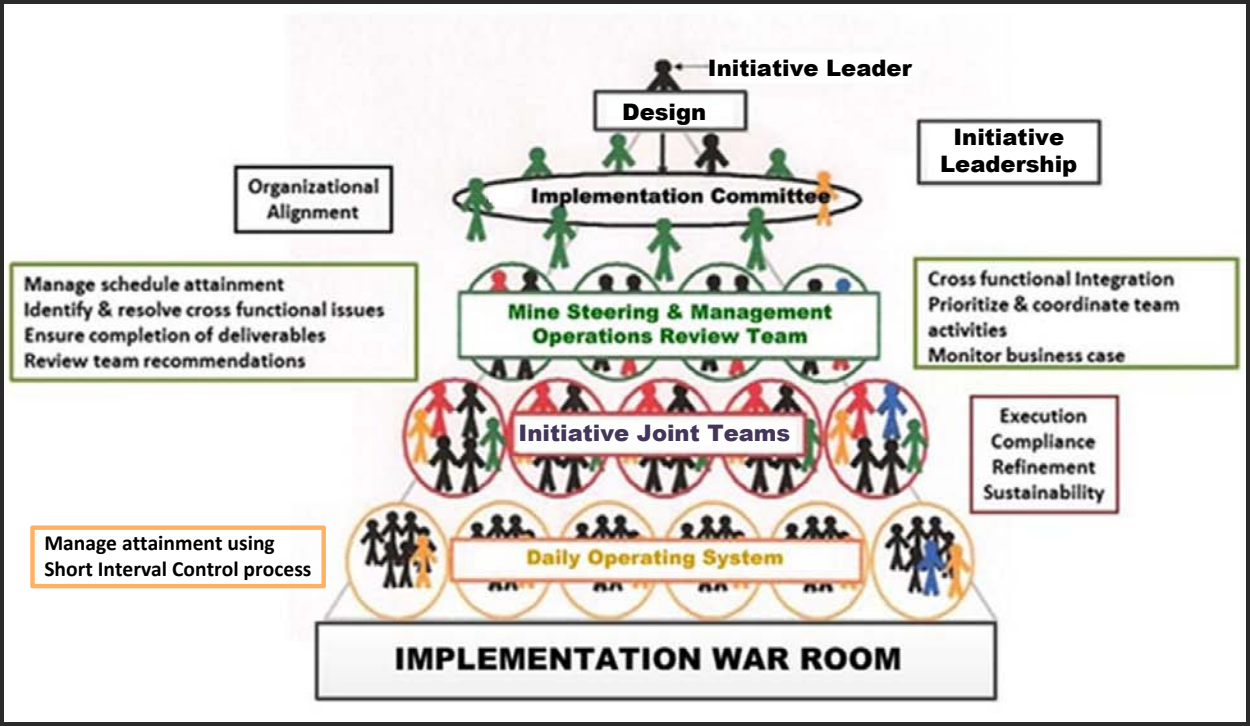


Figure 6: Improvement Operating System

- **Continuous Improvement Project Tollgate Process**

  Implementation Engineers facilitated the deployment of the continuous improvement team implementing a comprehensive structured road map, project financial review, and project tollgate process, whereby the project leader methodology is reviewed, scrutinized, and revised to accelerate the results and ensure that the net benefit is real.

Results

In April, three months into the new Improvement Operating System, the plant began to turn the corner on several of the seven KPI areas. Production recovered from a $7.5 million deficit and trended to be on track for the year, energy spending improved by $500,000 per month, and safety accidents improved by 20%. The clear objectives, cross business focus, improved communication on results variance, and actions improved esprit de corps rallied a previously disjointed team around common goals. The confidence of the managers increased

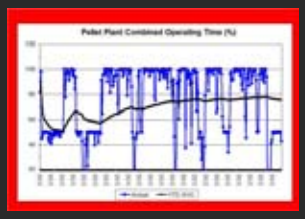
with each Management Operating Review as did their eagerness to share their performance improvements in their areas.

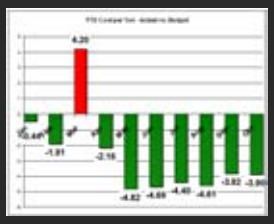
Because of the rapid improvement in performance by the end of the second quarter, the management team received performance bonuses – the first time in six years. This created a windfall of support in the new way of managing the operation. Admittedly, there was a great deal of resistance in the first three months of the process. Several managers were outwardly opposed to changing how things were run. It was through persistence, coaching, strong support from top management, and allowing the early adopters to take the lead and received positive feedback of wins that enabled the conversion of the initial skeptics – performance bonuses help as well.

At the beginning of the Third Quarter, the General Manager presented the new Improvement Operating System to the corporate Business Improvement leadership, and it was immediately rolled out to the other five North American mining operations to organize and standardize the company's operating system. At the end of the first calendar year, the management team sustained an annualized cost per ton improvements at Plant A and Plant B (see below).

Plant A

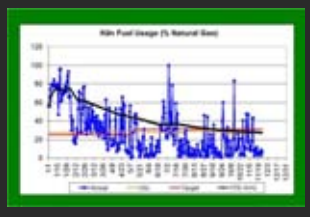
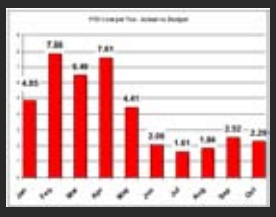
Improvement in Feed Rate by better managing the ore blend and operating time due to a 5S program implementation in Maintenance, improved cost absorption and got Plant A on target exceeding budget by $28 million.



Plant B

Improvement in Stripping Ratio by revising the mine plan and Kiln Fuel by converting to western coal reduced cost variance by $22M by year end.

In the 4th Quarter, Implementation Engineers lead the second annual cycle of Long-Term Implementation Planning by identifying additional savings opportunity in energy in the grinding lines, and also the next evolution of the Improvement Operating System implementing the Daily Operating System.

In the company's Annual Report, it was cited that the cost per ton of the operation was expected to have increased 12%, but due to cost reduction efforts the cost per ton in North American operations only went up 1%. In addition, because the high demand for steel and general inflation, the price of iron ore went up 10% creating a huge improvement in the company's bottom line. enCompass℠ continues to positively impact their financial performance - it has changed the culture and become the way this mining operation does business.