As the price of crude oil continues to remain high, refiners across the globe are increasingly focused on initiatives to protect their margins. Flexibility in changing the processes to get aligned to the dynamic business scenario is being aimed by the Refiners. Refinery executives are keenly examining on probable effective ways of managing & motivation their people, managing their business process and changing technology accordingly, to get tune their operations with dynamic supply chain in the business. This paper emphasizes on some key messages important to the refinery business, draws attention to interrelated processes in refineries and focuses on a Business Process Improvement case study. This paper also describes the approach and methodology, project planning, templates which accelerate the project, the solutions and benefits. This paper concludes with important measures that are taken to address the challenges of this business and critical success factors that must be in place to move to Operation Excellence. One aspect that is highlighted is performance management.
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Introduction

As the price of crude oil continues to remain high, North American refineries are increasingly focused on initiatives to protect their margins. They would like to be more flexible, more responsive and better aligned with their dynamic business and supply chain needs. So to manage refining operations in tune with business and supply chain requirements, refinery executives are re-examining the management of their people, their business processes, technology and projects. They are focusing on streamlining business processes, motivating their workforce, integrating their suite of applications for better information flow and increasing visibility into performance.

In this article, we shall be emphasizing some key messages important to the refining business, draw attention to interrelated processes in refineries and take you through a Business Process Improvement case study. We will share the approach and methodology, project planning, the templates which accelerate the project, the solutions and benefits. We will conclude stressing measures that are taken to address the challenges of this business and critical success factors that must be in place to move to Operation Excellence. One aspect that we will repeatedly highlight is performance management.

Oil & Gas consultants in Tata Consultancy Services (TCS) have successfully steered many such consulting assignments in various refineries and geographies. One of such assignments carried out by our consultants is at the Port Reading, Refinery of Hess Corporation located in New Jersey, USA.

TCS’ Business Improvement Program at Hess Corporation

TCS recently implemented a Business Improvement Plan for the refinery at Hess Corporation. Hess has a 65000 bpd refinery at Port Reading in New Jersey and has 50% interest in the St. Croix refinery which has a capacity of 500, 000 bpd. The refinery serves the needs of Hess retail outlets, as well as industrial and residential customers, in the major metropolitan area of New Jersey. With close
proximity to the New York market, the facility is uniquely positioned to respond to the sometimes rapid changes in the gasoline market.

The facility produces some of the cleanest burning gasoline available for the environmentally sensitive Northeast markets. The emissions per barrel produced are among the lowest in the United States.

The business needs of the refinery in today’s challenging environment are:

- Streamlined operations with minimal disruptions and less deviation from plan
- Better planning and scheduling
- Refinery operations insulated from logistic inefficiencies resulting from lightering at New York harbor, barge availability and movement, narrow water way, draft constraints, berth constraints, piping constraints, third party usage of terminal’s berths and tanks
- Identify gaps, determine degree of impact and close the gaps
- Performance management and accountability with clearly defined workflows, processes, roles and responsibilities
- Performance Excellence – streamline efforts in operations and maintenance and lay the foundation for continuous improvement

With the objective of reviewing, graphically depicting and analyzing the processes and to identify opportunities for efficiency and effectiveness improvement, the refinery management has outlined the following scope of work:

- Document the current processes and methodologies and identify opportunities to improve the supply chain processes between the Refinery and Supply, and Trading
- Perform a Gap Analysis and suggest improvements for the identified gaps after mapping the To-Be processes
- Define KPI’s for the refinery and provide a blue print for implementation of a Performance Management system

**Approach and Methodology**

The overall assignment was divided into multiple stages each with a corresponding key decision point. The stages were as follows:

- Current Processes Mapping
- Waste Identification
- New Processes Mapping
- Define KPI’s
- Best use of available applications at the refinery
• Provide a blue print for building a Performance Management System

The tasks performed during the entire project included the following:

• Project Startup–Project team introductions and orientation; establishment of communications channels; detailed planning of schedules and resource requirements, finalization of deliverable definitions
• Process Targeting–Identification of the sub-processes included in the scope of the processes in scope
• Near-term Improvement (including Quick Wins)–Identification of potential improvements and alternatives to realize those improvements
• Current State (Gap) Analysis–Receipt of files, documents, and data related to existing processes in scope, interviews with key Hess personnel familiar with the processes, documentation of the current state
• Visioning–Definition of potential alternatives to the current state processes
• Improvement Portfolio and Implementation Strategy–High level list of improvements to processes and description of approaches to implement changes to realize the improved processes
• New Process Definition–Documentation describing the proposed improved processes
• Definition of Key Performance Indicators–Map the KPI’s both for Business Activity Monitoring and Performance Monitoring to the Balanced Score Card

**Tools Used**

IDEF0, Process Flow Diagrams and Lean Six Sigma were the tools used for carrying out this exercise.

Integration Definition or Function Modeling (IDEF) is a program developed by the US Air Force to define existing or new systems and is directed towards increasing manufacturing productivity. There are a total of 16 IDEF methods developed for modeling. IDEF0 is used for modeling the decisions, actions and activities of an organization or system. It identifies what functions are performed, what is needed to perform those functions, what the current system does right and what the current system does wrong.

A template of IDEF0 Process Map is shown below:
Process Flow Diagrams (PFD) have been used to document the activities of the sub-processes, the reason and frequency of the activities, the swim lanes between functions and how the activity is performed.

Lean Six Sigma methodology is used for identifying the wastes, such as poor cycle time, non-value added activities, and costs in the processes.

This methodology is depicted in the figure below:
Findings and Recommendations

From the robust methodology and utilization of the tools, moderate to significant gaps between work processes and business requirements that inhibit operational excellence were identified.

The following Impact – Gap chart shows the gaps that some key processes have from the requirement of the business and the corresponding degree of impact.
From the Gaps – Impact Analysis the gap which impacts the refinery process improvement significantly is found to be Performance Management. At Hess, it is observed that there is a substantial scope for improving the process failure monitoring mechanism. TCS, has done a detailed analysis on the existing Performance Management system and suggested appropriate changes to the system.

**Performance Management**

Performance management in a refinery is a key element. There is a need to define metrics which will track operating efficiency, capital expenditure and growth in the supply chain processes. The identification of key measures and the method for computing them is vital in building a roadmap for implementation of meticulous Performance management system.

Refinery Performance Management Roadmap is illustrated below:
The process aligning the objectives with the balanced scorecard will enable a Refinery to translate strategy into action through defined strategic objectives and key performance measures. These objectives and measures provide a view of the refinery’s performance from five perspectives:

- **Financial:** The strategy for refinery growth and profitability through sustained growth, production optimization and management of OPEX.
- **Customer:** Achieve customer satisfaction and collaboration to create growth opportunities.
- **Internal processes:** Asset optimization through improved project management, improved reliability and operations excellence.
- **EHS:** Through improved process safety management, compliance with regulatory requirements and safety excellence.
- **People:** Create a motivated and prepared workforce with improvement of employee skills, creating organizational depth and becoming a strategy focused organization.

In addition to business performance measurement, the refinery also required business activity monitoring for provision of near real-time access to critical operational process indicators. This will deliver alerts to increase efficiency of
business processes and monitor shifts of priorities and conflicting goals between the process units and various refinery departments.

The goal of Performance Measurement is to link the refinery’s operational activities with the business strategy. Defining the metrics to use is a key aspect. If these are well chosen, they become appropriate measures of success of the refinery's strategic objectives.

Alignment with Balanced Scorecard (BSC) of Hess Port Reading Refinery

The objective was to make sure that the goals, metrics and data collection are defined accurately so that areas of the business that are necessary and appropriate to what the refinery is trying to accomplish are measured. The goal was to utilize dashboards for display and analysis of KPIs to show the health of each area of the refinery’s operations, gain new insight into the business processes and improve efficiency and performance.

Revision of Targets

In the best interest of refiners, it is suggested that the targets be re-visited after a year to revise the targets based on the performance during the year. There will also be a need to add, subtract, and modify some of the KPIs during revision.

Frequency of Monitoring

The goal is to make sure that individuals are not overloaded with information, but that relevant and sufficient KPIs are delivered on time so that action can quickly take place where necessary.

Automation of the Process Exploiting Functionalities of Existing Applications

The next step is to automate the process of data collection, aggregate and present these for Performance Management. There are several applications available which can assist in this endeavor. A judicious choice will have to be made taking into account the proposed IT architecture and how the application exploits the functionalities of ERP, Process Historians, Maintenance Planning and Management tools, Oil accounting tools, and presentation layers to the maximum extent.
External Review to Ensure Sustainability

It is also suggested that during the initial stages for preparation of the performance management KPI dashboard, external resources could be utilized to minimize time spent by process owners on putting together the dashboard and score card.

KPI Dashboard Hierarchy

To facilitate business activity monitoring and performance monitoring, TCS proposed to have a three-tier hierarchy in the KPI Dashboard with the potential for viewing trends and graphs.

The Period Performance, which will be visible in all the three tiers of the dashboard at different levels of break up, will also be supported by the Real time Key Process Indicators at the bottom tier. Along with real time indicators, the average or min-max of the Key Process Indicators is also proposed. This will assist every level to take calculated decisions on improving the performance of refinery operations.

The three tiers of KPI's are Top Tier, Middle Tier and Bottom Tier.

Top Tier Dashboard

This tier would give the overall refinery performance for the Refinery Head and the top management of the refinery. This tier would, at a glance, give the entire picture of the refinery with regard to the performance of the refinery and contribute towards taking firm and information driven decisions in improving the operations of the refinery.

The KPI’s mentioned in this dashboard are aligned to the Balanced Score Card objectives and are segregated under various focus areas – Finance, Customer, Internal Process (comprising Asset Optimization and Environment Health & Safety), and Learning & Growth. This tier is broken down to a summary level at Middle Tier.
Middle Tier Dashboard

This tier is the break down structure of the Top Tier by one level. For each line item of the Top Tier, there is a break up for contributions from each unit or department of the refinery. This tier also has the accountability attached to each and every line item. The high level reasons for KPI deviations could also be available against each line item for each unit or department.

Figure 5: Top tier dashboard template

Figure 6: Middle tier dashboard template
Bottom Tier Dashboard

This tier has a detailed performance of every unit. These key performance and process indicators, at this level for every unit, help the Unit Heads, Supervisors, Shift Engineers, Field Engineer and Operators take appropriate decisions by viewing the performance of the unit.

The Unit Head will also be able to get assistance on deciding the root cause of operational deficiency at this level. This information will be useful in assigning reasons for the failure of operations.

Various Key Process Indicators of the respective units will also be shown along with the period performance under this analysis tier of the KPI dashboard.

![FCC - Performance Indicators](image)

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<thead>
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<th>Indicator</th>
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![FCC - Process Indicators](image)

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Figure 7: Bottom tier dashboard template

Conclusion

In the Hess refinery, there is a strong desire for improvement in the functions involved in the supply chain management of feedstocks, blendstocks, and petroleum products. Such leadership is critical to ensure the start, support and sustenance of such projects.
Refinery employees need fit-for-purpose tools to help them focus on what is most important in achieving business objectives and to create real value for customers, stakeholders and themselves. They also need to know what is expected out of them, be trained and motivated to perform their tasks, and understand and agree to how their efforts will be measured.

TCS’ approach and methodology relied on the rigor of Lean Six Sigma - the benefits of lean management with its drive towards reducing cost and inefficiencies coupled with Six Sigma focus on reducing process variation leads to considerable improvement. From the overall consulting assignment it is evident that performance management aligned with balanced scorecard is a key element in process improvement of the refineries. We defined metrics aligned with the Balanced Scorecard to track operating efficiency, capital expenditure and growth in the supply chain processes.

The project delivered significant value through integrating the planning processes, scheduling closer to the economic plan for feedstocks and blendstocks arrivals and product dispatches, improving the transparency and communication between the operational groups and exploiting functionalities of the applications.
About Tata Consultancy Services

Tata Consultancy Services is an IT services, business solutions and outsourcing organization that delivers real results to global businesses, ensuring a level of certainty no other firm can match. TCS offers a consulting-led, integrated portfolio of IT and IT enabled services delivered through its unique Global Network Delivery Model™ recognized as the benchmark of excellence in software development.

A part of the Tata Group, India’s largest industrial conglomerate, TCS has over 100,000 of the world’s best trained IT consultants in 50 countries. The company generated consolidated revenues of US $5.7 billion for fiscal year ended 31 March 2008 and is listed on the National Stock Exchange and Bombay Stock Exchange in India.

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