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Refinery Supply Chain Management Solutions

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Advanced refinery planning requires the ability to respond rapidly to changes in the market or refinery capacity. Traditional methods for running the linear planning tools rely on time-consuming processes for data collection, verification and scenario analysis, resulting in delayed decisions. Rapid and informed decision making requires integrating plant, trading and marketing data. Infosys proposes refinery planning data integration by utilizing an enterprise portal approach. Portals can serve as a point of integration for data collection from both internal sources and external partners, perform analytics, and generate proactive alerts and reports on demand to a wide variety of user types, in a secure manner.

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Use an enterprise portal to link plant data with refinery planning tools

Here's how to better automate and integrate the process

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The key tools to enable refinery planning are linear programming (LP) tools. These have been proven to be very useful for refinery economics and planning. Over the past few years, many developments are making LP models even more accurate and realistic. This entails better availability and accuracy of the input data for the LP.

The input data comes from two primary sources:

- Internal data—refinery operating data, internal best practices, etc.
- External data—crude data, product price and demand projections.

These data are available in various formats, time periods and specifications. Extensive efforts are still required to classify, structure, cleanse, validate and integrate such data. We propose that an enterprise portal should be used for such purposes. The enterprise portal would provide a unified Web-based interface for integrating applications such as enterprise resource planning (ERP), trading, plant information system, oil movement system, etc., with the refinery planning tool.

Refinery planning. These processes are key for determining the profitability of refinery operations. Refinery planning objectives are crude evaluation and product mix optimization. The planning processes result in crude selection, product mix determination and target operating conditions.

The refinery planning processes are not isolated. They are run with various other processes such as demand forecasting, replenishment planning, plant operations, refinery optimization, crude planning, etc. Fig. 1 shows the refinery planning context.

Refinery planning inputs. Many inputs are required for running a refinery

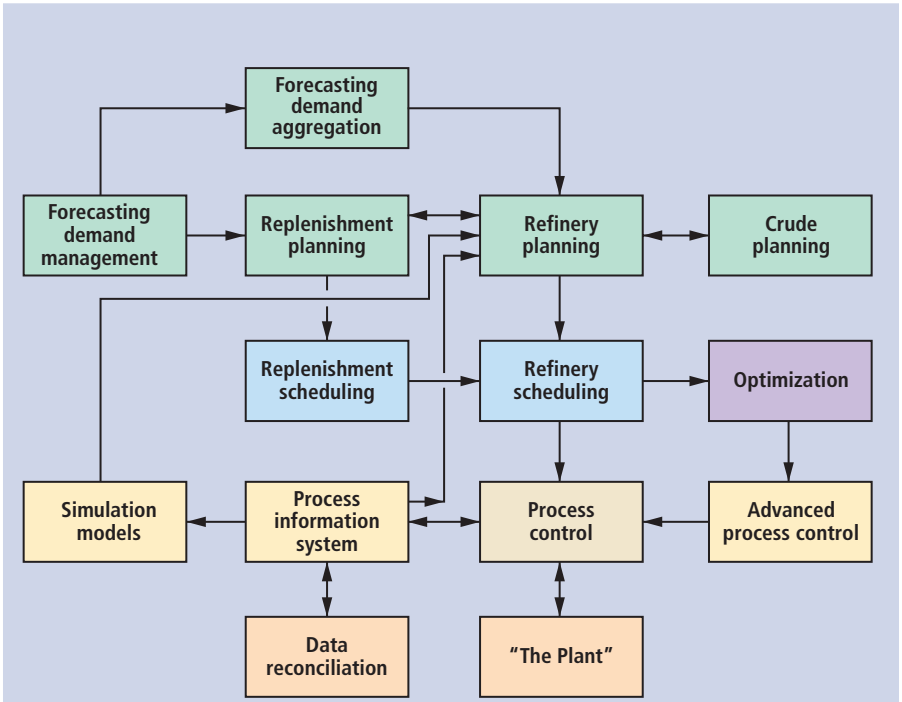

FIG. 1 Refinery planning procedures are not isolated.

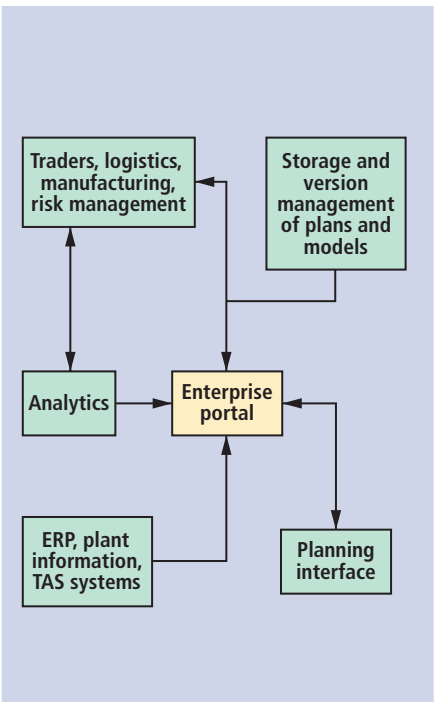

FIG. 2 An enterprise portal can streamline the refinery planning process.

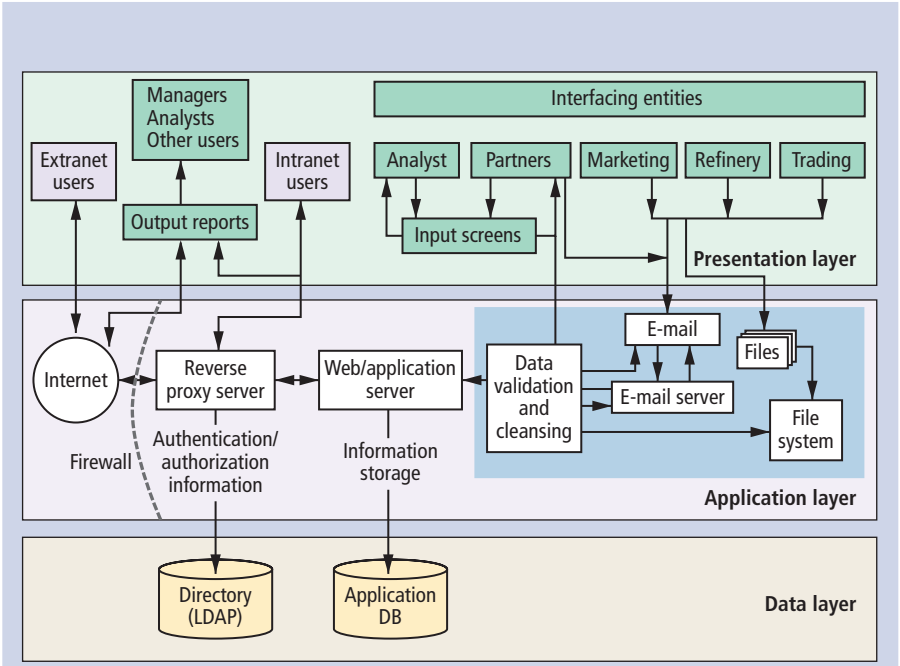

FIG. 3 Enterprise portal architecture can provide a 360-degree view into the entire planning process.

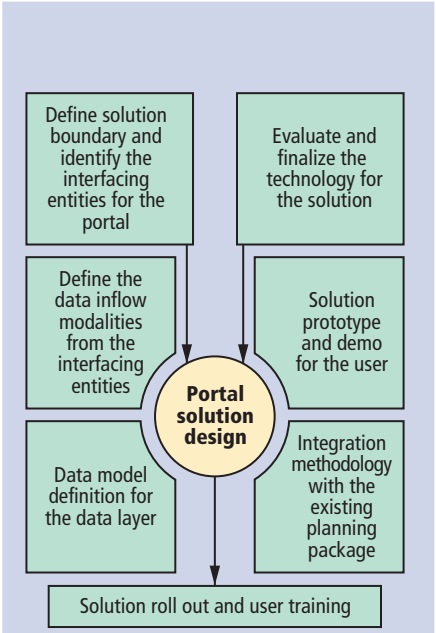

FIG. 4 Implementation. The portal can be built using readily available software.

planning model. These various inputs are:

1. Demand numbers for different grades of different fuels
2. Future prices for different grades of fuels and petrochemical feedstocks
3. Inventories of various raw materials, intermediate products and finished products
4. Manufacturing units, blend headers and tankage capacity availability, catalyst operating conditions
5. Crudes availability, quality and parcel sizes
6. Logistics, jetties, ports availability, capacity utilizations, etc.
7. Plant parameters, conversion rates, actual yields
8. Delta vectors from rigorous refinery models.

For optimal results, having updated information from all the above sources is important. However, all the above inputs come from different operating units, and the coordination required to get all information in a suitable input form takes a lot of time and effort. This often leads to either suboptimization or losing a window of opportunity that may have opened due to market conditions.

Complex issues. Refinery planning is an intricate exercise. The complexity arises from the following:

- Data is required from multiple resources. An effective refinery planning exercise requires data from the refinery (the operating data, constraint data), marketing (demand and price data from different businesses like bulk, gasoline, aviation, marine, lubes and industrial fuels), data from external agencies (e.g., Platts) and data from traders (crude data).

All these data are available in different formats and different time intervals. Typically, no database stores all these data. The availability of updated and unambiguous data (to the extent possible) would make the planning exercise much quicker and more useful.

- Event-based planning. The other complexity arises out of the frequency of carrying out the planning exercise. Typically, the exercise is performed at scheduled times. However, there are triggers to perform the planning exercise at unscheduled times. In such cases, it is a scramble to get the right, updated and real-time data. Much effort is spent in gathering the data; consequently, less time is available for the actual planning exercise.
- Another major issue is the extent of manual processes involved in data gathering, data cleaning, data interpolation and extrapolation, input sheet preparation, report generation and presentation. These all involve significant resources and are time-consuming.

The issues cited above are complex and time- and resource-consuming for a single refinery scenario. Imagine the challenge of a multirefinery scenario. An effective planning exercise today looks at decoupling the data for want of integrated data. If the issues related with data availability can be resolved effectively, a more complex multirefinery planning can be accomplished more accurately.

Enterprise portal strategy. If the different activities that are needed for doing the planning exercise are critically evaluated, the following main activities are revealed:

1. Collecting and consolidating inputs
2. Cleaning and validating inputs
3. Inputting data in the model
4. Running the model
5. Publishing the reports
6. Communicating the reports
7. Storing the reports and the models.

An enterprise portal can streamline all these activities.

1. As it is: Collecting and consolidating inputs is performed by the planning department, which gets the information at a scheduled time. If getting the information at any trigger, a lot of coordination time and effort is required as data are captured by different groups through different sys-

tems. Sometimes the data are sent through e-mail or through spreadsheets or via telephone, etc. In many cases, approximations need to be done.

► *A better way:* This process can be automated to a great extent. The manufacturing inputs can be taken through SAP or from systems like IP-21, etc. For inputs such as unit availability, the manager concerned can be asked to input the number at the portal, and it can be captured.

2. As it is: Cleaning and validating inputs is an important step before inputting the data in the model. If this step is not meticulously performed, the LP model can come out with weird results that would be very difficult to analyze.

► *A better way:* Rules can be set to check for abnormal deviations, and appropriate flags can be inserted for drawing attention.

3. As it is: Inputting data in the model is also important as there is a spreadsheet interface, and errors in the formula in the spreadsheet can lead to erroneous results.

► *A better way:* A simple interface to the spreadsheet of the case file can be built. This can ensure that incorrect links, etc., do not come into play.

4. As it is: The core activity of the planning group is to run the model and analyze the results. Unnecessary spikes are smoothed and efforts are made to present a challenging, yet workable plan.

► *A better way:* More time can be devoted by the planning team to this core activity.

5. As it is: The LP model churns out reams of data. Very little of it is relevant to all departments. Standardized formats are used for publishing relevant portions of the report to different groups.

► *A better way:* All tables can be populated automatically at the press of a button.

6. As it is: Communicating that a plan is ready is normally done via e-mail. There are meetings to discuss draft plans.

► *A better way:* The draft discussion can be at the portal itself, with different parties giving their comments. The planning team can then consolidate and input this feedback wherever possible.

7. As it is: Once a plan is approved, it is sent to different stakeholders. It is important that everybody has the latest versions for reference.

► *A better way:* The published plans can be sent as a link to various stakeholders with appropriate authorization limits. They can all access it through the portal, where proper version control can be performed. Also, the model used for the plan can be archived for future reference.

Thus, an enterprise portal becomes an ideal strategy to successfully carry out the refinery planning process. Fig. 2 shows the enterprise portal solution.

Portal capabilities. A portal would have the following capabilities:

- User interface. There would be users at multiple locations as well as various access levels for the portal applications. They would be able to use the portal for providing inputs (like unit availability, unit availability plans, etc.), cleansing and validating the data, analyzing the reports, viewing the content, carrying out scenario analysis, etc.
- Application integration. The portal would carry out data integration between different applications like ERP (carrying product inventory data), plant information system (carrying yield and intermediate stream inventory data), plant control system (carrying intermediate stream inventory data) and refinery planning LP tool.
- LP input sheet preparation. The portal would integrate all the relevant data and prepare a PIMS input sheet. The input sheet would have all the data assesses from various applications as well as manual data and would classify the data. The fresh input sheets would be prepared at specified time intervals (say, daily) and would be available for a periodic or event-based LP run.
- Content management. The portal would contain data and forms. For example, it would contain crude data, product data, simulator's yield vector data, etc. Both recent as well as archived data would be maintained.
- Reporting. The portal would present the planning report to the users. If required, it would also integrate any standard report format. All types of reports—such as weekly, monthly and yearly—can be made available in usable formats. It would also work as a repository of all the reports.

Fig. 3 shows a typical portal architecture.

Portal implementation. The portal can be built using readily available software pieces. Integration packs can integrate the portal with business applications. Integration templates are available for custom Web-parts development to connect other applications as well. Fig. 4 shows the portal implementation approach.

Portal benefits. The enterprise portal can bring a lot of benefits to the organization through automation of the refinery processes as well as through process integration. Some key benefits are:

- Automation of data collection and consolidation of the refinery planning, thus enabling quicker and more accurate decisions.
- Reminders and follow-ups for updating data
- Event-based planning
- Archiving and storing plans and models
- Version control of plans and schedules
- Data for LP submodel updates
- Building in modeling capabilities by extrapolating historical data
- Measuring/analyzing effectiveness of the planning after the execution, thus the decision-making model can be fine-tuned over time
- A 360-degree view into the entire planning process. **HP**

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