THE DEVELOPMENT OF A SITE WIDE KPI AND INFORMATION SYSTEM FOR NABALCO

O'Sullivan, D. and Barnes, J.
Nabalco Pty Ltd

Abstract

During September 2000, Nabalco's management identified the need for a corporate system to deliver its Key Performance Indicators (KPIs). After a review of the technologies available, the decision was made to develop the system in-house, in preference to purchasing a commercial software package. This would allow much greater control over the structure, and provide for an iterative, concurrent development process between software and key business developers. This has proven invaluable in the development process.

The purpose of the KPI system is to provide a unified reporting tool for all performance indicators. These indicators include Production, Safety, Health and Environment, Personnel, Costs, Continuous Improvement Initiatives and Opportunity Losses. All of these disparate measurements must be brought together into the KPI system and used to determine the performance for each department or area. The general principles of the Balanced Scorecard business approach were applied to achieve this performance determination.

In the process of gathering data from diverse sources, the concept was extended to cover a common outlet for all Nabalco corporate information. The same data that was gathered for the Key Performance Indicators for areas and departments, would also provide Outcome Reporting (corporate views) of Nabalco. The corporate views provide horizontal slices (views) through Costs, OH&S, Environmental, Production, Opportunity Losses, Personnel, Caustic Soda consumption and Energy (fuel oil) consumption.

The KPI system was developed using Web technologies and is available to any internet enabled device with Internet Explorer installed. This removes the need for software rollouts and user training. This will promote the wide use of the system throughout Nabalco and Alcan.

1. Introduction

In September 2000, Nabalco's management identified the need for a corporate system to deliver it's Key Performance Indicators (KPIs). This was to be the fundamental framework for Change initiatives that were instigated throughout Nabalco at this time. It was identified that existing systems were not able to deliver all the required information in a timely and common fashion.

After review of existing corporate information delivery and balanced scorecard systems, Nabalco's management accepted a proposal from the Control and Technical Systems (CTS) group to develop a system in house. This would promote onsite learning to be maximized, to leverage off existing systems at Nabalco (in effect, maximum customization), and also incorporate many features that were not available through commercial packages at the time. A small team of one system developer (software architect), one business analyst (process engineer), and one contractor (software) was established in October 2000 to design and develop the system. The decision to develop in house has provided an excellent opportunity to explore and develop new avenues for improving performance measurement and information delivery across Nabalco.

The first process was to establish the philosophy, and criteria by which the system would work. After review of the business publications and mining journals in this field an approach based on Performance Measurement utilising the Kaplan and Norton Balanced Scorecard approach was adopted, albeit modified to suit a commodity refinery situation.

The Performance Measuring system places KPIs into a hierarchy under each area or department at Nabalco. This is a vertical view through the organization with all KPIs aligned under relevant areas. These KPIs are scored and aggregated together to give overall performance scores for each of the areas and departments. However, it was identified that a Reporting Outcomes (corporate view) system could also be developed to deliver information from all the different sources in a single system. This information could be accessed as corporate views (or horizontal slices), through the whole organization under the categories of Production, Personnel, Costs, OH&S, Environmental, Capital etc. The philosophy and criteria along with the development of the different views are discussed later in this paper.

A Rapid Application Development (RAD) approach was adopted whereby the business requirements and software development could evolve concurrently, rather than as a fully pre-scoped software application. This approach has enhanced the final product, as there have been many reviews and improvements included in the current design that could not be foreseen at the commencement of the project.

The RAD philosophy is to tackle small slices of the project, such as one area (eg Laboratory or Whiteside) and one corporate view (eg Costs or Personnel) and take these prototypes through to completion. This approach allows an earlier look at the final product and a chance to make modifications and improvements prior to large scale development. The development of these initial prototypes will be discussed later in this paper.

2. System Goals and Philosophy

The goals and criteria established at the beginning of the project were:

- Achieve a unified system for Performance Measurement (KPI) across the Nabalco Site.

- Achieve a timely Reporting Outcomes (Information delivery) system that is common to all employees
- Information would be updated daily from all sources
- No manual entry of data — all data will be retrieved from existing systems
- Information will be available to all personnel in an easy to use format.
- KPIs must be measurable — preferably online
- KPIs must be controllable by the area/group they are assigned to.
- KPI weightings and scorings to be transparent and reflect Nabalco strategies.

3. System Operation

Each KPI in the system is configured using a 3-tiered data presentation approach as shown below.

3.1 *Acquisition*

Data for each KPI can be acquired from one or many of a range of data acquisition components. The components allow data retrieval from a number of existing systems, providing access to a variety of databases, Process Information (PI) servers, HR systems and data files.

3.2 *Analysis*

The data is then analysed using VisualBasic Script (VBScript), which provides a flexible means to manipulate and scrutinize the data, producing a KPI score as well as other calculated information. There is a library of VBScripts available to ensure that a consistent scoring method is applied to each class of KPI. It is these scripts that contain the business standards, that are then applied to the incoming data to calculate the KPI score. Combinations of scripts can be applied in more complicated analyses.

3.3 *Visualisation*

Visualisation of the KPI presents the data on web pages. All data that has been acquired or calculated in the previous two steps is available (stored as ADO recordsets) to the visualization component for display. Data can be visualized as text or in charts, tables, pivot tables or combinations of these. The score appears as a percentage in a box next to the heading of each KPI. This allows for quick scanning of the status of multiple KPIs, and identification of poor performing issues that require further investigation.

The KPI hierarchy is available over an intranet/internet. This makes the system available to everyone that has access to a computer with a web browser, while restricting the need for the KPI software to the web server.

The information contained within the system is updated on a daily basis by an updating utility, scheduled to ensure the data contained within the system is up to date at the start of the working day.

The KPIs are presented in a hierarchy structure that can be opened (expanded) to drill down to the lower level KPIs. The scores from each KPI are weighted and combined together at each level in the hierarchy to give summary scores.

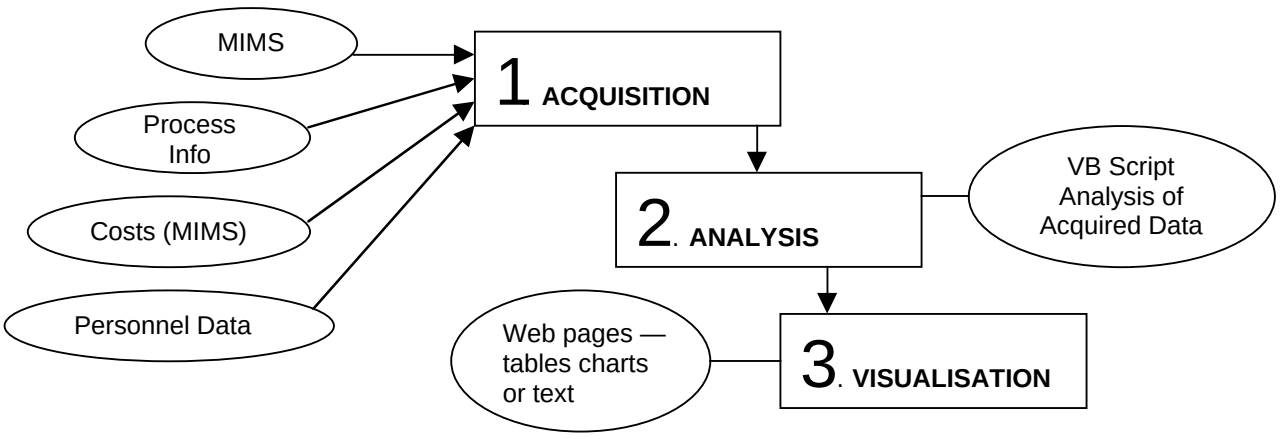
Outcomes (corporate views) are also presented in a hierarchy, but as these are of a common unit, such as costs or tonnes, they can be aggregated directly to the higher levels, without the need for scoring. The data for the corporate views is acquired, analysed and visualized in the same way as in the Performance management section, but there is no scoring applied.

4. Performance Measurement

The Kaplan and Norton Balanced Scorecard approach offered the most appropriate methodology for the new Performance Measurement system. The Balanced Scorecard has four main perspectives, Financial, Internal Processes, Learning and Growth and Customer. The Nabalco system emphasizes the first three, with particular emphasis on internal processes. The Customer perspective is not high profile and was not included in most of the areas. When applied to a Nabalco area, the Balanced Scorecard philosophy extends the scope of normal production metrics (tonnes, recovery etc) to include all responsibilities of each area. These include Production, Process Parameters, Personnel, Continuous Improvements, Costs, Environmental and OH&S. There are also area specific responsibilities as well, such as Instrument Accuracy in the Laboratory area. All of these responsibilities are important, and the measurement of all of these should be included in the performance of any area.

Performance Measurement requires the utilisation of a scoring system to allow the comparison and aggregation of disparit measurements. A scoring system is needed (rather than desired) because of the diverse units of measurement of each of these KPIs. Without a common scoring system the KPIs from OH&S cannot be brought together with Costs and Production etc. The scoring system allows for KPI scores to be weighted together into a summary score within the hierarchy.

The scoring metrics and weighting criteria are critical, and have been subject to many revisions through the development phase. Initially it was considered that a normalized scoring system was important. This means that a performance in one KPI, should have the same score as a similar



performance in another KPI. Thus absolute scores could be compared and conclusions made as to the best performance. This was ideal, but proved difficult to achieve without significant manipulation of the raw data in the analysis phase to give the comparative score.

A simplified approach to scoring has now been adopted, and appears to be more effective. Less manipulation of the data is evident in the analysis phase and the score usually represents an actual metric, such as %time on target, or %uptime, or %of milestones achieved. On the downside, these performance scores are not readily comparable, as similar %time might be more easily achieved for one KPI than for another. On the upside, these performance scores are real and tangible metrics, and scope for performance improvements can be immediately quantified. While these KPI scores are not comparable with each other, the trend of each KPI score can be used to determine whether performance is improving or not. Improvements can be set by either tightening the measurement specifications or by setting higher score targets.

5. Performance Measurement Prototype (Laboratory)

As proof of concept, a prototype was developed for a specific area, the Laboratory. Discussions and analysis of the Laboratory area revealed a fairly simple structure of KPIs as shown below.

The weighting reflects the importance of laboratory measurement accuracy for the overall control of the refinery. Laboratory costs, albeit significant, are largely fixed and therefore do not warrant a high weighting in the performance measurement. The overall weightings are based on a combination of cost based analysis and also to reflect corporate doctrine.

The development of laboratory KPIs led to data acquisition tools being built to access LIMS (Laboratory results database — Oracle), Powerplay (Financial accounting tool — MIMS), Lattice (Personnel database — Progress) and PI (Process Information historian). These tools have become the basis of data acquisition used for nearly all other KPIs developed so far.

A branch of lower level KPI summaries is shown under the Accuracy node as shown below.

This structure shows the weightings applied to each of the major pieces of equipment in the laboratory. The ThermoTitrators (TTs), are given priority weightings as their outputs are key to the online control of the refineries main liquor streams.

Underneath each instrument node is the actual KPI that measures the performance of the equipment against standards and reports this as a score. The scores are typically the %time the standards results are within a specified control band over the previous 30 days. Standards are run on every batch and this result is analysed by the KPI to provide the score. Statistical Process Control analysis is applied to the standards to ensure appropriate control bands and targets are in place.

The overall Accuracy score is determined by the individual scores for each piece of equipment, then weighted together using the weightings shown in the diagram, to give the summary score.

On the next page is a snapshot of a KPI for the Malvern Sizer, showing the control chart for the standard samples on the right and the expanded KPI hierarchy in the left hand explorer bar.

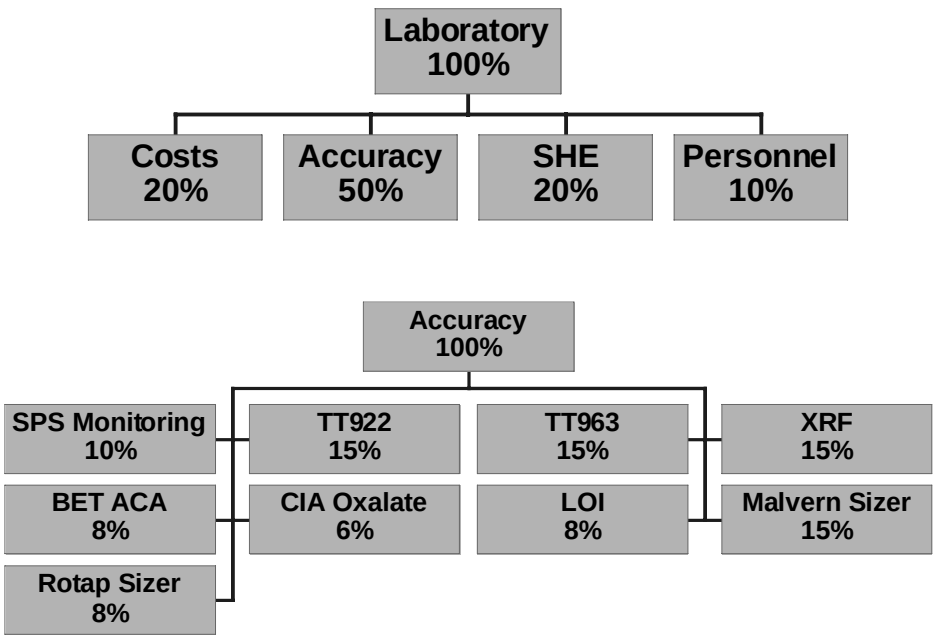
6. Reporting Outcomes (Corporate views)

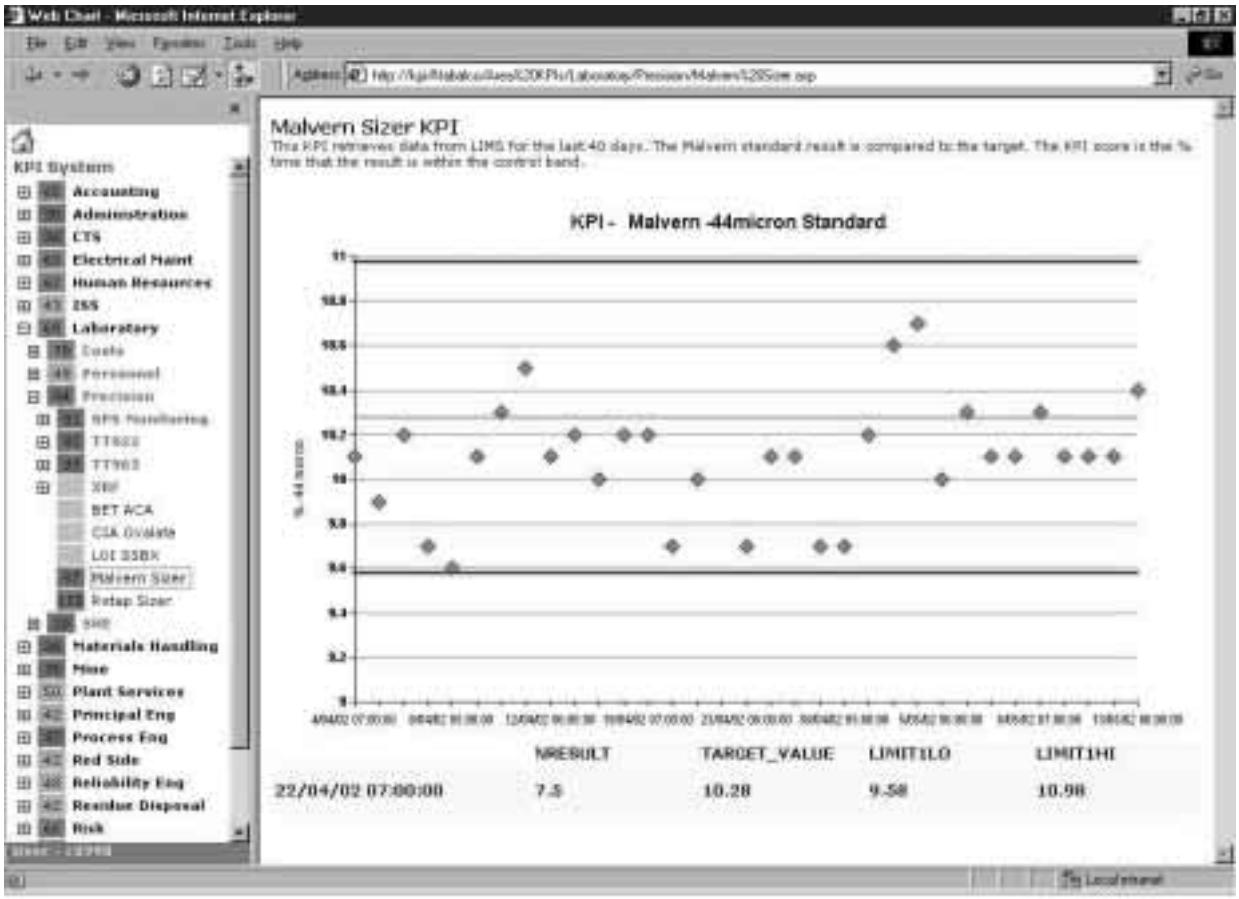
The same data gathered in the Performance Measuring system can be used to review the corporate views of the overall company. These views cut horizontally through the vertical hierarchy of the Performance structure and capture the data into overall corporate views. Corporate views look across the organization to gather all data into functions or categories (such as production, personnel, OH&S, environmental, costs, maintenance, stores). The information can be drilled down to look at the different levels in each category.

The data does not get scored as it does in the Performance management system. Rather the information is simply reported as actual results. Hierarchies of costs, OH&S statistics and production statistics are available in these corporate views.

7. Reporting Outcome Prototype (Personnel)

As proof of concept a Reporting Outcome prototype was developed for "Personnel". This view would report on





Personnel measures across the site, such as Attendance, % overtime and annual leave and long service leave accrual. Direct access to the existing data (Lattice Personnel database) proved difficult, so an overnight file was automatically generated from Lattice which could be loaded into the system. As reporting of Outcomes, rather than performance is the goal in Corporate views, this information is structured in a typical organizational hierarchy, with the data summing up the hierarchy.

8. Future Developments

The system is constantly being expanded with the incorporation of new ideas. Some of the current developments are:

1. Inclusion of a reporting feature for Area managers. Monthly reporting is currently a very time consuming process at Nabalco. Using the data and the performance management information will allow the construction of monthly reports for each area manager, with only comments/explanations needing to be filled in. The reports will be online and save a significant amount of time. The reports will also be aligned to the business needs, by reporting on the actual KPIs in the system.
2. Further use of Statistical Process Control methods to determine system limits and targets. The Performance Management system has significant flexibility in the analysis process to allow the implementation of various new processes.
3. Conversion of the KPI structure from file based system to a database. This is an internal improvement that will allow the implementation of many ideas. The existing file-based system has reached maximum functionality, and further modifications would require significant overhauls.
4. Improved visualization. This will allow the full reporting feature as described in 1) above. The database structure has incorporated access to all data retrieved by the acquisition servers and also all data created by the analyses servers. This will allow more information to be available for display than currently.
5. New Metallurgical Accounting (MA) System. The existing system is a loosely connected set of Excel spreadsheets and paper log sheets. Data is stored in Excel and difficult to retrieve automatically. Data is also stored in more than one unique location. A new MA system is being developed that utilizes web-based access and a single database storage. The MA system will have the ability to be audited, and the performance of the accounting system itself can be measured and hopefully improved. The system will operate on a daily input basis, all data will be stored once every day. The data will be adjusted to suit monthly reconciliations, and any other process corrections required. The MA system is designed in such a way to be expanded to include any other data in the future. It is intended that the MA system will become an integral data source to the Performance Measurement system. The two systems already have many links and data transferring between them.

9. Conclusion

The Performance Management system has been developed from concept to a functioning system within 18 months. This has included all software development and business analysis. During this time the process of in-house development has been extremely beneficial to the overall

value of the system as the completed system is a culmination of many iterative improvements and ideas during this time. The system is designed to incorporate other systems around it and now will operate very closely with monthly reporting systems and metallurgical accounting systems.

The benefits of the system will be realized in terms of consistent data, and ease of access to a wide scope of data. Reporting against standard and agreed KPIs will be an important improvement.

Maintenance of the KPI system and associated metallurgical systems will be very low. Maintenance of the data handling will be reduced to minimal levels, allowing more resources towards the analysis of the data.

The system will provide a daily objective view of performance and this will be available to all personnel onsite. This will facilitate the process of informing and aligning the workforce to the current issues and direction for the refinery.

Acknowledgement

The authors would like to thank Nabalco Management for the support and the permission to present this paper. The authors would also like to thank the software development team of Terry Snow (initial architecture), Mark Colquhoun (System developer) and Geoff Ennis (System developer).

Reference

Kaplan R. and Norton D. *The Balanced Scorecard*, HBS Press, 1996.