Information Alliance, Inc.

Transforming data into decisions

Case Study

Using Corporate Scorecard Automation to Drive Quality Improvement

Revised March 8, 2017

Company Overview

Company Y is a heavy-duty truck manufacturer based in the Pacific Northwest. It employs approximately 19,000 people worldwide, and operates several manufacturing plants across Canada, the Unites States, and Mexico. In 2004, they built approximately 152,000 trucks across 6 major brands. Some plants build 25-30 trucks per day, while others build over 500 trucks per day. Each plant has one or more assembly lines. Each assembly line is made up of assembly areas. Each assembly area is staffed by one or more work teams. Plants typically operate 2-3 shifts per day, and work 5-7 days per week, depending on the order backlog. As you might envision, the assembly process begins at the front of the line, and results in a fully-assembled truck at the end of the line.

To ensure a quality vehicle is delivered to the customer, several inspections occur during and after assembly, as well as random audits of the final-assembled trucks. Defects are manually logged at some inspection points, while logged electronically at others. Teams meet briefly before each shift to review daily objectives, defects logged during the previous shift, and their own performance from the previous day.

Current Process

As with most manufacturing processes, there are direct relationships between quality, customer satisfaction, and competitive advantage. For this reason, there is a continued focus on quality improvement (i.e. defect reduction). To reduce defects, you first need to identify where they are occurring, focus on those that are most important, and put processes and controls in place to prevent future occurrences.

Company Y has been building trucks for many years. Each of its manufacturing plants has standard definitions for what constitutes a defect. A misrouted wire harness, a paint chip or scratch, and wrong or missing hardware are just a few examples of hundreds of defined defects – each with its own defect code and description. The following series of bullet points offer a summarized view of the current process for capturing and analyzing assembly defect information.

- There are several (~ 10) inspection stations during the truck assembly process. Inspectors at each station check for defects relating to the assembly activities which took place at that station, but also look for existing defects that were caused “upstream”.
- Defects are logged and repaired on the assembly line, when possible. Otherwise, they would be resolved offline. The key was to identify the defect, log the appropriate code, time found, inspector #, truck s/n, and any other relevant information.
- Some inspection areas logged defects directly into the system using a computer terminal. Other inspection stations logged defects on a sheet of paper. These defects may or may not get entered in the system.
- Inspectors often had to choose the best available defect code, if the appropriate code was not available.
- “Miscellaneous” fields were used to capture a variety of inspection data, depending on the plan, shift, and inspector.
- Shift supervisors downloaded defect data from the mainframe, then manually cleansed and summarized the results in Excel. Printouts of pie charts, bar charts and line graphs were made, and displayed ay key locations in the assembly areas. Refer to Figures 1 and 2 for examples.

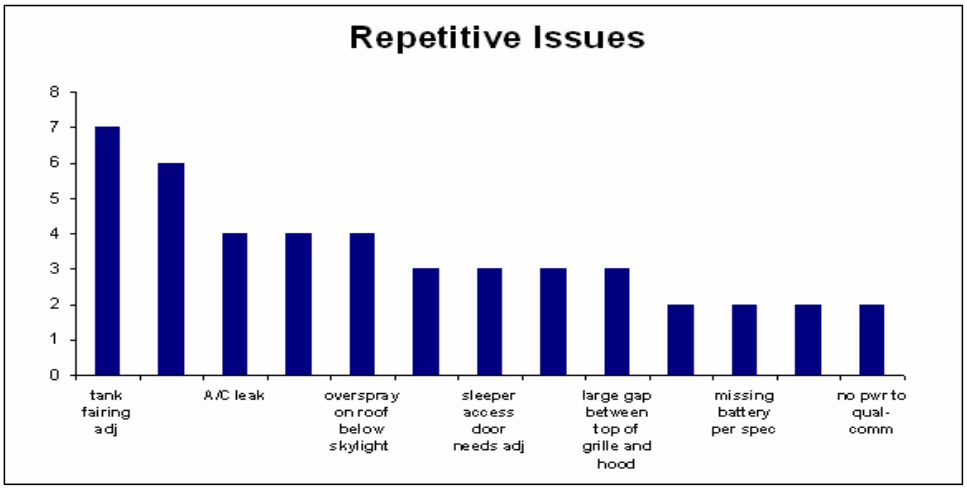


Figure 1 (Pareto chart of repetitive defects)

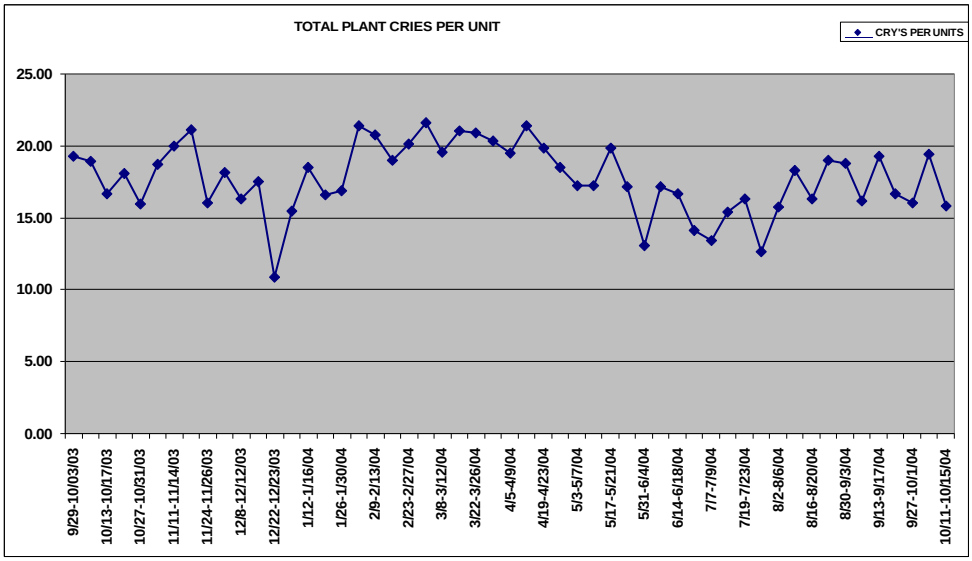


Figure 2 (Average Defects Per Truck)

- Some QA departments stored defect data in multiple systems (Access, mainframe, Excel, SQL Server), thus making it difficult to obtain a complete view of assembly performance.
- Not all manufacturing plants shared the same scoring and defect code definitions. For example, one plant might consider a paint blemish to be of "low" importance, thus assigning the defect a score of "3". Another plant may consider the same paint blemish to be of "medium" importance, thus assigning it a defect score of "5". This made it difficult to compare assembly performance across plants.
- Most defect information captured electronically or subsequently re-entered electronically (from paper copies) was stored on the company mainframe. However, depending on the manufacturing plant, some information resided in Access and SQL Server databases.

Business Problem

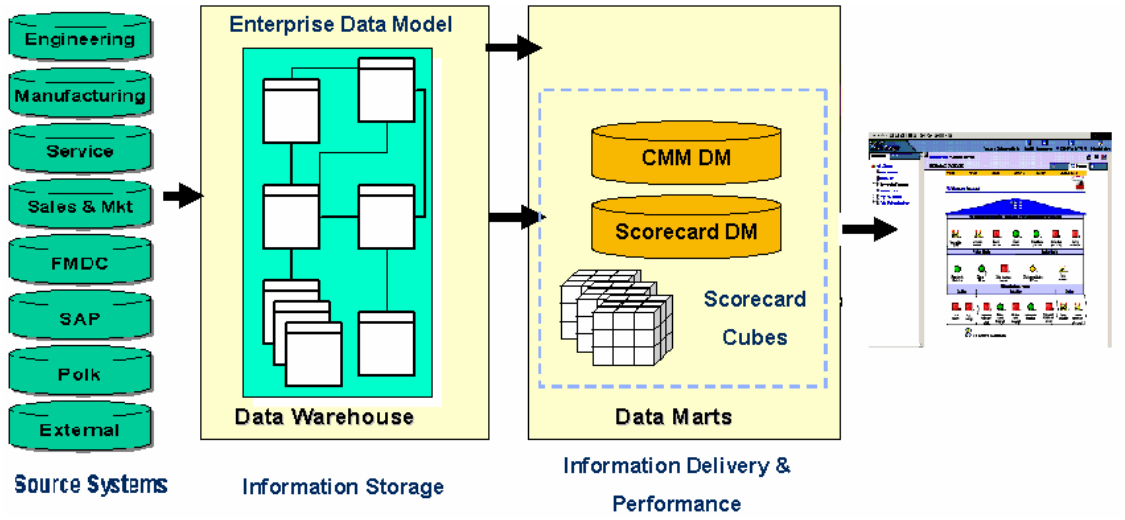
In theory, if the company could capture the right information, they could then analyze defects per truck, per model, per day, per assembly area, per team, per shift, and per plant. Management could then review this data and reward good performance, and also educate assemblers and inspectors on where improvements needed to be made. However, the accuracy, timeliness, and level of effort required to produce this information was a significant obstacle in achieving the desired results.

Because teams and assembly areas were being closely scrutinized on quality performance, it was important that defects found were attributed to the appropriate team or area. For example, if a defect occurred early in the assembly process, but was not found until further down the assembly line, how would the inspectors know where to assign the defect? There were far too many defect codes and inspection line items to expect a person to learn and remember all of them.

Because some inspections were performed with manual log sheets, the data which was captured electronically only represented a partial snapshot of the overall defect count. Moreover, in many cases, only partial information was being captured during inspections. Optional fields were left blank, or inconsistent information was being entered, which added to the manual burden of cleansing, summarizing, and interpreting the results.

The Solution

After careful evaluation, a decision was made to implement a series of data capture improvements, then utilize Cognos Metrics Manager to provide senior management with an automated corporate scorecard, enabling them to view high-level "stoplight" performance charts, with the ability to drill-down on problem areas to assist with root cause identification. For example, a plant manager or executive in the corporate office may see that for a particular make of truck – defect performance is "red" while other makes show "green". The manager could drill down to analyze defects per model, assembly area, shift, team, and even serial number to quickly see where the defects are occurring. This is a critical step toward determining where improvements need to be made. But of course all of this depends on accurate and reliable data capture at the inspection points, followed by the proper filtering, aggregation, and grouping of data for the presentation tool.



Data Quality and Data Input Improvements

- At the point of data entry, inspection sheets were updated with "cleaned up" codes and descriptions. This enabled inspectors to improve the accuracy and consistency of defect logging.
- Some fields on the inspection entry screen were changed from optional to required, where it was determined that the information would be known at the time of the inspection. This enhanced analytical capabilities and improved the consistency of results.
- The inspectors were given additional fields to identify the "out of area" defect origin, if known. This ensured that defects were attributed to the point of origin, rather than to the point at which they were found.
- Provided dedicated fields on the inspection screens for data elements being written to the "Miscellaneous" fields. This enhanced analytical capabilities on this data.
- Proposed a process to log all defect data into the mainframe, than have automated cleansing and summarization of results.
- Pushed for standardization of defect definitions and scoring across all manufacturing plants. This would enable corporate QA personnel to compare performance across plants.

Data Mart and Scorecard Implementation

- On a nightly basis, data was extracted from the mainframe into an IBM DB2 EEE relational database. This "data warehouse" represented the 3NF layer.
- Data was then extracted from the 3NF layer, denormalized, and stored in a Defects Data Mart. This data mart had a star schema design to facilitate reporting and analysis.
- Denormalized data in the defect data mart was uploaded nightly to an SQL Server database which stored aggregated data accessed by Metrics Manager. Metrics Manager then accessed this data and presented the results in the form of pre-defined stoplight charts. Cognos ReportNet was automatically invoked when drill down analysis was needed.
- A suite of standard reports were developed using Cognos ReportNet, and accessed data residing in the defects data mart.

Summary

The automated scorecard solution represented the initial implementation which was part of an overall strategic roadmap. For the first time, corporate QA managers would have an accurate and consistent means of comparing assembly performance from several different perspectives. The drill-down capability will give team leaders, shift supervisors, managers, and executives with visibility into potential root causes of repetitive assembly defects. This insight will serve as input to the required training and/or process changes needed to reduce defect occurrences and improve overall product quality.

Quality improvement is an ongoing process requiring proper monitoring and analysis, followed by adjustments and corrective actions to both assembly and inspection processes. If improvements are to be made, the overall process must include root-cause analysis. If root cause analysis is to be performed, there must be accurate and timely data capture, which will ultimately feed a business analytics solution tailored to provide the necessary insight for these activities.

About Information Alliance, Inc.

Information Alliance, Inc. is a management consulting firm dedicated to helping clients achieve their business goals by providing expertise in project management and business analysis, with specialization in data warehouse, document management, and information delivery implementations. Their depth and breadth of experience, coupled with a structured approach helps clients transform data into useful information.

Information Alliance consultants have managed dozens of project for Pacific Northwest companies, including one of the largest regional electric utilities. Strong emphasis is place on planning and analysis activities. Specifically, ensuring executive-level sponsorship is in place, and that user requirements and concerns are completely understood and documented. Finally, Information Alliance works closely with clients to develop an incremental roadmap that documents a phased approach to delivering capitalizable assets along the way to arriving at the final solution.