MINI-PAPER

Minimizing Business Risks Through a Statistics-Based Predictive Scorecard System

Forrest W. Breyfogle III, President and CEO, Smarter Solutions, Inc.

Organizations need to minimize the risk of quality, delivery, and design problems with their offerings. Entities need to be measurable, auditable, sustainable, and consistent; however, if care is not exercised, executives, operations personnel, and quality departments can be making inappropriate decisions that lead to problems and/or excessive costs. Metrics and their wise application can help mitigate these risks.

Risks are mitigated through two primary methods; eliminate the risk through structural or procedural changes, or create a reporting structure that is able to identify performance changes before there is a risk of impacting a customer or client. This article is about the tools and methods to introduce a reporting structure that allows a business to identify and mitigate risk before it impacts the bottom line.

Good measurements provide decision-making insight that can lead to the most appropriate conclusion and action or non-action. Effective and reliable metrics for accomplishing this objective require the following characteristics:

- **Business alignment:** Metrics consume resources for both data collection and analyses. Metrics need to provide insight to business performance, its issues, and its needs. Metrics surrounding your business alignment can be found by looking at your value chain.
- **Honest assessment:** Creating metrics so that the performance of someone or an organization will appear good has no value and can be detrimental to the organization. Metrics need to be able to provide an honest assessment, whether good, bad, or ugly.
- **Consistency:** Identified components in any metric need to be defined at the outset and remain constant. Criteria and calculations need to be consistent with respect to time.
- **Repeatability and reproducibility:** Measurements should have little or no subjectivity. We would like a recorded measurement response to have little or no dependence on who recorded the response or when.
- **Actionability:** Often measures are created for the sake of measuring, without any thought as to what would be done if the metric were lower or higher. Organizations need to create actionable metrics; e.g., to remove a measurement degradation problem or hold a performance gain. When a metric response is unsatisfactory, organizations need to be prepared to conduct root-cause analysis and corrective or preventive actions.
- **Time-series tracking:** Metrics should be captured in time-series format, not as a snapshot of a point-in-time activity. Time-series tracking can describe trends and separate special-cause from common-cause variability in predictable processes.
- **Predictability:** A predictability statement should be made when time-series tracking indicates that a process is predictable.
- **Peer comparability:** In addition to internal performance measurements, benefits are achieved when comparisons can be made between peer groups in another business or company. A good peer comparison provides additional analysis opportunities, which can identify improvement possibilities.

Metric utilization requires commitment and resource allotments; hence, it is important to do it right. When organizations strive to become more metric-driven, it is important to avoid metric-design and metric-usage errors. Common mistakes include the following:

- Creating metrics for the sake of metrics.
- Formulating too many metrics, resulting in no actions.
- Poor metric follow-up.
- Describing metrics that do not result in the intended action.
- Creating metrics that can have subjective manipulation.
- Combined reporting of metrics with different relative importance in the same scorecard view.

If not exercised effectively, metrics can become a dark force where good energy is absorbed by bad stuff – a black hole where good resources are lost.

Continued on page 13

MINI-PAPER

Continued from page 12

Performance Reporting

Performance-measure report-out formats can have a dramatic influence on behaviors and the identification of business risk. Many situations can have numerous report-out options. Much unproductive work can be generated if the best scorecard/dashboard metric is not chosen.

Table 1 exemplifies one commonly used performance measure report out. This report format has calendar boundaries that reflect only quarterly and annual results. This type of chart does not present response data as though it were a result of internal processes that inherently have variability. In addition, this chart cannot identify trends, detect unusual events in a timely fashion, or provide a prediction statement.

Performance Measure	FY 2001 Actual	FY 2002 Actual	FY 2003 Actual	FY 2003 Amended	FY 2004 Amended
Percentage of customers satisfied with dispatch staff	99.99%	100%	99.99%	98%	98%
Percentage of priority one calls dispatched to field crews within 80 minutes of receipt	99.99%	99%	99.99%	95%	95%
Labor cost per customer call taken in Dispatch Operations	$4.20	$5.31	$5.09	$4.88	$5.09
Number of calls taken through Dispatch Operations	62,054	59,828	63,046	60,000	60,000
Number of priority one calls dispatched to field crews	5,797	4,828	6,686	5,000	6,500
Number of work orders and component parts (segments) created in database	8,226	4,724	7,742	5,500	6,700

Table 1: Traditional Performance Measures: Tabular Reporting

Is there a consistent message presented in Table 1? Invariably you will get stories that cannot be verified in the chart. Look at the third line. You might hear something like "We staffed up in 2002 to prepare for annexations, but they did not happen as quickly as expected. This drove our cost per call up. As we annexed in 2003, you can see it coming down. We are on track."

It may be a true story, but is it the whole cause as it is represented? It is a good bet that the presenter will describe many of the ups and downs in the table in a story format, where in reality much of this motion is the result of common-cause variability. Have you seen tables like this before? Is there a risk to the organization that this reporting method could not demonstrate?

This form of performance reporting and of other year-to-date metric statements typically leads to *stories*. This means that someone presenting this scorecard/dashboard will typically give an explanation for the up-and-down movements of the previous quarter or year. This is not dissimilar to a nightly stock market report of the previous day's activity, where the television or radio reporter gives a specific reason for even small market movements. This form of reporting provides little, if any, value when it comes to making business decisions.

Whether in a business performance measure or a stock market report, these reported causal events may or may not have affected the output. The individual measurement value may cause an alarm that triggers some corrective action, or the numbers may be viewed only as a simple report. In either case, most measurement variability is typically the result of the system's common-cause variations.

An alternative to table presentations for a data-driven company is chart presentations; however, similar to summarizing data through a table, pie, line, stacked bar, stop-light scorecards, and other typical charting formats, conclusions typically lead to *stories* about the past. This is unfortunate since in most cases our true interest lies in what future performance might be expected, where if we don't like what we are predicting something needs to be changed in the process to improve future performance.

Continued on page 14

MINI-PAPER

Continued from page 13

In addition, other common-place forms of reporting have issues too. For example, lot inspection techniques [e.g., Acceptable Quality Level (AQL)] and process capability indices (e.g., C_p and C_{pk}) can lead not only to historical or one-point-in-time statements but also to deceptive results.

Integrated Enterprise Excellence (IEE) Predictive Metrics

An alternative performance reporting method, which positively addresses all aspects of the previously listed eight good metric points, is provided through an Integrated Enterprise Excellence (IEE) predictive-performance reporting system. This form of reporting can reduce much organizational day-to-day-problem firefighting, as the following illustration describes. The IEE reporting methods leverage common statistical tools in order to allow all business risk to be un-ambiguously reported. These methods reduce the likelihood of a business risk going undetected.

The red-yellow-green scorecard shown at the top of Figure 2 is from a corporation's actual scorecard system. Below this stop-light dashboard, is an alternative, IEE 30,000-foot-level performance report-out. This different reporting format provides a high-level metric view of the situation, like an airplane's 30,000-foot-level view of the terrain below. In addition to a macroscopic observation, 30,000-foot-level reporting can also provide a prediction statement.

The IEE metric creation system has two steps. The first step is to analyze for predictability, while the second step is the formulation of a prediction statement, when the process is considered predictable.

To determine predictability, the process is assessed for statistical stability using a 30,000-foot-level individuals control chart, which can detect if the process response has changed over time and is stable. The second step is the formulation of a prediction statement, when appropriate.

A process could have multiple regions of stability, where the latest region of stability could have been for the last three weeks, three months, or three years. If a process has a recent region of stability, it can then be said that the process is predictable, where the assumption is being made that nothing is being done that is either favorable or detrimental to the process.

It is important to note that 30,000-foot-level control charting is not the same as traditional control charting where the emphasis with the classical approach is to identify special causes so that a process can be stopped for issue resolution. For 30,000-foot-level reporting, individuals control charts are used to assess stability; i.e., not x-bar and r charts, p-charts, or u-charts. The reason for this is that, unlike other common control charting techniques, an individuals' control chart limits are mathematically a function of the variability between subgroups. When a current region of stability with a 30,000-foot-level control chart exists, data from this latest region can be considered a random sample of the future.

For the Figure 2 illustration, the 30,000-foot-level control chart indicates that nothing has changed over time, even though a traditional red-yellow-green scorecard showed a frequent transition between red, yellow, and green. For this stoplight scorecard, the performance level was red 5 out of the 13 recorded times.

Included in this figure is a probability plot that can be used to make a prediction statement. Much can be learned about a process through a probability plot. Let's further examine the probability plot, making note of some of its characteristic benefits.

The x-axis of this probability plot is the magnitude of a process response over the region of stability, while the y-axis is percent less than. A very important advantage of probability plotting is that data do not need to be normally distributed for a prediction statement to be made. The y-axis scale is dependent upon the distribution type; e.g., normal or log-normal distribution.

If the data on a probability closely follow a straight line, we act as though the data are from the distribution that is represented by the probability plot coordinate system. Estimated population percentages below a specification limit can be made by simply examining the y-axis percentage value, as shown in Figure 2. For this case, we estimate that about 33% of the time, now and in the future, we will be below our 2.2 specified criterion or goal.

Continued on page 15

MINI-PAPER

Continued from page 14

There is a certain amount of technical training needed to create 30,000-foot-level metrics; however, the interpretation of the chart is quite simple. In an IEE 30,000-foot-level report-out, a statement is included below the chart that nets out makes a process performance statement. For this chart, one can state that the process is predictable with an approximate non-conformance rate of 32.8%. That is, using the current process, the metric response will be below the goal of 2.2 about 1/3 of the time.

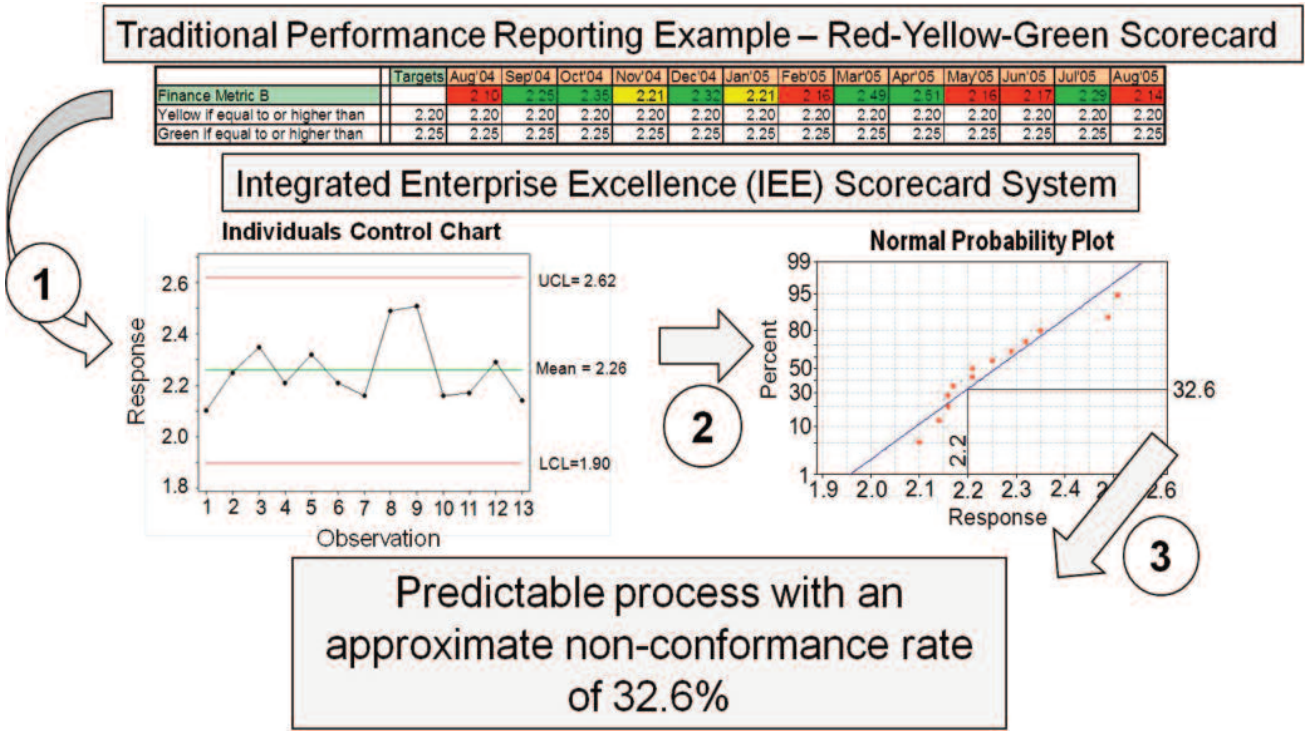

Figure 2: Illustration of Stop-light Scorecard versus IEE reporting

As a business-management policy, red-yellow-green versus IEE reporting can lead to very different behaviors. For this example, a red-yellow-green reporting policy would lead to fighting fires about 33% of the time because every time the metric turned red, management would ask the questions, "What just occurred? Why is our performance level now red?" Red-yellow-green scorecards can result in counter-productive initiatives, 24/7 firefighting, the blame game, and proliferation of fanciful stories about why goals were not met. In addition, these scorecards convey nothing about the future.

With IEE-performance-metric reporting, we gain the understanding that the variation in this example is from common-cause process variability, where the way to improve performance is through improving the process itself. With IEE, someone would be assigned an improvement project, where the success of this effort is gauged by the 30,000-foot-level control chart transitioning to an improved level of performance. The assignment of this task assumes that this metric improvement need is where targeted efforts should focus to maximize improvement efforts for the business performance as a whole. But, how do we determine if this metric is where resources should be spent? Other aspects of the IEE system can help with this determination.

The use of the individuals chart within business performance scorecards provides visualization power to the identification of risks from business performance shifts and increased performance variability. Traditional methods of performance reporting focus only on the average or most recent value, while most business and customer risk exists in the performance variation; i.e., customer problems often occur at the extreme tails of the performance distribution. A performance reporting method that does not provide insight to process variation and extreme performance values can result in high organizational risk.

Continued on page 16

MINI-PAPER

Continued from page 15

The IEE Value Chain to avoid the risk of unmonitored business functions

In many businesses today, scorecards are not viewed as part of an integrated enterprise management system. Performance reporting is used for the "important" functions of the business, but may be ignored in the other business areas. There is a risk in most businesses that there are key functional metrics that are not included in the scorecard reporting. The IEE value chain is a tool that allows an organization to examine its performance with a functional view, rather than by the organization chart, to ensure that all of the functions required to operate the business are monitored for performance risk. This includes the support organizations and other non-value stream functions.

The IEE value chain shown in Figure 3 describes what the enterprise does (rectangles in the figure) and its performance measures of success (ovals in the figure), from a customer and business point of view. In describing what the organization does, the center portion of the value chain can have procedural drill downs with attached documents. Metrics for each of the functional steps are described within the connected ovals.

With IEE, the organization chart is subordinate to the value chain. In an enterprise, the value chain is long-lasting even through organization changes, where ownership of process functions and metrics would change, when appropriate.

Let's now consider the metric portion of the value chain. In IEE, metrics are to have alignment to how the business is conducted. This is in contrast to creating metrics around the organization chart, which can significantly change over time. It is important not only to determine what should be measured but also to have a reporting methodology that is most beneficial to the business as a whole.

What an organization needs is predictive metric statements that can be viewed collectively so that if the predicted metric future performance is not what is desired for the organization as a whole, an improvement project can be created. I call this a metric-performance-improvement-need pull for process improvement project creation.

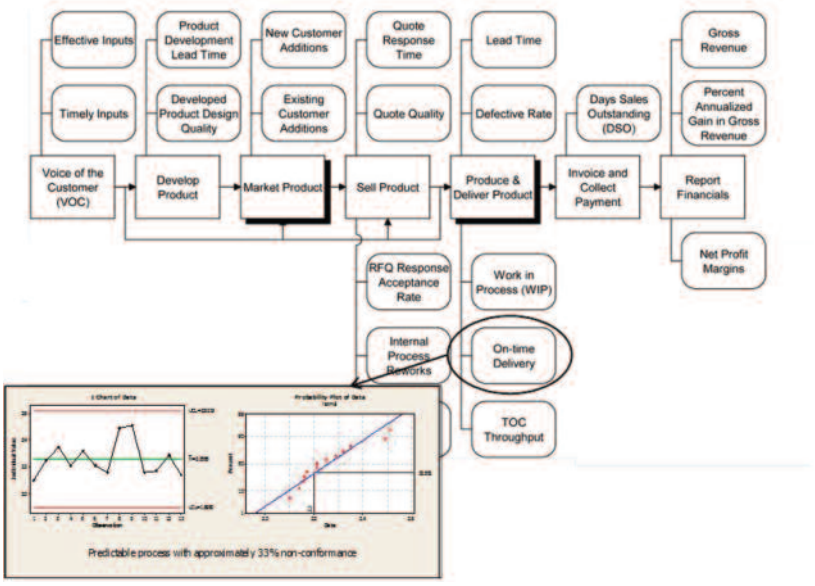

Figure 3: IEE Value Chain with Example Predictive Scorecard

Reducing the risk of working non-valued improvement projects

In every organization there are limited resources for improvement and driving change. These may be staffing limitations, financial constraints, or even a lack of time in the production cycle to evaluate improvements. The IEE EIP is a tool that can be used to translate your IEE value chain business performance reporting into a list of improvement projects that are directly related to the business success. The risk of executing an unnecessary improvement project is significantly reduced.

Continued on page 17

MINI-PAPER

Continued from page 16

This approach is in contrast to leadership brainstorming for projects that someone is to work on, for example, during a Lean Six Sigma training session next week. I call this traditional Lean Six Sigma deployment approach a push for project creation. This measurement improvement need pull-for-project creation is demonstrated in the example Enterprise Improvement Plan (EIP) shown in Figure 4, which summarizes steps 4-7 of the 9-step IEE business system.

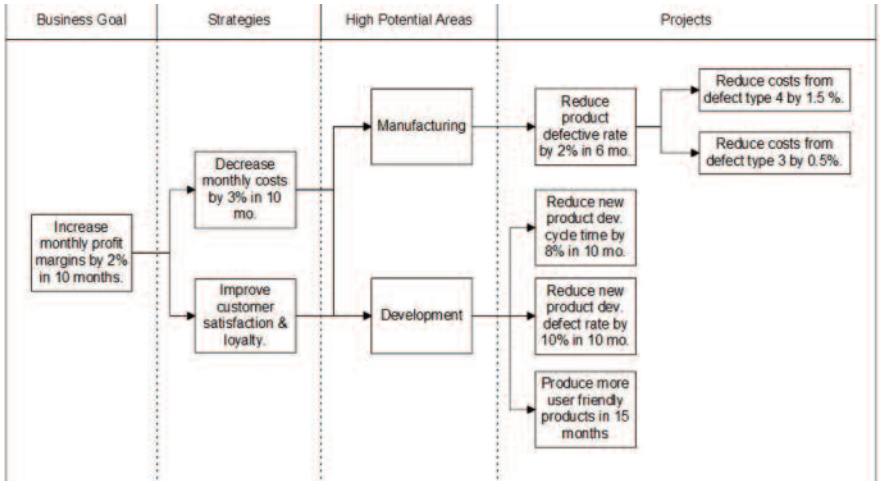

Figure 4: Example Enterprise Improvement Plan (EIP)

Summary

If you want to reduce performance risk throughout your business, the IEE method will provide a few methods to support that need.

- 30,000-foot-level reporting methods provide a view of variation and predictability that allow an early detection of performance changes before they impact the customer.
- The IEE Value Chain provides a functional tool to ensure that all areas of the business are monitored for performance. The business will not be surprised by support-organization performance issues.
- The IEE EIP methods will ensure that all of the scarce improvement resources are assigned to the efforts that will support the overall enterprise performance. There will be very few "so-what" projects that drain staff and money away from the improvements that are needed.

One of our clients, a charity in the mid-west, adopted the IEE methodology. Through the implementation and 30,000-foot-level reporting method, it was able to identify a shift in funding that its previous business system methods did not show. This led to the initiation of an improvement effort using its volunteers to develop a new funding process that ended up providing additional funding and allowed its organization to survive the recession's drop in donations and funding that developed soon after the IEE methodologies had begun. The CEO of the charity acknowledged that, if it had not recognized this issue, when it did, that it might have needed to close its doors. This is only one of many examples illustrating how the IEE methods have identified and mitigated risk for the benefit of an organization.

References

Breyfogle, F. W. (2008), *Integrated Enterprise Excellence Volume II—Business Deployment: A Leaders' Guide for Going Beyond Lean Six Sigma and the Balanced Scorecard*, Citius Publishing, Austin, TX.

Breyfogle, F. W. (2008), *Integrated Enterprise Excellence Volume III—Improvement Project Execution: A Management and Black Belt Guide for Going Beyond Lean Six Sigma and the Balanced Scorecard*, Citius Publishing, Austin, TX.