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An Alternative p-Chart Application for Predictive Scorecards

By: Forrest Breyfogle III

An analytical-based system for making choices over time

During a Sept. 23, 2011, *Quality Digest Live* [1] interview, I made several comments relative to business metrics and the need for an enhanced business management system. This article will elaborate on those comments and show the business application of an alternate p-chart, using the data from Donald Wheeler's excellent Sept. 30, 2011, article, "What About p-Charts? [2]"

In Wheeler's article, data were used to describe the benefits of individuals control charting over p-charting. That same data set will now be used to illustrate this application of individuals control charts for attribute situations, as part of an overall enterprise business value chain that provides predictive scorecards.

However, rather than tracking percent on-time as Wheeler did, I have elected to examine the data from a nonconformance rate perspective—i.e., 100 minus percent on-time. The reason for making this data transition is that a process capability statement will later be made, where, for attribute data, process-performance statements are typically made in terms of a nonconformance rate.

Figure 1 provides an examination of these data as they would be experienced in month 17. The individuals control chart shown in figure 1 is not stable; hence, no prediction statement should be made about the process's response. This out-of-control condition conclusion is an indication that causal identification is probable, although not certain. If these data represent an important business process output, a diagnostic effort would be undertaken that should identify a process improvement to implement.

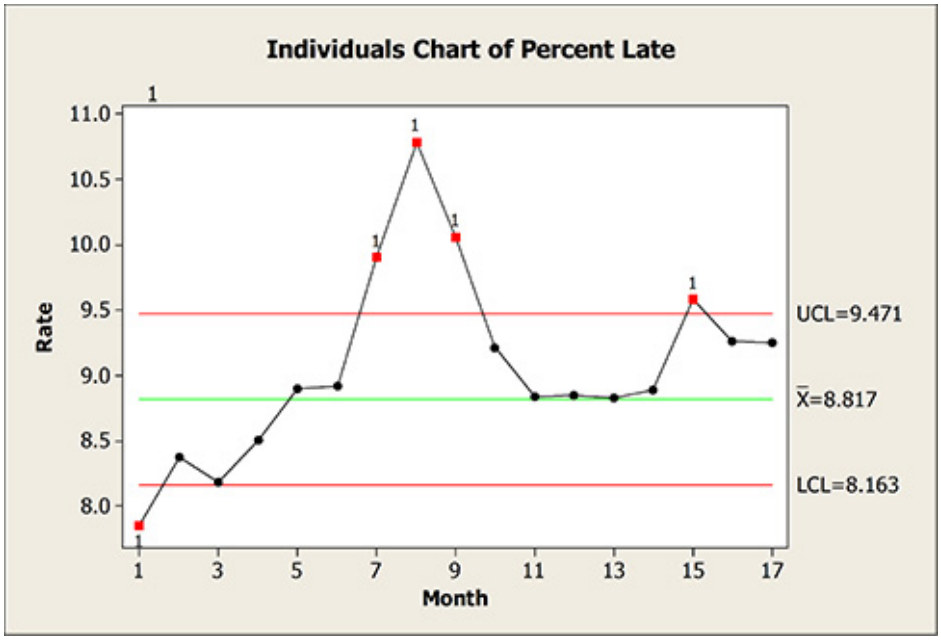

Figure 1: Percent nonconformance (month 1–month 17)

Consider now that at the 18th month corrective action was incorporated that addressed this lack of process stability and overall undesirable performance.

An examination of the process at the 24th month with a staging of the individuals control chart at the point where the process change was made could lead us to conclude that the process now appears stable, as shown in figure 2. In general to create a new stage like we did in this illustration, we want to know what changed in the process to cause the shift and get a technical confirmation of the change using standard control charting rules. Because we concluded that the process now has a recent region of stability, the process can now be considered predictable since the process change was made.

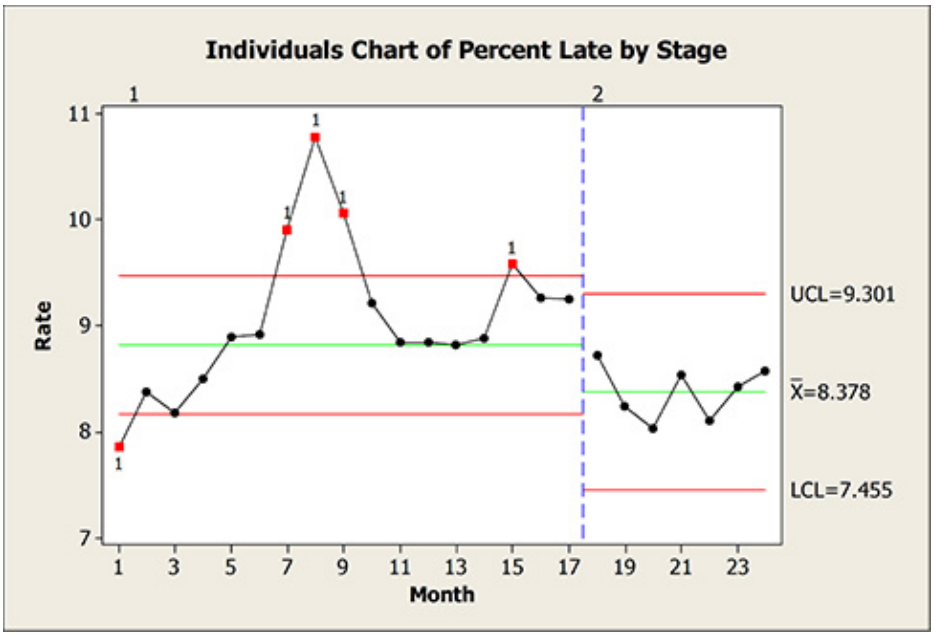

Figure 2: Percent nonconformance (month 1–month 24)

Next, a prediction statement needs to be formulated. To accomplish this, the data from the recent region of stability can be considered a random sample of the future. If the subgroup sizes were equal, the centerline of the individuals control chart provides a best-estimate for the process's new level of performance, i.e., 8.378-percent nonconformance rate. However, if one were to examine Wheeler's original article, one would note that the subgroup sizes were not equal. Because of this, one could get a better estimate by analyzing the raw data from the region of stability; i.e., dividing the total number of nonconformances by the number of transactions and multiplying this value by 100. For the data from Wheeler's article, this calculation would be (116/1387)100 = 8.36 percent. For this case, the results are very similar; hence, I will use the original subgrouping-averages estimate.

Figure 3 describes how this stability and predictability could be reported out as an organizational scorecard. Below the chart in figure 3 is a statement about the chart's predictability.

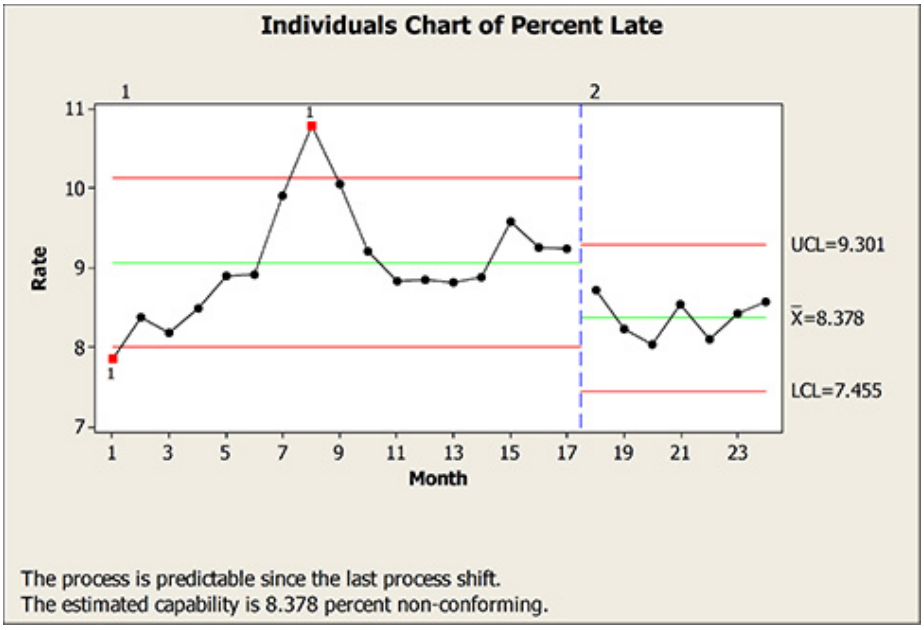

Figure 3: Integrated enterprise excellence (IEE) predictive scorecard for attribute data

Now that we have created a scorecard presentation that represents the delivery performance, the chart will be integrated into an innovative performance reporting system.

Organizational measurements and scorecards should result in behaviors that benefit the business as a whole. For these metrics, it is most desirable to have a predictive measurement system where undesirable anticipated events lead to process improvement efforts which produce more desirable performance results. However, traditional metric reporting such as pie charts, stacked bar charts, and red-yellow-green scorecards are not only nonpredictive but can also lead to unhealthy behaviors. For example, organizational management through stoplight dashboards can lead to much firefighting and is not unlike driving a car by looking only at the rear-view mirror—i.e., a dangerous practice.

Organizations can overcome these issues through the integrated enterprise excellence (IEE) business management system. IEE not only provides predictive scorecards but also structurally integrates these performance metrics with analytically/innovatively-determined strategies where improvement efforts are identified and undertaken so that the enterprise as a whole benefits.

As part of the overall nine-step IEE system, an enterprise's value chain (see step two in figure 5) integrates what an organization does and how it will measure these activities. With this methodology, organizational functional metrics are selected relative to quality, cost, and time, which can be reported in a predictive format.

This approach provides a system that is not unlike looking out the windshield of an automobile where, if we do not like what is seen straight ahead, we must apply the brakes or turn the steering wheel. Similarly, for a predicted organizational performance response, if the magnitude of what is being predicted is undesirable, then process improvement action is needed to enhance the level of performance.

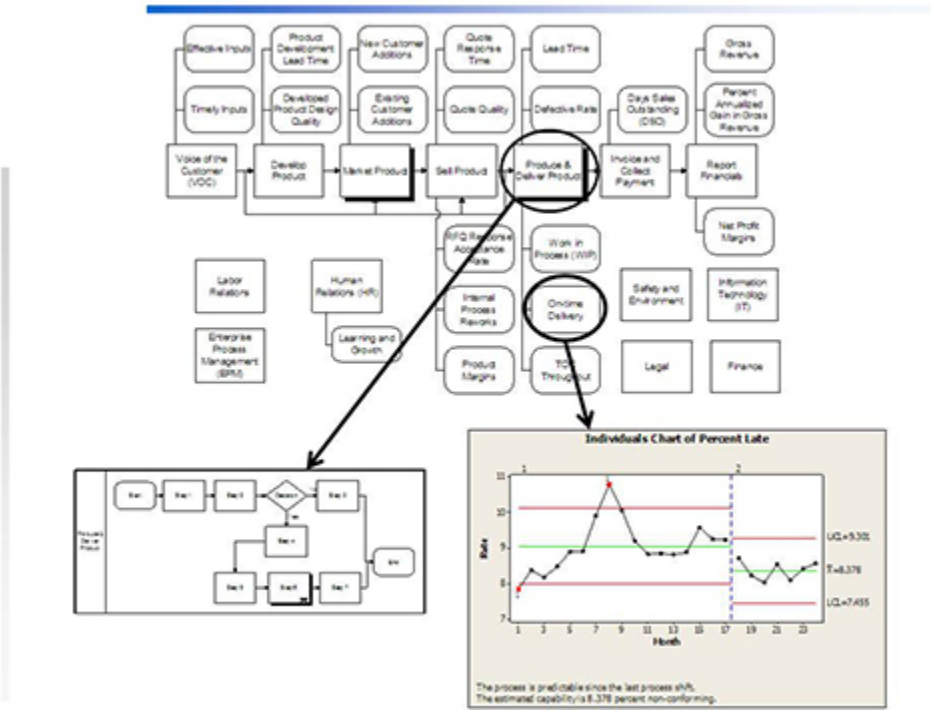

Figure 4: IEE business management system (Click here [3] for larger image)

An IEE value chain can help organizations transition from unstructured, intuitive decision making to an analytical-based system for making choices over time. Performance metrics, as part of this functional process integration system, help organizations move to the most appropriate actions, (or inactions), so that the enterprise as a whole benefits.

To reiterate, step two of the nine-step IEE system (figure 5) provides a means for linking organizational processes and procedures with their performance measures.

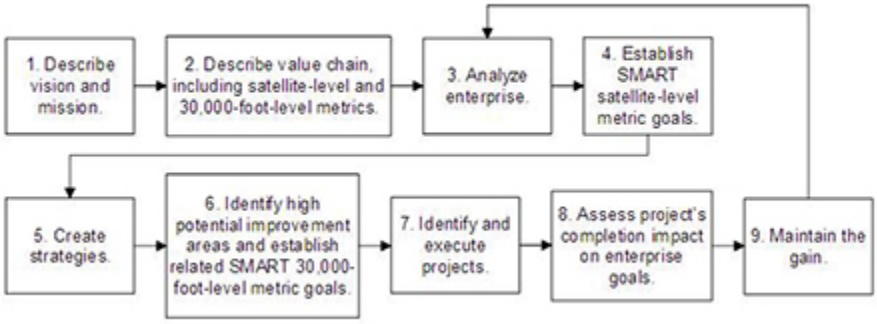

Figure 5: Nine-step IEE system

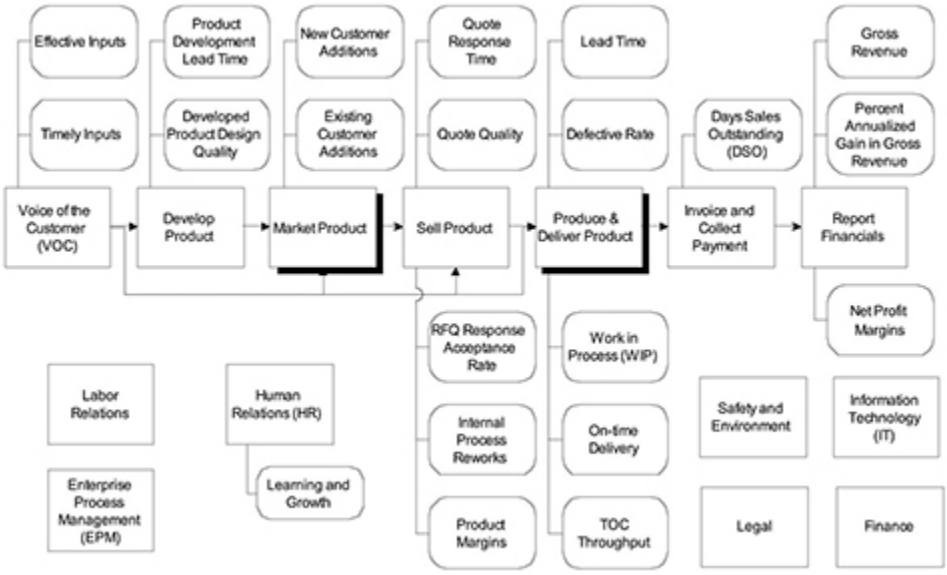

Figure 6: Sample of an IEE value chain

Figure 6 illustrates a sample IEE value chain, where procedural information travels through the rectangular boxes and performance metrics through the oval boxes.

If an organization believes that the metric drill-down shown in figure 6 or other performance capability metrics are not satisfactory (e.g., 8.378% nonconformance rate in figure 3), the processes that affect the selected measurements need improvement. Because process improvement can require much effort, the process enhancement activities should focus on areas where the enterprise as a whole benefits. Collectively assessing overall organizational needs and making appropriate decisions that benefit the enterprise as a whole are addressed in steps three through seven of the IEE nine-step system shown in figure 5.

About The Author

CEO and President of Smarter Solutions Inc., Forrest W. Breyfogle III is the creator of the Integrated Enterprise Excellence (IEE) management system, which takes lean Six Sigma and the balanced scorecard to the next level. He received the 2004 Crosby Medal for his book, Implementing Six Sigma. *E-mail him at forrest@smartersolutions.com*