How to Cut Costs and Quantify Savings Using WinSPC's Cost Inspector

Introduction

Many quality professionals today, in addition to overseeing quality, are being asked to identify potential strategies for lowering manufacturing costs and, once a strategy is identified, report on bottom line dollars-and-cents savings. To this end, they lean on a combination of traditional SPC tools, such as the Cpk statistic, and cost-estimation methodologies, such as the Taguchi Loss Function. Though helpful, these tools and methodologies have only partially been able to answer the challenge.

With the release of WinSPC Version 8, a more precise approach is possible. The feature at the heart of this approach is the Cost Inspector™ and, because of its unique design, it offers a more accurate solution than has been available in the past.

The concept of the Cost Inspector is straightforward. It provides users with an interface to submit the costs assigned to a process. Once those costs are submitted, it cross-correlates them with the distribution of the variable data collected for that process (i.e. the distribution of the measurements taken to monitor the quality of the process' output). The Cost Inspector then quantifies the savings possible by shifting a process, as well as the savings possible through reducing process variability.

The savings associated with process shift--also known as process offset--are the savings that would be realized by shifting the process mean from its current position to its optimal position. The optimal position of the process mean, or *optimal mean*, is the point identified by the Cost Inspector at which one unit can be processed for less cost than it can at any other point given the process' unique spec limits, data distribution, variability and costs.

Following is a sample report which presents these savings (a report, incidentally, which can be generated in seconds with a few mouseclicks):

One of the important concepts to keep in mind concerning these values, and indeed all of the results of the Cost Inspector's cross-correlation, is that they are not estimates. They are, in fact, statistically-sound *calculations* derived from actual process costs and distributions of process data. This is the fundamental characteristic that distinguishes the Cost Inspector from other approaches to cost-based optimization.

With this kind of savings-related detail, quality professionals can more accurately prioritize their optimization efforts. They can conduct a Cost Inspector analysis on a series of processes and identify those processes which possess the most significant savings opportunities. This information enables them to calculate whether the savings associated with shifting a process or reducing variability justify the expense to achieve the process improvement. Because the Cost Inspector delivers the dollars-and-cents savings frequently asked for by management, quality professionals can rely on the Cost Inspector for convincing and credible project justification.

Five Steps to Cost-Based Optimization Using the Cost Inspector

There are five basic steps to using the Cost Inspector to lower the cost of manufacturing without compromising quality. These are briefly summarized here to give readers an idea of what to expect if they adopt the Cost Inspector as a process optimization tool. More detailed instructions concerning these steps are available from DataNet on request.

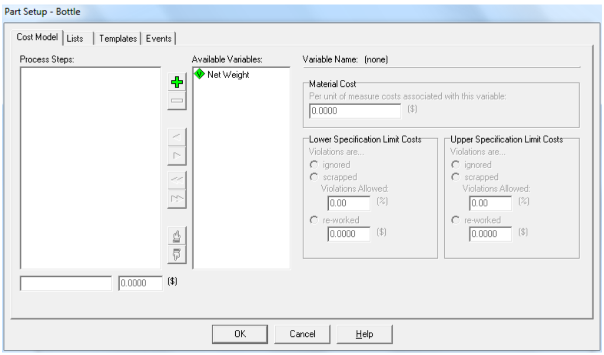
- **Step One: Collect process data.**
  Collecting process data refers to standard data collection into WinSPC of variable data (i.e. the net weights, diameters, temperatures or other measurements taken during the manufacturing process to monitor quality).

WINSPC STATISTICAL PROCESS CONTROL

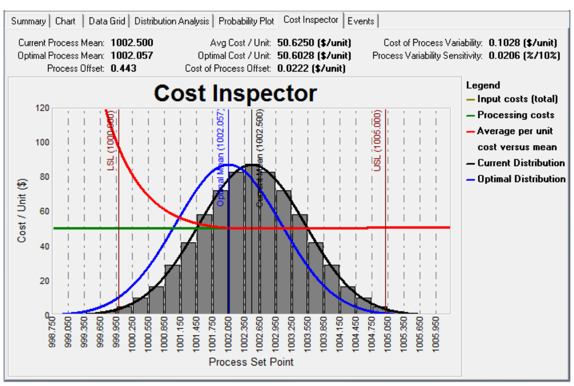
Process Improvement Savings Report

Part/Variable Name	Avg $ Cost/10,000 @ Current Mean	Avg $ Cost/10,000 @ Optimal Mean	Savings/10,000 from Process Shift	Avg $ Cost/10,000 @ Current Variability	Avg $ Cost/10,000 @ 50% Reduced Variability	Savings/10,000 from 50% Reduced Variability	Savings Total /10,000 from Process Shift & 50% Reduced Variability
SKU - 1751							
Diameter	$13,750	$13,500	$250	$13,750	$13,244	$506	$756
Width	$6,200	$5,998	$202	$6,200	$5,982	$218	$420
Length	$7,450	$7,255	$195	$7,450	$7,290	$160	$355
Total Savings			**$647**			**$884**	**$1,531**
SKU - 1760							
Thickness	$10,070	$9,493	$577	$10,070	$9,731	$339	$916
Hardness	$2,050	$1,903	$147	$2,050	$1,907	$143	$290
Flatness	$3,150	$3,092	$58	$3,150	$3,065	$85	$143
Total Savings			**$782**			**$567**	**$1,349**
SKU - 1886							
Fill Weight	$10,322	$8,671	$1,651	$10,322	$9,784	$538	$2,189
Package Weight	$2,815	$2,770	$45	$2,815	$2,738	$77	$122
Total Savings			**$1,696**			**$615**	**$2,311**

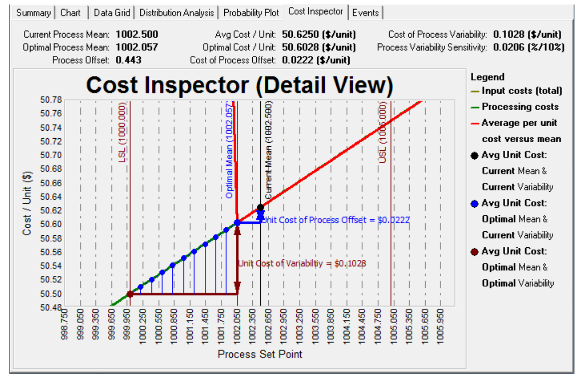
- **Step Two: Supply process costs.**
  Supplying process costs refers to entering the applicable processing costs, material costs, scrap costs and rework costs for a specific process. To facilitate this, the following interface is provided:



- **Step Three: Assess the savings associated with process offset.**
  Assessing the savings associated with process offset simply means determining if the process offset savings identified by the Cost Inspector are significant enough to pursue. A graphical representation of these savings can be viewed in the Process View of the Cost Inspector (as shown below) and a table-style representation of these savings can be viewed in reports similar to the report shown on page one.



- **Step Four: Assess the savings associated with process variability.**
  Assessing the savings associated with process variability means determining if the process variability savings identified by the Cost Inspector are sufficient to justify a project to reduce variability. A graphical representation of these savings can be viewed in the Detail View of the Cost Inspector (as shown at the top of the next column) and, as with offset savings, a table-style representation can be viewed in a variety of standard Cost Inspector reports.

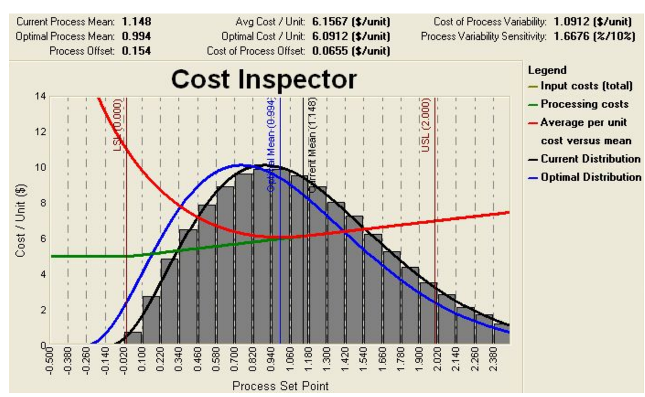


- **Step Five: Prioritize optimization projects according to potential savings and implement those projects which offer the greatest return.**

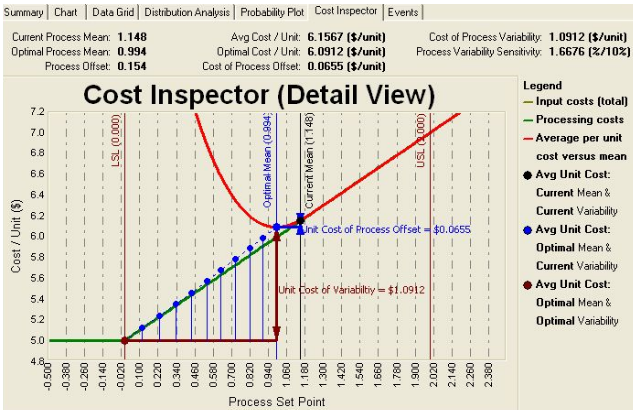
Process Examples

Example #1: Filling

This example concerns a filling process in which a machine dispenses product into containers. If the net weight of a filled container is less than the lower specification limit (LSL) defined for the process, the container is reworked, meaning additional product is added to it. The costs submitted for this process include processing costs, material costs and LSL rework costs. For this process, the Process View of the Cost Inspector appears as follows:



According to this view, the Cost Inspector has determined that the current mean of this process is offset from the optimal mean, resulting in a *Cost of Process Offset* amounting to more than 6 cents per container. Since, in this example, the optimal mean is closer to the LSL than the current mean is, the offset can be corrected by adjusting the filling machine to dispense slightly less product. At the top of the next page is the Detail View of the Cost Inspector for the same set of data:



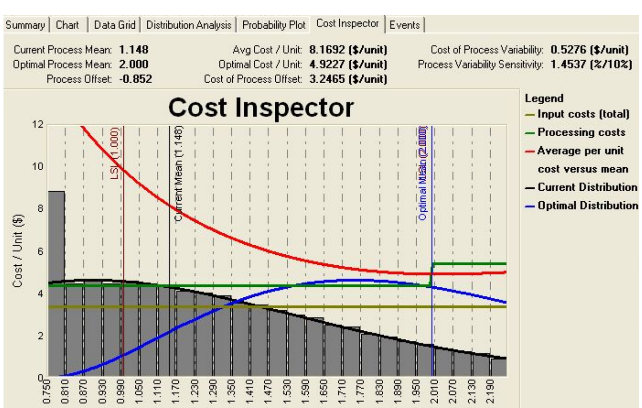
Notice the series of blue dots angling down and to the left from the middle of the graph. These dots represent greater and greater savings resulting from incremental reductions in process variability. A numerical display of these savings can be viewed by hovering the mouse pointer over the *Process Variability Sensitivity* value in the top right corner.

Sigma Reduction	Savings Per Unit	Savings Per Thousand Units	Savings Per Million Units
0%	$ 0.0000	$ 0.0000	$ 0.0000
10%	0.1016	101.5749	101,574.8723
20%	0.2044	204.3733	204,373.3390
30%	0.3085	308.4871	308,487.0775
40%	0.4140	414.0274	414,027.4105
50%	0.5211	521.1335	521,133.5367
60%	0.6300	629.9924	629,992.4403
70%	0.7408	740.8419	740,841.8602
80%	0.8540	854.0265	854,026.4759
90%	0.9702	970.2274	970,227.4334
100%	1.0912	1,091.1634	1,091,163.4132

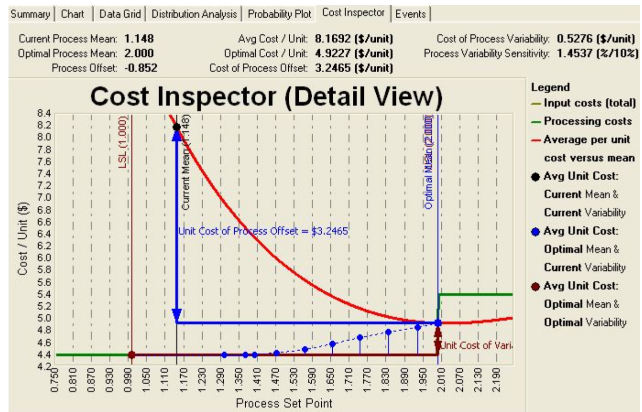
As can be seen in this mouseover hint, a complete elimination of variability will result in a savings of over a thousand dollars for every thousand containers filled.

Example #2: Machining

This example concerns a machining operation that comprises two individual processes, cutting and drilling, both of which have been analyzed by the Cost Inspector. For the cutting process, the Process View looks like this:



In this case, the process' current mean is offset to the left of the optimal mean quite a bit, resulting in a *Cost of Process Offset* equalling nearly $3.25 per unit. If the process is shifted to the optimal mean, $3,250,000 would be saved for every million units cut. Following is a look at the Detail View for this body of data:

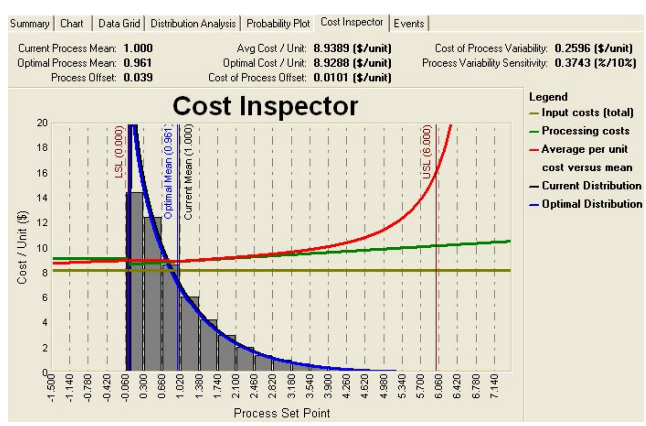


And the mouseover hint associated with the *Process Variability Sensitivity* looks like this:

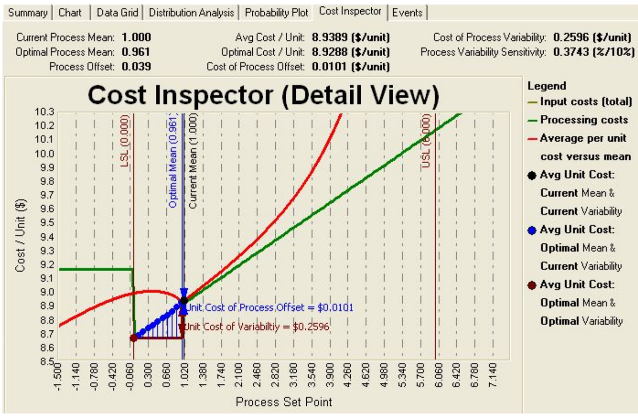
Sigma Reduction	Savings Per Unit	Savings Per Thousand Units	Savings Per Million Units
0%	$ 0.0000	$ 0.0000	$ 0.0000
10%	0.0716	71.5595	71,559.5320
20%	0.1512	151.2260	151,225.9788
30%	0.2407	240.7123	240,712.3226
40%	0.3364	336.3939	336,393.9381
50%	0.4285	428.5112	428,511.1716
60%	0.4981	498.0904	498,090.3794
70%	0.5259	525.8983	525,898.2639
80%	0.5276	527.6457	527,645.7366
90%	0.5276	527.6458	527,645.8011
100%	0.5276	527.6458	527,645.8011

According to this information, the savings associated with process variability peak at the eighty percent level.

For the second process within the larger machining operation, drilling, the Process View appears as follows:



Here, the optimal mean and current mean are visually close. Given that the *Avg Cost / Unit* for this process is nearly $9.00 and the *Cost of Process Offset* is around 1 cent per unit, efforts to correct offset may not be worth pursuing. The Detail View of this process' data appears as follows:



The series of blue dots in this case indicate that some savings, from reducing variability are available to be had, though perhaps not a tremendous amount. Looking at the *Process Variability Sensitivity* mouseover hint will clarify the savings opportunity precisely:

Sigma Reduction	Savings Per Unit	Savings Per Thousand Units	Savings Per Million Units
0%	$ 0.0000	$ 0.0000	$ 0.0000
10%	0.0334	33.4161	33,416.1334
20%	0.0631	63.0905	63,090.4785
30%	0.0898	89.7650	89,765.0112
40%	0.1147	114.7476	114,747.6165
50%	0.1391	139.0711	139,071.0715
60%	0.1633	163.2521	163,252.1129
70%	0.1874	187.4222	187,422.1533
80%	0.2105	210.4934	210,493.4423
90%	0.2347	234.6634	234,663.3642
100%	0.2596	259.5657	259,565.7079

Here, it can be seen, that a forty percent reduction in process variability will result in a per unit savings of over 11 cents. Depending on the number of units processed, this could add up to a significant total.