THE BASICS OF PROCESSES (1)

What is a process?
See definition in Figure 1 and an over-simplified example “Prepare a sample for assaying” in Figure 2.

Process Map

A process is
- A set of linked activities
- With a START and an END
- Each activity adds value
- The process is "owned" by somebody
- The process is repetitive
A process "turns inputs into outputs"

Inputs
Start

yes

no

“yes / no” decision point

Outputs

End

1. Crush sample to P95 / 1mm
2. Split off 500g
3. Pulverise to P95 / 106\(\mu\)
4. Check grain size
5. Split off 50g of pulp

Figure 2

Measuring process performance
On the example of Figure 2, let us make grain size a CTQ characteristic (Table 1) and assign the specification \([P95/106\mu, \pm 3\%]\) to it. Not meeting the specification results in a defect. One CTQ characteristic provides one defect opportunity per sample while two CTQ’s would provide two defect opportunities per sample and so on. In Figure 3, as 25 defects out of 125 samples processed equate to 200,000 defects per million opportunities (DPMO), on a scale of 1-to-6 Sigma, this DPMO number converts to a rather low Sigma value of 2.3 (Table 2).

Table 1

<table>
<thead>
<tr>
<th>Sigma</th>
<th>DPMO</th>
<th>% of outputs meeting the customer’s needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>308,538</td>
<td>69.1</td>
</tr>
<tr>
<td>3</td>
<td>66,807</td>
<td>93.3</td>
</tr>
<tr>
<td>4</td>
<td>6,210</td>
<td>99.38</td>
</tr>
<tr>
<td>5</td>
<td>233</td>
<td>99.977</td>
</tr>
<tr>
<td>6</td>
<td>3.4</td>
<td>99.997</td>
</tr>
</tbody>
</table>

Benefits of using a process-based approach
- Use process mapping to understand better how work is done!
- Add to CTQ’s any pertinent critical characteristics e.g. CTC and CTD’s (C for cost, D for delivery).
- Use the SIGMA metric to measure process performance. Too much process variation relative to customer specifications results in a low process sigma value.
- Core mining processes should aim for a performance rating around the 4-sigma mark.
- Use the 6-sigma methodology to improve an under-performing process and reach the target sigma value. Six-sigma includes a host of quality management and statistical tools as well as more sophisticated techniques such as FMEA (Failure Mode and Effects Analysis) and DOE (Design of Experiments).