ZEN GUIDE
to Manufacturing Intelligence

the path
to an enlightened look at
Quality Metrics

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Data intelligence is good. But *wisdom* is even better. Here's the difference...

In the digital age, no manufacturer needs to be told that it is important to collect data. But while it's smart to gather data that helps us track quantities and monitor quality, real wisdom often remains elusive.

The difference? An enlightened approach to data exposes the causes of production chain problems, not just the symptoms. When good data become incorporated within a larger system of intelligence, you can anticipate, monitor and control the downstream consequences of upstream events; you can achieve a mastery of the entire chain that not only measures quality, but provides actionable insights into manufacturing performance.

The truth is, manufacturers like you have no choice but to "go with the flow," to be swept into the current of dramatic changes as technology evolves and customer demand ebbs and flows. But with real data wisdom, you can gain the power to make more efficient choices; with enlightenment, you may be able to replace or mitigate expensive capital and/or resource investments with shrewd course corrections in processes, placing your enterprise in the most competitive position possible.

Achieving wisdom is not a one-shot effort, but a journey that unfolds over time. In this *Zen Guide to Manufacturing Intelligence*, we invite you to meditate on the steps along the way, revealing the potential for quality-control and cost-savings available to you by extracting more value from the data you collect.

Taking the first step on the data journey

For most manufacturers, the journey begins with good intentions and a clipboard. You're aware that you need data to monitor the performance of outputs, verify quality before shipping, and, in some industries, meet regulatory requirements.

At this "awareness" stage, collecting and reporting the data is mainly a manual process of inspected dials and spreadsheet entries. The application of the data is comparably primitive, often limited to basic pass/fail analyses that determine whether the output can be released or must be withheld. Components, subassemblies and functions are checked against design requirements; if the data are favorable, the product moves forward to the customer.

Shedding more light on processes

Yet even this primitive, manually-collected pass/fail data can be used to gather more useful manufacturing insight. Your pass/fail data can be used to compare the performance of:

- Similar machines
- Work stations
- Personnel activity
- Shifts
- Comparable assembly or subassembly workflows
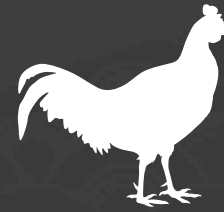
MEDITATION:

Fast-food chain gives a flock for healthy chickens

For a famous fast-food chain, achieving consistent quality in its chicken-breast sandwiches meant tracking the upstream quality of the chickens raised by its supplying farmers. In addition to monitoring feed, water, weather and other patterns, the fast-food company watched for disease levels, like septicemia and toxicity among its suppliers.

But they went beyond pass/fail inspections for its chickens; by comparing disease data farmer by farmer, flock by flock and even inspector by inspector, the fast-food chain gained insight into the process behind the consequences, helping it identify and then control the sources of outbreaks.

Taking the first step on the data journey
(continued)

The key is shifting focus, our mindfulness, from *product to process:*

Focusing on **product** simply tells us whether the output meets our or our customers' requirements.

Focusing on **processes** reveals differences between similar machines/resources/work flows, allowing us to identify more efficient ways to achieve the same outcomes.

Either way, you manually collect similar data from similar components, but the shift in mindfulness gives you much more valuable manufacturing intelligence.

In traditional Zen practice, a "koan" is a riddle Zen masters give their students to help accelerate their progress toward enlightenment.

In this guide (and with all due respect to tradition), a koan can be a key question manufacturers must ask themselves in order to extract more value, not just more information, from their data.

AWARENESS KOAN:

Does your pass/fail data pass the process test?

At the Awareness level in which basic pass/fail data are collected manually, your key question is this: are you using your data merely to pass judgment on product quality, or can you compare data from multiple sources to gain actionable intelligence that can help you improve manufacturing processes?

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Seeing the steps along the path

Perhaps the worst way a mine supervisor could collect carbon monoxide data would be to count the number of dead miners after exposure to the gas. Even into the early 20th century, miners used animal sentinels, the famous "canaries in the coal mine," as an in-process check; with a greater sensitivity to the gas, the birds would give way before the miners, giving the latter time to escape or apply masks.

The coal mine canary is a morbid example of the next advance in data consciousness from pass/fail outcomes. By intercepting information *upstream* – as the gas emerged and before it could concentrate in levels that would cause harm – the event could be addressed before its full downstream consequences, sickness and death, were imposed.

"Interception" represents a more progressive alternative to the retrospective, pass/fail awareness that collects product data at the tail end of a process. Collecting data *throughout* the process allows manufacturers to take corrective actions before adverse consequences occur.

MEDITATION:

Preparing landing gear for take-off

An aircraft parts manufacturer was responsible for a landing gear component, a set of double gears joined at ninety degree angles that fulfilled the crucial role of allowing the entire assembly to extend or retract – to move up or down.

Given the importance of the part, the manufacturer could not afford to defer data collection to the end of the production cycle. Instead, the gear subassembly performance was tested at various stresses and RPMs to inspect for abnormalities and failures. By intercepting data midway through the process, the manufacturer could not only determine whether or not the parts were built to specifications, but whether the specifications themselves were sufficiently designed for practical performance.

AWARENESS KOAN:

Where are the canaries in your coal mines?

Retrospective pass/fail analyses might come too late to provide real value for your manufacturing process. Where can you intercept the process with timely data collection that would allow you to make meaningful course corrections before you suffer adverse consequences?

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Coordinating intelligence and activity

At the previous level, intercepting the process to collect data allows manufacturers to make informed decisions affecting outputs.

But what if you could not only collect data, but *apply* that data to take corrective action immediately? The key is connection, linking data points to live manufacturing activities. In a French fry processing plant, for example, a rolling, six-foot belt throws freshly cut potatoes, three inches deep, into the air. Cameras inspect the fries, but they're not just collecting quality data, they're directing knives that move much faster than the eye can see to cut away unwelcome blemishes, creating a higher-quality product.

To achieve the data-action feedback loop, manual data collection is no longer sufficient; manufacturers must take a quantum leap into automated data collection that integrates data points into a real-time processing stream.

MEDITATION:

Replenishing anodizing chemicals at the speed of (flash)light

When you anodize aluminum – for flashlight cases for example – you must monitor the anodizing bath very carefully. As the treated products deplete the anodizing chemicals, manufacturers need to adjust time and temperature to maintain consistency before these chemicals, which are expensive, are replenished.

How much should such a manufacturer invest in data collection? If the company is small, works with limited batches, and has customers willing to accept broad output tolerances, it may be able to rely on third-party lab testing with data turn-arounds of up to three days. Should business grow, it might invest in its own internal lab, cutting feedback to 24 hours. But if the manufacturer is engaged in big business, it will want to make the most expensive yet most rewarding investment: real-time chemical analysis that can instantaneously stream data to systems that automatically adjust time, temperature and the chemical composition of the anodizing bath.

Coordinating intelligence and activity
(continued)

AWARENESS KOAN:

If a tree falls in a forest, can you harvest the lumber?

In manufacturing, the real question is not what the data reveals, but how it can be applied. Automated data collection allows you to integrate information from multiple collection points into one source of accurate feedback that, with the right systems, can instantly direct appropriate actions.

Using data for strategic, not just tactical, decisions

When integrated into operations, automated data collection adds obvious value to shop floor activities. But when that same data are mapped to key performance indicators – such as inventory levels, delivery schedules, even revenues and profits – the data gains strategic significance of value to the C-suite.

The next higher level of consciousness shifts attention from process improvements to business performance. By linking data to business goals and objectives, executives can make more enlightened decisions for greater cost-reduction and efficiency, such as:

- Gauging and adjusting capacity
- Anticipating supply and inventory needs
- Identifying opportunities for improvement that merit investment
- Quantifying the potential value of improvements
- Comparing real performance outcomes to business expectations

MEDITATION:

Delivery trucks "drive" production for beverages plant

Every day, beverage plants have to determine just which drink flavors they should produce in their facilities. If they're wrong, they could end up with excess inventory, or worse, they could fall short of customer demands.

A plant in Wisconsin closed the loop by linking delivery truck stocking data to their production scheduling. As drivers scanned product destined to convenience store shelves, the data automatically communicated demand to the processing plant. By integrating delivery at one end with operations at the other, the company allowed consumption to drive production, cutting inventory storage costs while seizing immediate sales opportunities.

Using data for strategic, not just tactical, decisions *(continued)*

AWARENESS KOAN:

How can the resources on the ground help you reach for the sky?

Chances are, you already have a great deal of production data to draw upon for process improvements. But can you take that data to the next level of value by using it to inform strategic decisions for achieving business objectives?

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Achieving ONE point of complete consciousness and control

We use data to form a more accurate picture of our manufacturing processes. But if our vision is confined door-to-door – from the intake of supplies for making our products to the loading bay from which we ship them out – we may be blind to the bigger picture: all the variables that affect our supply chain *before* manufacturing, plus the business impact of our products (such as customer satisfaction or consumer waste) *after* they have left our hands.

At the very highest data and quality control level, everyone can see the information they need to make responsible decisions through one integrated system of intelligence and action. In such a system, our quality nirvana, you understand and monitor *all the* important interdependencies anywhere in the chain, and are ready to deploy, in real-time, effective contingency plans that address issues as they arise. In this nirvana…

- All parties, from the factory floor to the executive suite, can see the information they need when they need it;
- Data are not only automatically collected, they are automatically integrated into supply, manufacturing and distribution streams;
- Every aspect of your business, from sourcing to consumption, is visible through one common data "window"
- Data can be applied to multiple levels of mastery, from the adjustment of design specifications to the projection of profits.

When data are integrated into an "enterprise quality hub," companies apply statistics to their data flows that help them predict and plan for likely future events. In this flow, quality metrics inform statistical analyses, which in turn inform contingency plans. While measuring quality does not, in itself, remove problems, it does help you prepare for them with *informed* choices that allow you to make cost-effective investments for the most efficient resolution of production and business challenges.

MEDITATION:

What's your nirvana look like?

The most important quality story is *your* quality story. Given the multiplicity of variables involved, it's impossible for us to draw a precise picture of a quality nirvana.

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CONSCIOUSNESS LEVEL: Nirvana

Achieving ONE point of complete consciousness and control (continued)

By asking yourself the following questions, you can begin to see what a completely enlightened quality hub could do for your enterprise:

- Can you gather relevant data at *every* point in the process that's relevant to output?
- Can you use data to compare performance by machine, resource, work team and other variables?
- Are you able to collect data from upstream nodes that allow you to intercept process issues before they become quality problems?
- Can you connect downstream output quality to your upstream data variables?
- Have you constructed a data-action feedback loop that links data to corrective actions?
- Have you automated your data collection?
- Does your quality data automatically feed into your manufacturing systems?
- Can you link your data metrics to your business performance indicators?
- Does your data inform your business at every level, from the factory floor to the executive suite?
- Do you have one window of visibility into all your quality data, regardless of source?
- Is all your relevant information integrated, from supply sourcing to product consumption?
- Does everyone in your organization have timely access to the information they need to function effectively?
- Have you applied your metrics to predictive statistical models?
- Do you have contingency plans in place for predictable events?
- Do you regularly revise your statistics and update your plans based on the data you collect?

Every unknown represents an opportunity for meaningful improvement – for practical ways you can apply data to save money and achieve greater manufacturing efficiencies. To learn more about controlling quality at your enterprise, contact a quality expert at 703.961.0200 or sales@infinityqs.com

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