InfinityQS®
Quality Re-imagined

Mastering Quality

White Paper

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From Data Collection to Data Transformation

Introduction

In today's highly competitive marketplace, manufacturers are only as good as their processes—and every organization is judged on the quality of the products they produce. Manufacturing organizations face a constant struggle to:

- Reduce scrap, waste, defects, and rework
- Improve product quality
- Eliminate variation in processes
- Maintain compliance with regulatory and customer requirements

As a quality professional, you may need better methods: to fix problems and prevent them. To reduce waste and rework, and improve the bottom line. And to improve quality—and never ship a bad product again. A modern approach to Statistical Process Control (SPC)—using real-time quality data—can help you master quality and achieve the operational excellence you need.

Optimize: Harness Your SPC Data Collection

The first step in establishing a successful SPC solution is to collect data. The second critical step is to make sure to measure the right things—and to then make good decisions based on that data.

With a bit of planning, your SPC data collection can set the stage for significant process and product improvements—and your SPC system will be poised to become the foundation for greatly reducing risk, waste, and defects. But for SPC to work correctly, you need to take a hard look at how you collect data.

When considering SPC solutions, consider this: You must be able to collect data from the process points that matter most to your business and customers—without jumping through hoops or purchasing additional software modules or devices.

Erase the Problem of Paper & Pencil

Surprisingly, collecting data with paper and pencil is more the rule than the exception: this is true despite many modern manufacturing plants incorporating some level of automation.

So why do companies still use paper to track this critical information? Usually, they claim that paper is "less expensive" than software. Another reason is habit: paper has been used for so long, it has become a habit—albeit a bad one.

Unfortunately, manual data collection has the propensity to introduce errors into an SPC system in the following ways:

- Data might be misread from paper
- Numbers could be transposed
- Data written on paper may be illegible or misinterpreted
- The paper might get damaged or lost altogether
- If transferring data from paper to an electronic system, numbers might be misread or entered incorrectly

Paper habits are not only ripe for error, they can be expensive. Case in point: generating enough paper to employ a librarian to manage it. And just what do you do with all that paper once the onsite library fills up? You pack it up and ship it to a warehouse! Librarians, paper, writing utensils, warehouses, and transportation: paper systems can be expensive.

Worse, how do you generate summarized reports from paper-based systems? First you must find the paper you need—the one with the right data on it—and then you need to cross your fingers and hope you can read it. If so, you then need to transfer the data to another medium, such as a spreadsheet. It's a time-consuming, laborious process fraught with error.

But here's the rub: if you don't transfer paper-based data to another system for analysis, that data is forever imprisoned on paper, and is not a benefit to your manufacturing operations.

The Problem with Spreadsheets

If you think moving paper-based systems to spreadsheets is a good idea, think again. Not only are spreadsheets unwieldy and challenging for operators and inspectors to work with, they are difficult to manage and organize. And they're a headache when the time comes for monthly reporting.

Consider a manager who requests a simple summary quality report for the month. Most companies create a new spreadsheet for each part number they run. Data from each part is saved in unique spreadsheets—and potentially hundreds of different part numbers can be manufactured in a month.

So, how can data from hundreds of different spreadsheets be combined to summarize a plant's quality levels for a specific month? How would you even know which part numbers were manufactured and which spreadsheets to access? It's not just tough, it's nearly impossible. And yet, the information contained within and across those spreadsheets is exactly what managers need in order to make intelligent process decisions.

Whether using spreadsheets or paper-based quality systems to gather data, the critical information needed by companies to better manage their plants is inaccessible—and unable to be leveraged for improvement.

Modern Data Collection Features

Modern data collection should support data entry on tablet devices, PCs, and smart phones. Wireless connectivity should be all that's required, and there should be little need to involve your IT department.

Make certain that the software you use to collect data has the flexibility to mirror the way your operators collect data on the shop floor. Software should make data capture much faster than an operator writing on paper, and it should enable operators to easily enter (without typing) traceability fields, quality data, and other information found on paper forms—while automatically noting time, date, shift, and operator name.

Look for variety in data collection technologies. You want to consider electronic data collection features for hand-held gauges, programmable logic controllers (PLCs), pre-existing databases, and manufacturing execution and enterprise resource planning systems.

Those types of data should be able to be captured automatically, without engaging an operator. In addition, barcode scanners are a fast, convenient, and inexpensive way to enter defect data or to associate information (such as purchase order numbers, lot codes, and other descriptive fields) to data that is being captured by operators and inspectors.

Operators enjoy working with InfinityQS because it makes data collection fast and easy. If it eliminates the hassles associated with juggling paper and spreadsheets, they will thank you. And if you win the support of operators and inspectors, they will quickly embrace your new SPC system.

Notify: Use SPC Process Alerts to Stay on Track

The purpose of real-time Statistical Process Control (SPC) is to monitor production processes and leverage critical information to improve product quality. SPC answers that call by regularly collecting, monitoring, and analyzing production data. An important part of that analysis is providing process alerts and notifications to operators, inspectors, quality professionals, and managers.

By analyzing data and triggering alerts, SPC software communicates in real-time to the right people when issues arise—reducing or eliminating risk, waste, and defects.

When data is collected on the shop floor, you need to decide what alerts and alarms should be enabled, such as when:

- Operators and inspectors are required to gather data
- Process performance changes significantly (statistical alarms that define out-of-control conditions)
- Data falls outside of specification limits (engineering limits that define a product's acceptability)

These notifications are so important because they enable your SPC system to give you information that can prevent trouble—or minimize its impact—before issues negatively affect your bottom line.

Data Collection Notifications

Your SPC system needs to remind operators and inspectors when data collections are required. SPC software should be extremely flexibe, enabling you to configure scheduled, regularly-occurring quality checks at different times of the day—and in different areas of the plant. And when data collections are missed or skipped, you need to be notified, and reports should tell you what was missed and why.

Timed notifications help to ensure that samples, inspections, and quality checks aren't forgotten, and that they occur when

they need to. Say you need data from a specific product feature to be collected every hour. Rather than ask your busy operators to remember to gather data every 60 minutes, they can instead concentrate on production tasks while relying on the software to remind them.

Timed notifications in our products display to the user as:

- Countdown timers
- Emails
- Dashboard icons indicating number of notifications
- Notification windows that display in different colors based on data collection status

Notifications when Process Performance Changes Significantly

Your SPC software should alert you the moment data violates a statistical alarm rule. Operators should be notified in real time—and so should engineers, support staff, and you.

Real-time alerts help mitigate the damaging consequences of excessive variation, unsafe products, unbalanced ingredients, and more. Whether visual or auditory, alerts must catch the user's attention and reach them **wherever** they are, **whenever** a violation occurs.

Notifications when Data is Outside Spec Limits

No one wants their products to violate specifications. When it happens, you need notifications to reach the right people.

All team members—engineering, management, quality, or other support personnel—must receive real-time notifications stating exactly what product is out-of-spec, and where and when the violation occurred. This minimizes additional violations, and helps your company isolate and remove the root cause of those issues.

Get the Notifications & Information You Need

You need to choose a SPC solution that provides simple configuration of notifications, automatic alarming, emailing, and robust process alerts and notifications—to help keep operators and quality users focused and ahead of potential quality issues.

Prioritize: Make the Biggest Impact on Quality & Cost

Alerts and notifications are great for helping to put out fires. But that's just the problem-solving part of data collection. What about data that doesn't trigger alarms?

And what do you do with the overwhelming amount of data that actually falls within specification limits? The good news is this: this data can help focus and prioritize your quality improvement efforts.

Whether you are responsible for the quality of a single line or hundreds of plants, look for an SPC solution that stores all quality data in a single, centralized repository. When it's all in one place, data can be easily accessed and aggregated.

Data aggregated across multiple lines or plants enables you to see the big picture—and that drives strategies that can transform your organization's performance.

How to Quickly Make a Big Impact

With your data all one place, you can make a difference. Imagine being able to roll up all that data and view it in its entirety on a single screen—a view that highlights where your company has the greatest opportunities for improvement. Imagine being able to instantly determine where to initiate improvement projects that could make the greatest positive impact on quality and costs.

This all comes down to prioritizing quality efforts, and we're not talking about analyzing data that triggered alerts and alarms.

We're talking about aggregating all your quality data—even those that fall within specification limits. Doing so will enable you to pinpoint and prioritize where to deploy your scarce and valuable quality experts—and generate the biggest bang for your buck—as quickly as possible.

Prioritization in Action

Let's say you're an operations director at a company that has 16 plants. Your company has quality issues, and your competitors are tougher than ever. You need to reduce costs and make a big impact on your company's bottom line, as soon as possible.

You need the ability to view quality across all your plants, to identify clear strategies for how to eliminate costs of poor quality.

That's where a cloud-based quality intelligence system—such as those offered by InfinityQS—can help. Since quality data

	Grading		Minimum	Maximum	Definitions
Yield Potential	A	High	99.950%	100.000%	Good Technology
	B	Moderate	99.730%	99.950%	Satisfactory Technology, Consider Maintenance
	C	Low	---	99.730%	Poor Technology. Technology Update or Maintenance Required
Yield Performance	1	High	95.000%	100.000%	Effective Operations
	2	Moderate	90.000%	95.000%	Satisfactory Operations, Consider Additional Training
	3	Low	---	90.000%	Ineffective Operations, Additional Training Required

from the 16 plants is centralized, you should be able to easily aggregate all data on a single chart. That chart should provide critical information to you, such as performance comparisons, yields, and related metrics between regions, plants, and production lines. The table below—from an InfinityQS cloud-based quality solution—shows grading definitions for both Yield Potential and Yield Performance.

Color-coded "stop light" reports (like the image to the right) should identify grades for each plant, production line, product, and/or feature. With reports like these, your greatest opportunities for improvement—and your quality priorities—will be clear. As a result, you should be able to easily prioritize company- and plant-specific efforts to improve overall quality. The image below shows an example of how easy it should be to understand where you could prioritize your quality efforts.

Quality employees who want to drive improvement and competitiveness throughout an organization need this level of visibility.

Without it, you are blind to the greatest opportunities to cut costs and boost quality. Powerful reports such as these highlight your greatest opportunities for improvement while guiding global and local plant-based quality efforts. The big quality picture can help you prioritize your quality efforts and drive specific, meaningful, beneficial improvement strategies throughout your organization.

Site(s)	Weight	Length	Width
Buenos Aires, Argentina	A1	B1	A2
Fairfax VA, USA	A3	C3	B3
San Jose, Costa Rica	A2	B2	B1
Stillmore GA, USA	A1	A2	C1
Toluca, Mexico	B1	A2	A1

Analysis: Digging in With the Right SPC Tools

It's not enough to prioritize. You need to get your "detail people," your data experts, involved and let them do what they do best—analyze data and extract actionable information that can drive efficiency and yield improvements.

Engage the Data Experts

Quality Professionals, Engineers, and Six Sigma teams: they are the miners who will extract gold from the big picture of your quality—providing guidance and prioritization.

But first they must know where to look. The prioritization you just performed, in which you aggregated all operations data and identified "stop light" items, is the map that highlights opportunities for improvement, and which defines where your analysis experts need to dig.

Dig into Priorities

For your data experts to perform the necessary analyses, your SPC solution must include a broad variety of statistical tools. They shouldn't need a statistician, an IT expert, or a code writer—data should be intuitive, simple to manipulate, and easy to interpret.

These experts must be able to easily sift through vast amounts of process data using robust statistical tools. The best tools should easily enable analyzing of aggregated data from multiple plants, product codes, production lines, and features—and display it on one chart. Only then will that process information be easily consumed and critical information instantly highlighted. Your analysts will likely be working with massive amounts of data from disparate sources—still, their statistical tools should be easy to use.

Statistical tools also need to be sophisticated enough to enable expansive sorting, slicing, and dicing of data—while contending with varied numeric scales and different specification limits. These capabilities should be expected of any cloud-based quality system deployed across an enterprise.

Once properly equipped, your data experts can dig up the gold you know is hidden in your data. Their success means that you will know exactly where issues lie, and which improvements can immediately benefit operations—in specific areas, and across the enterprise.

Reporting, Communicating & Convincing: Using SPC Data Analysis to Effect Change

Now that your data miners have completed their analysis and determined some groundbreaking ideas for plants across your organization, they need to report on what they've found.

Your company can operationalize process changes only if your data experts can effectively communicate their findings. Only then can they convince the powers that be that proposed improvements will result in operational improvements… and make life better for everyone involved.

Convincing Them Why Quality Data Management Matters

Your data experts need to report their findings to local plant personnel: operations directors, plant managers, quality managers, and other operations team members with one goal in mind: **convincing them** that the valuable information that was uncovered will dramatically improve operations.

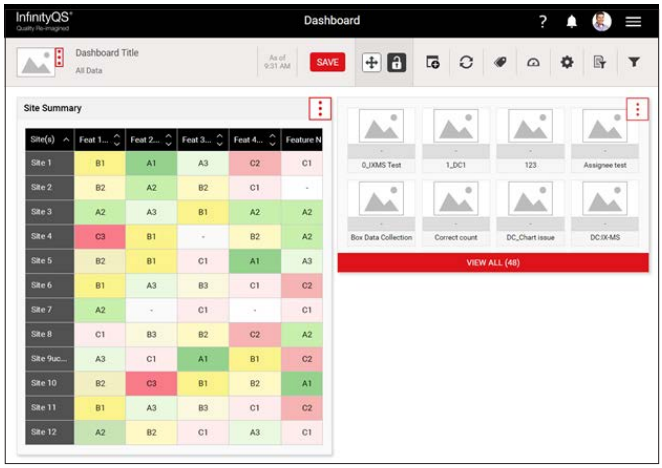
Why is convincing even required? Because data experts typically don't work at a plant, and they run the risk of being viewed as outsiders. So, despite having a plant's best interests and heart—and trying to help manufacturing operations run more efficiently—they are often perceived as interlopers.

Critical information still must be conveyed because it can be organization-changing; your data experts need to be **convincing** to achieve buy-in from plant personnel. And the real work—the changes that needs to occur within the organization—take place at the plant level. Shop floor personnel put into action the plans conjured up by the data experts. The first step data experts need to take to get through to these people is to be sure that the **reports** they generate are communicating the right information to the right people.

Reporting to Multiple Audiences: Help Them Buy What You're Selling

The statistical tools in your SPC solution should easily support the analysis of aggregated data from multiple plants, product codes, production lines, and features, and **place it all on one chart** that's easily digestible.

The information that speaks the loudest to plant managers is often cost/efficiency improvement and waste reduction numbers. Plant managers need quantifiable data that makes their operations (and, in turn, themselves) look good.



The chart above shows an example of prioritization in action: the red squares alert you and command attention, while the green squares indicate that everything is ok. To dig into the red cells in the example above, a user simply right-clicks to display the information they need to act upon—including more detailed statistical reports.

Transform Your Organization from the Plant Floor Up

When reports have been communicated and you have everyone's buy-in, the exciting work begins. The information is put into play (made "actionable") and the transformation of your organization can truly begin.

Creating the "Aha!" Moment

It's time! Your corporate Six Sigma and quality experts have arrived at the plant to communicate the information they have found. They have the plant's best interests in mind, but it's possible that local experts may cautiously receive the information from the corporate folks.

The experts make their pitch—a variety of improvement recommendations—and the local shop floor operations people are skeptical. But, they're willing to try something (maybe just one little thing) on a limited basis.

Your experts recommend the following: gather data from a single line or across multiple lines and compare the results to the data.

That is the "Aha!" moment: data can be converted into useful, operationally-beneficial information—even when generated by people who reside outside of the plant. We hear it all the time: "We had no idea this was happening," or "We had no idea we could learn so much from data that's in-spec."

Consider the benefits moments like these can have for an organization: suddenly, people realize that corporate quality experts are truly invested in supporting plant operations. It becomes a case of, "we're all in this together," and "look what our team can do to support company success."

InfinityQS has played a role in many situations like this, and it is very satisfying to see data, information, and success brings people together. It helps everyone involved—and makes every one of them an engaged stakeholder.

From "Aha!" to "Let's Try This!"

Collected data gets people thinking about areas from which data **isn't** collected—and where it would be beneficial to do so—making them think of other ways in which quality can be improved and where additional costs could be reduced.

That initial push can become a catalyst to further quality improvements for your organization and, eventually, a lasting transformation of performance.

The beauty is that everyone benefits: plant managers, quality managers, operators, quality personnel, data experts, engineers, and executives… not to mention the company's bottom line.

But It Doesn't End There

The most successful organizations we have worked aggregate data across production lines, products, and plants. They make a **habit** of interrogating that data (once a month or once a quarter), and continuously uncover information they didn't previously have at their fingertips—and then they act on it.

Regular data interrogation is an excellent strategy for companies who want to maximize operational efficiency while minimizing costs.

Remember, the "techniques" are easy—and here they are in a convenient sequence of eight events:

1. Keep collected data in a centralized data repository
2. Use an SPC solution that configures scheduled, regularly-occurring quality checks
3. Aggregate the collected data so you can get a fresh look at it
4. Prioritize possible improvements in your operation
5. Engage your data experts to analyze and really dig into the priorities
6. Unearth exactly where issues exist
7. Report and communicate findings to operations
8. Rinse and repeat (monthly or quarterly)

It has been our experience that—almost without exception—operations folks exclaim something like "We had no idea that improvement results could be so dramatic!" Behind closed doors, local employees are usually thinking "Well, what do you know. Those corporate guys can be useful after all!"

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Continued Success = Momentum

From here, keep your foot on the gas: nothing keeps momentum going like continued success. Become comfortable talking about the data that might be interesting to aggregate, the potential you see in continuing monthly data interrogation activities, where changes might be made, how exciting it is for your organization, and how the team is making lasting changes to make your organization more profitable, more competitive, and more successful.

Continually working through these techniques—and having the right SPC solution in place to make it all easy—pulls everyone together. The ongoing results can help you truly transform your company through quality.

About InfinityQS International, Inc.

In business for more than 30 yesrs, InfinityQS is the global authority on enterprise quality. The company's manufacturing intelligence solution delivers unparalleled visibility across the enterprise, from the shop floor to the boardroom, enabling manufacturers to re-imagine quality and transform it from a problem into a competitive advantage. Powered by centralized analytics, InfinityQS solutions provide operational insight to enable global manufacturers to improve product quality, decrease costs and risk, maintain or improve compliance, and make strategic, data-driven business decisions.

Headquartered near Washington, D.C., with offices in Seattle, London, Beijing, and Shanghai, InfinityQS was founded in 1989 and now services more than 40,000 active licenses with more than 2,500 of the world's leading manufacturers, including Kraft Foods, Ball Corporation, Boston Scientific, Graham Packaging, and Medtronic. For more information, visit infinityqs.com.

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