A Guide for Manufacturing Managers: 7 Common Tasks Made Easier Using Your Part Production Data

Improve response time to quality problems, first time yield (FTY), test limits, cycle time, EOL failures, and more

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INTRODUCTION

For many manufacturers, staffing and supply chain pressures in recent years have accelerated the need for change. Manufacturers are advised to invest in processes and technologies that will increase their resiliency and adaptability. This particularly important for operations that continue to rely on manual, paper-based processes.

Regardless of where your plant lies on your digital transformation journey, your most essential tool for achieving practical, and profitable, change is your production data.

In this ebook, we discuss 7 topics that impact any production line. We use case study examples to illustrate the results that can be achieved when a manufacturer's line is equipped to collect, correlate and analyze the ***right*** data, to achieve new levels of quality, efficiency and profitability.

So, what do we mean by the ***right*** data? It's what we call, "part production data". We'll discuss this further in the next section.

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Overview:The Difference Between Part and Machine Data

There are many types of data generated in a factory, each with its own role to play. Many approaches focus on tracking what is occurring with each station, monitoring machine performance. Though important, it does not provide some critical information that can enable improvement or quick response to issues.

The examples in this ebook are based on what happens when serialized part-specific data is collected at key operations along the assembly line – detailed tracking of what is happening at each process or test – and how it can be used to address common everyday requirements.

Making Your Part Production Data Work for You

With the correct measurement, monitoring, and alerts set in place, quality engineers and operators are empowered to respond to product quality issues quickly, in production real-time, before the issue progresses further downstream and becomes a bigger problem.

The rest of this ebook illustrates 7 practical ways that your part-specific production data can be used to boost performance on your line, with real stories and results from Sciemetric customers.

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1 | Better Performance Begins with First Time Yield (FTY)

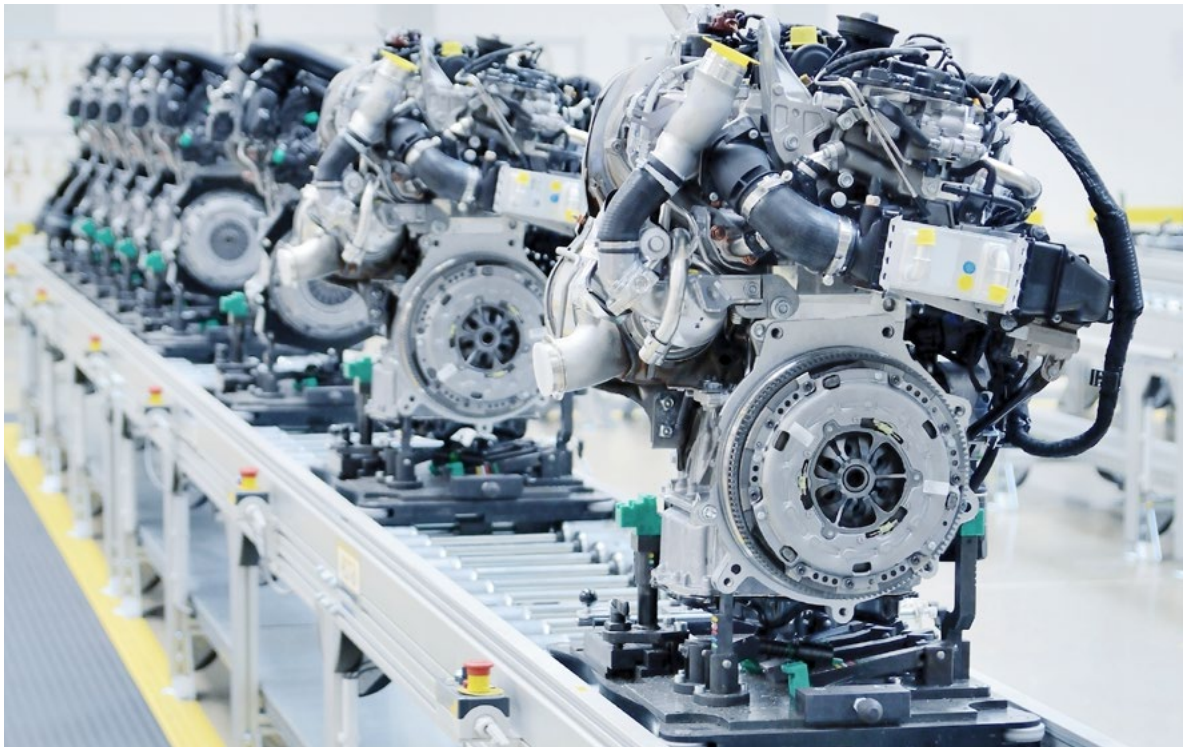
First time yield (FTY, also calculated as rolling throughput yield (RTY), or first time through (FTT), is often a manufacturer's touchstone for greater efficiency and quality, versus overall production yield. Here's why:

Production yield alone can be deceiving. It doesn't break out the added costs associated with those parts or assemblies that had to be reworked or re-tested to make the grade.

For example, a production yield of 98% may sound great, but if 10% or more of the parts required some amount of re-work, the average cost to produce each unit may be quite expensive.

FTY, on the other hand, yields more accurate insight into the health of the line because it tracks the percentage of good parts produced that make it through the entire manufacturing process without any failures.

On a complex line with many production steps, parts can be re-worked or re-tested multiple times. Successfully tracking FTY requires the right data and can result in significant cost savings each year.



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Achieving $3M+ in Annual Savings Through a Focus on FTY

Take a product that costs $5,000 to manufacture – $2,500 for material costs and $2,500 for transformation costs. The annual target production run rate is 10,000 units and the overall FTY is 90%. If the manufacturer doesn't re-work the failed units, then 11,112 units must actually start production to achieve the target output of 10,000.

This results in $5.6 million in scrapped products – millions of dollars that's wasted every year. This has another consequence – it also increases the total cost to manufacture the product from $5,000 per unit to $5,556.

Now assume that the manufacturer implements a re-work process that recovers 80% of those failed units. This boosts overall yield from 90 to 98% (note that FTY remains at 90%). The cost of this re-work is 50% more than the initial transformation cost, so $3,750 per unit instead of $2,500.

This does appear to be a worthwhile investment considering that $5,000 has already been committed to the failed unit. But look at it this way – total rework costs amount to $3.8 million per year. This boosts total average production cost per unit from $5,000 to $5,485.19.

Now, what if we could raise FTY from 90 to 98% – hitting the same yield without the cost of rework?

Total average production cost per unit would be $5,102.04, for a total savings per part of $383.15. That adds up to about $3.83 million in savings per year.

Such FTY improvements can be achieved by adding – to your existing stations – in-process test and monitoring tools that use your part production data to cut the cost and complexity of improving FTY.

See how another manufacturer improved their FTY by over 18%, using production data to overhaul quality on a global scale Case Study ›

2 | Set More Effective Test Limits for More Accurate Pass/Fail Results

To improve FTY, our first step is to determine and apply the right limits and feature checks for each production process or test.

The methods to create tests often involve a lot of guesswork, but with the right tools, they can be data-driven. More accurate pass/fail means you can reduce false rejects, catch actual defects and learn how to avoid them in the future.

Modern analytics software makes it easy to visualize and manipulate part production data, to identify where limits should be tightened (or loosened) and to determine what new feature checks may need to be added to a process or test.

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Improved Test Repeatability

We worked with one manufacturer of agricultural machinery that had a Gage R&R on a leak test so dismal (about 40%) that plant staff had begun to ignore fail results altogether. They resorted to tricks attempts to achieve a pass, such as pressurizing the part faster during the fill phase or running the test repeatedly.

Warranty claims began to rise in the field on tractors that were worth hundreds of thousands of dollars. This threatened the market reputation of a premium brand.

The manufacturer turned to us for help to identify the right test limits. Running analytics against available part production data compared to the signature data of past failures, we were able to test various scenarios off-line. It was determined that the test required more capabilities to address the issues. We added digital tools to the existing test stands that could measure and manage pressure regulation down to one-millionth of a PSI, along with sensors sensitive enough to compensate for any ambient and internal temperature variations.

This resulted in a Gage R&R of 40% being cut to 5% and far fewer faulty assemblies leaving the plant. The investment in new technology paid for itself in a matter of weeks.

Learn more about how this manufacturer cut warranty claims using a combination of the CTS Sentinel 3520 and Sciemetric's QualityWorX software solutions

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Faster Test Setup

Such data-driven insight can also be applied to set up and run-off a new test stand – or a production line – faster.

Take leak test.

You don't have to run a series of tests to set up and run-off a new station. Instead, run the test just once at the longest cycle and then review the data that's been generated. This will provide a visual record that illustrates the results of running the test at only five seconds, or 10 or 25, without having to run the test again at those cycle times.

At one manufacturer of military vehicle parts, we used this principle to quickly determine which of two types of leak test, pressure decay or flow, should be used for shock absorbers that need to take a beating.

Another Sciemetric customer has been able to launch new lines 8x faster, going from 180-360 days down to 15-45 days. The data collected from the stations during run-off made it easy to identify the causes of start-up problems, quickly resolve issues and generate needed reports. When lines were being cloned at other plants, using the data from the existing line provided clear expectations on targets for the new ones.

The more signatures you capture from any process or test station on the line, the easier it becomes to run data models and simulations that accelerate how quickly you can hit your full production stride.

3 | Reduce Cycle Time to Boost Output

The need to increase production capacity often forces manufacturers to reduce cycle times. With historical part data and the right analytics tools, test cycles can be analyzed to determine where time can be saved, with real insight on the trade-offs.

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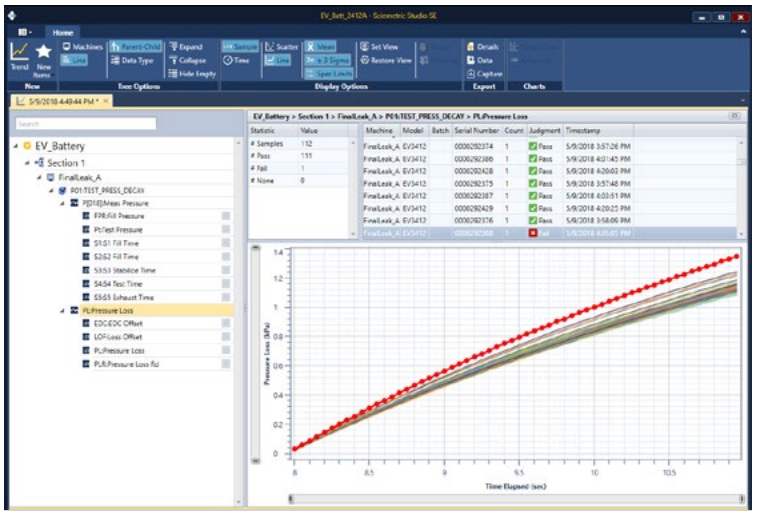
Data Analysis and Visualization Used to Reduce Cycle Time by 21%

At an automotive OEM, test cycle times were too slow to meet production targets. In addition, the FTY rates at transmission stations were well below acceptable percentages.

The OEM launched a trial where we added to the existing stations the digital intelligence to collect, visualize and analyze all the relevant test station data to determine the fix.

Quality engineers soon were able to attribute the low FTY rate to a valve in the transmission assembly that wasn't opening properly. This caused slower pressurization of the torque converter cavity, leading to a longer test cycle and a less reliable test. The manufacturer was able to adjust the tests to find this issue more quickly.

Learn how the manufacturer implemented this solution Case Study ›



Sciemetric Studio allows you to overlay waveforms to easily visualize and identify anomalies in the data to pinpoint faulty applications/processes. This screen shows a waveform trend on pressure loss data at a manufacturing station, with the faulty process clearly identifiable (highlighted in red). This part can then be easily identified by part number and removed from the line.

Correcting the issues identified using data analysis led to a 21% reduction in test cycle time, as well as an 11.5% increase in FTY.

75% Production Increase Met Thanks to Faster Cycle Times

A small engine manufacturer had to run eight off-line leak test stations to keep up with an annual production volume of 3.2 million assemblies on its carburetor line. The cycle time for a leak test was 16.3 seconds. To bring the test in-line, this had to be cut to less than eight seconds.

The real challenge came when the manufacturer decided to shift production from another plant. The carburetor line had to boost its production by 75% – 2.4 million additional units per year – without increasing the number of leak testing stations or the associated costs.

We worked with the manufacturer to apply a digital, data-driven approach and improve test efficiency. As a result, leak test cycle times were cut, not to the desired target of eight seconds, but to 4.5 seconds. The leak test could now be integrated back into the assembly line. Only four, rather than eight, test stations had to be staffed to handle all 5.6 million units now being produced.

The new system also addressed a 5% failure rate that had left thousands of units to be scrapped every week and eroded confidence in the reliability of the leak test. A Gage R&R rate so high that staff stopped measuring it at 30% was reduced to just 4%. Without the visibility and insight provided by part data, this would not have been possible.

4 | Save Cycles and Costs Caused by EOL Failures

The sooner you detect and correct a production flaw, the less disruptive it will be to overall production, and the less costly it will be to fix.

For overall quality gains, your team's focus must be on more than just a final quality check at the end of the line. Consider what additional checks can be implemented at every critical stage as a part or assembly progresses down the line.

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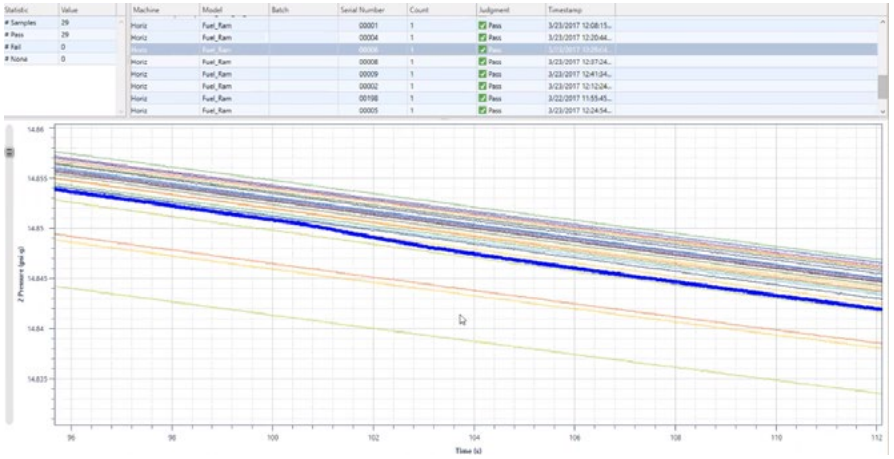
Cracking Valves Drive EOL Failure

An engine manufacturer experienced failures at end-of-line test. Check valves were failing at the final test and plant staff couldn't determine why. The parts had already passed an upstream leak test.

By analyzing data of all engines assembled on the line once the failure showed up, we were able to characterize the issues and set up new feature checks to catch these problems in the future – *before* the part moved further down the line.

We began by examining the part production data – specifically, the digital process signatures – generated during the leak tests of the engine valves that had subsequently failed their EOL tests (see right).



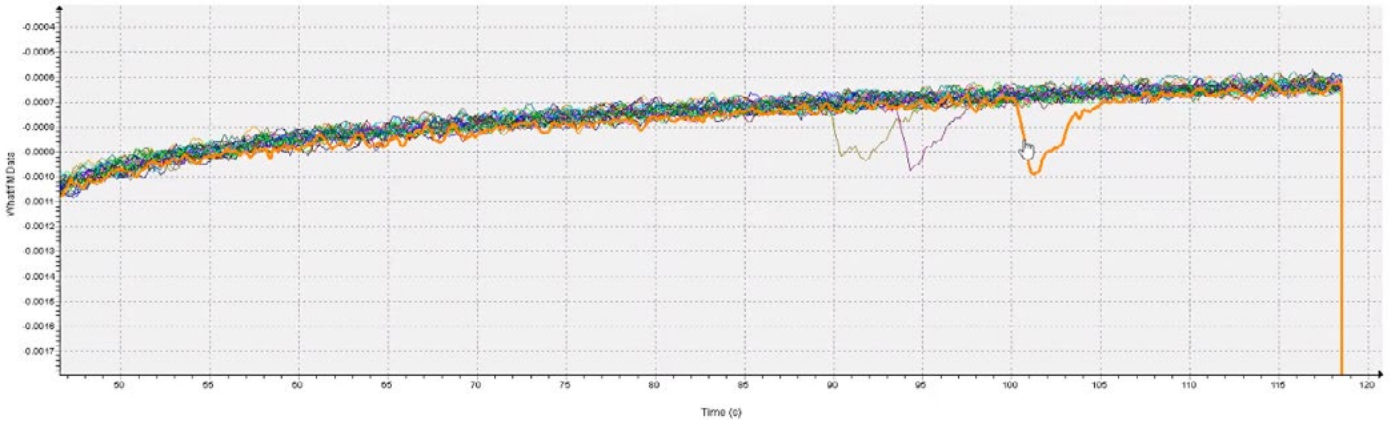
Using Sciemetric Studio, we were able to isolate the waveform for a specific failed part by serial number to spot anomalies during test.

In this view, it is evident that there is a very slight "cracking" or pulse, by each faulty check valve during its leak test. The test pressure was only 15 psi, when it should have taken magnitudes greater pressure for that valve spring to crack for even a split second. The fault caused a very slight leak of about two CCs over a few seconds that would then self-correct.

This deviation went unnoticed given the current leak test "pass" parameters. So, we employed Sciemetric's "what-if" analytics tools to help identify new featured checks that would catch this deviation during the leak test and make it more obvious to a station operator.

We then implemented the new algorithm as part of the leak test station quality checks on the factory floor for more reliable pass-fail in production real-time.

The key to success in this case was being able to access the right data, collected and archived by part serial number. Having the digital process signature of the entire leak test cycle provided the manufacturer with the granularity to zoom in on the data and determine how best to highlight deviations that had otherwise been missed.



Using Sciemetric's "what-if" tools to apply new parameters to the production data offline, we were able to confirm a new algorithm that would catch these deviations in future tests.

5 | Improve Repair Bays to Enable Proactive, Continuous Improvements

On many manufacturing lines, the production data that charts a part's history continues to be left scattered and trapped in data silos. There is no insight for a repair tech to spot emerging trends or patterns that may point to a systemic problem at a specific point on the line.

Repair bay operations can be viewed as much more than a reactive function. An effective repair bay in the modern plant should operate with a two-way flow of data.

When part-specific data is available, the repair bay can become a *proactive* part of the production line, to drive your defect data management strategy for continuous quality improvement.

Real Benefits

Manufacturers that have implemented Sciemetric solutions have access to all the data related to the part – defect, location, repair data and operator or repair tech comments – and it can be aggregated into a consolidated birth history record that is tied to the part's serial number. All these records can be stored in a single database that can be searched and cross-referenced with data management and analytics software, on demand.

Any repair technician can then draw on the part's production history in digital format using its serial number. Once the repair is complete, they can add the work they have done to that record.

This enables two benefits: First, your team will be able to diagnose future failures faster and identify exactly what needs to be repaired. Second, they can trace the root cause of the issue on the line and determine which production adjustments or refinements can be made to prevent the quality issue from happening again.

6 | Enable a Fast Response When Something Goes Wrong

What if a defect isn't caught until after a product is on the way out of the factory or already in the field? With the right data strategy in place, you will be able to respond quickly and efficiently. We've seen customers able to pull specific parts from the loading bay – what they called a "trailer pull" – within an hour of discovering an issue.

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Recalling 7 Instead of 10,000

We worked with one automaker that faced recall costs of > $5M due to a problem that only cropped up after vehicles were on the road. To find the issue, the manufacturer revisited the part found in its serialized part production data.

The customer used our analytics to identify the defect and understand what to look for in the data. The issue turned out to be an undrilled hole in the engine block. **They were able to characterize what that issue looked like using digital signatures and find the seven specific engines out of 10,000 suspect ones that possessed the defect and had incorrectly passed an EOL test.**

This not only avoided millions in costs, it also mitigated the negative public relations impact with consumers.

See if there is anything off about the part's original leak test signature, even within the range of standard deviation. And look at the signature data from the other processes upstream that touched the part. Sometimes, a problem just doesn't show up at the leak test station.

For example, maybe a pressing operation was flawed and this can show up in the force versus distance reading of that process. The part may still pass its leak test, but will eventually leak like a sieve when subjected to the conditions of normal use over time.

Avoid Production Downtime Due to a Quality Issue

When a manufacturer of agricultural machinery had a unit come back from the field due to a customer complaint or potential warranty issue, it routinely took as long as a week to retrieve all the associated data from across the plant to identify the cause and fix it on the production line.

In a specific example, a faulty gear system caused high-risk issues for customers in the field. The plant halted production until the cause of the defect could be found and addressed, every minute costing the factory.

Following the implementation of Sciemetric digital monitoring and data analytics, they were able to quickly drill down into the data to determine the problem in hours, limiting the downtime. They also updated their tests to detect the defect going forward to eliminate future risk.

A single incident provided payback on their investment.

7 | Digitize Paper Records for Greater Access and Deeper Insights

We often reference the "data silo." These are datasets that may be key to catching a defect early and tracing root cause, but they can't easily be used for this purpose because they remain trapped in a PLC, a process or test station, a computer terminal or some other device that isn't networked with a central database for easy retrieval. However, if data is digital, it can be consolidated.

Many data silos are not digital at all. Instead, they exist in the form of paper and folders. In this case, these records should be converted into a digital format if they are to be made effective for comparison and data review or analysis in the event of a quality issue. This will avoid the typical downside of manual data entry: accuracy and human error in reporting and the ability to scale production if required.

For this conversion, a next step could include looking at ways to automate more of this collection. Most production floor systems have a data output mechanism that can be harnessed; even if the vendor cannot provide collection and storage, 3rd party systems like Sciemetric make it possible. refine what is being collected and how it is being reviewed, and looking for ways to 'connect' your data that is gathered across the line, or even across different plants, to eliminate data silos and enable more informative data analysis.

Consolidating data from multiple processes into a single source makes it easier for front-line workers and plant managers to access the information they need.

PROVEN RESULTS

Plant Expects to Save $2M-$3M/Year

Adapting a fully automated workflow to digitize your paper records may require a substantial upfront investment. The benefits over the long-term, however, can far outweigh the initial cost.

In fact, one maker of medical devices estimated that eliminating manual paper processes and applying our automated data collection solution will reduce its costs per plant by $2 million to $3 million a year.

It all began by eliminating a costly production bottleneck related to quality inspection by switching to digital records. Production yield, and product quality, could then increase to meet soaring customer demand. **Read our case study to learn how Sciemetric made this possible >**

Ditch the Spreadsheets for Reports and Fast Response

Manufacturing engineers and quality managers tend to spend a lot of time producing reports to demonstrate part compliance to quality standards. This is in addition to deep-dive analysis whenever there are quality issues that need to be investigated. Hours, days or even weeks can be spent trying to get the information that answers the questions.

For over 20 years, Sciemetric has been at the forefront of providing useful and actionable production data to help manufacturers not only save time in their busy days but also provide real value-added information that makes a difference.

How Sciemetric Can Help

Sciemetric delivers the insight to conquer your most critical issues and enable continuous improvement on your line

Your plant generates data. That data is a powerful tool for your team provided it is collected and organized in a way that allows for easy visualization and analysis, in real-time.

That's where Sciemetric comes in.

Our digital tools and expertise—honed and proven over decades on hundreds of client sites worldwide—can help hone the large amounts of data generated by your operation. We can connect and measure virtually any test or process across a production line or in a plant.

Get practical insight that is useful, today. Sciemetric's team of specialists are expert at using your data to find and fix the root causes of issues that are costing you time, money and reputation with customers and partners.

It all begins with additive technologies that are fast, efficient and cost-effective to install, configure and operate. **At Sciemetric, we help you make the most of your existing technology investments—without a costly rip and replace.**

You can rely on us to:

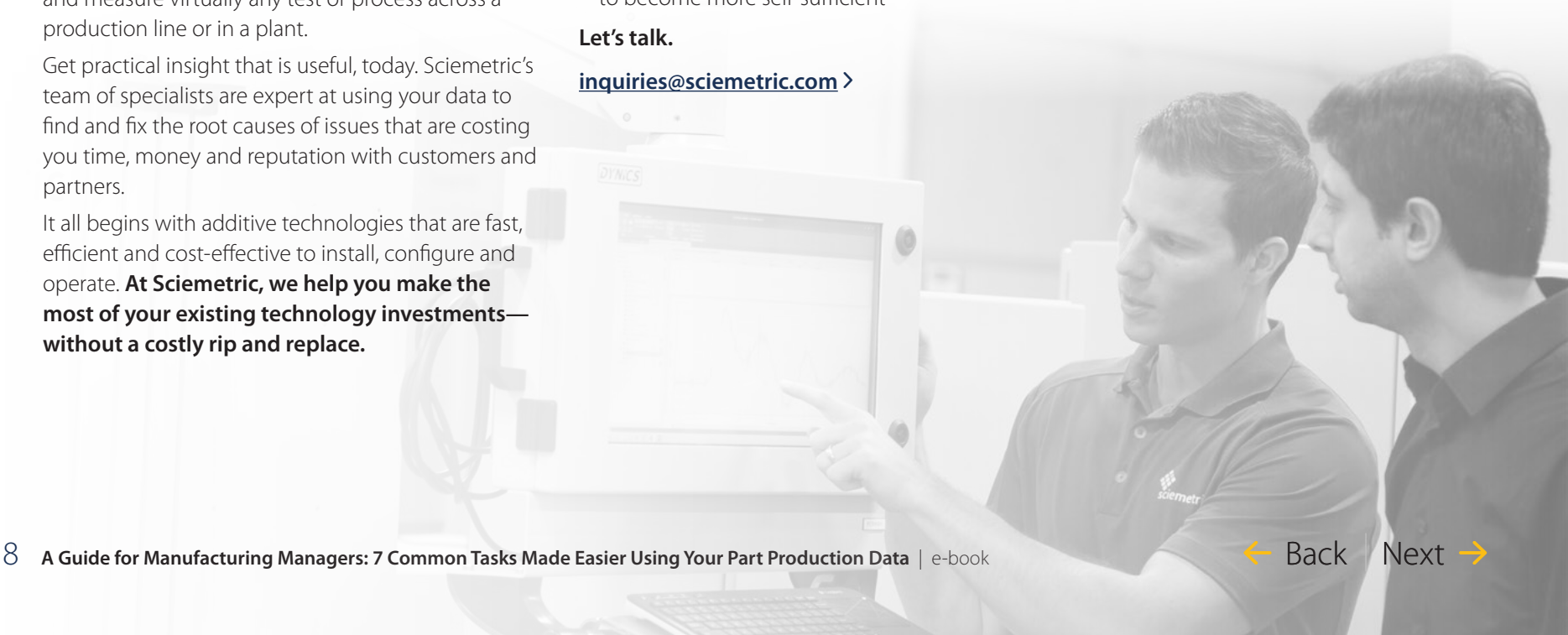
- Trace root cause and correct a quality flaw
- Raise first-time yield and cut costs
- Monitor and manage machine performance
- Avoid downtime and boost efficiency
- Drive continuous improvement across the enterprise
- Equip your team with the skills and knowledge to become more self-sufficient

Let's talk.

inquiries@sciemetric.com ›

In our next ebook …

Get practical tips and advice on how to turn your part production and in-process testing data into a critical resource that will improve quality and plant-floor processes. Learn why your plant can no longer rely on machine and equipment data as its primary tools for quality control and process improvement if you want to prosper in the digital age.



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