Manufacturing Data 101:
What You Need to Know to Start Using Your Part Production Data to Improve Quality

Learn about different types of manufacturing data systems, and how to get started as you collect, structure, and analyze your data for success

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INTRODUCTION

Everyone wants to use their manufacturing data to improve product quality and production efficiency, but where do you start?

If manufacturing data feels daunting, you are not alone. Perhaps it feels too complicated. Or too costly. Or you're not sure what type of tools will work the best to help you deal with the daily challenges on your production line.
If any of these apply, this ebook is for you!

In modern manufacturing, we can no longer rely on manual reports and siloed information for quality control and process improvement. Regardless of where your plant is on the spectrum of data acquisition and digital adoption, your data will prove to be your most powerful ally in solving quality problems on your line and enabling continuous improvement to your quality and processes.

In this ebook, we cover the basics of what you'll need to know to get started with manufacturing data. In most cases, it's simply about enhancing the equipment and processes you already have, to make more effective use of the in-house datasets already at your disposal.

Read on for practical tips and advice on how to turn your part production data into a critical resource that will improve quality and plant-floor processes.

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1 | How Much Data to Collect, Which Data to Collect, and How Long to Keep it

How much data to collect?

Let's start with the collection and retention of your part production data.

Of the vast reams of machine and part data that are generated during a production shift, which sets are the right ones to collect?

That's a bit of a trick question because all if it could be the right data. But not all data is the same, nor is it useful in the same way.

The challenge is to get all the data flowing in an integrated and organized way so your team can understand it and gain quick insight to take timely action.

When starting out, begin with heavy, organized data collection—collect every bit of data you can from every process or test that touched each part as it moved through production.

As you review more data from more parts, you will gain a deeper understanding of, for example, what feature checks and limits are sufficient to distinguish a good part from a bad one. Using this analysis, you will be able to identify ways to pare back on how much data you are collecting or how many different feature checks are implemented.

WHAT DO YOU WANT TO USE THE DATA FOR?

Set some goals for what you want to be able to achieve with the data. These goals can address key challenges in the day-to-day running of the production line or simply make certain tasks easier so you can focus on other things.

For example, are you looking for:

- More machine uptime?
- Faster creation of reports?
- Part traceability?
- More efficient test station set-up?
- Ability to increase throughput?
- Comparisons of performance of parallel stations?
- Defect analysis?
- Predictive alerts?

Your goals will impact which types of data are needed and where they will come from.

How to prioritize which data to collect and analyze

When prioritizing which data to collect (and later analyze), apply a Pareto approach and the 80/20 rule. Have your team first triage your data by considering what are the largest bottlenecks on the line that are impacting overall throughput or first-time yield—the 20% that is causing 80% of the problems.

Focus your data collection efforts on these trouble spots first. You can then apply algorithms to find trends and patterns that reveal the "how" and the "why" of the part defects you are experiencing. Your team can then make informed decisions about necessary adjustments to processes or tests to catch the problems leading to these defects before they move further down the line. This can be used with any controlled process or operation—from press fitting, leak test, rundown, crimping, welding, dispensing, and more.

This approach works best if you have serialized production—each part that you will produce bears its own unique serial number. Serialization makes it easy to create a birth history record for each production part that includes all the data from every process or test that touched it.

How long to store your manufacturing part data

How long you should store your production data depends on how long you want to support a unit in the field. What is the warranty period on your products? If you are a supplier to an OEM, how long is their warranty on their products that include your part or assembly? Your long-term data storage strategy should cover those time periods.

It will always cost less to store all the data for the length of your part's warranty period than it will to deal with a single recall where you don't have enough data to properly identify and selectively recall only those parts that you have been able to determine are the bad ones. It is also worth noting that the price of a recall isn't only monetary, it's also the impact on the public perception of your brand and the reliability of your products. This makes it all the more important to invest in your data strategy.

DATA ARCHIVING

To efficiently manage what can be very large datasets, an archiving strategy is required. You need to determine at what point data should be archived (e.g., after a month, or three months, etc). Even if you haven't had any issues during this period, the data should remain accessible so you can use it should a product quality issue arise.

TIP: Always keep both your pass and failed part data

Don't fall into the mistake of only keeping or documenting failed part data.

If your "good", passed parts turn out to have been mis-evaluated, and you didn't keep that pass data, you have eliminated any means of being able to extract the true failures from the good parts.

2 | How to Structure and Consolidate the Data

In an ideal world, all of your key production data is grouped, indexed and cross-referenced by batch or serial number in a single silo.

Reality is rarely ideal. A more practical alternative is to apply a common indexing method across all of your part production datasets to facilitate analytics.

It's all about indexing

Part production data should be stored and tagged in ways that allow for it to be easily matched with the line's corresponding machine data and historian data for analytics.

If a member of your team looks up a part record, it should be easy to find the machine data from when that part was being assembled at a given location. The matching historian data for that same point in time should be just as easy to find.

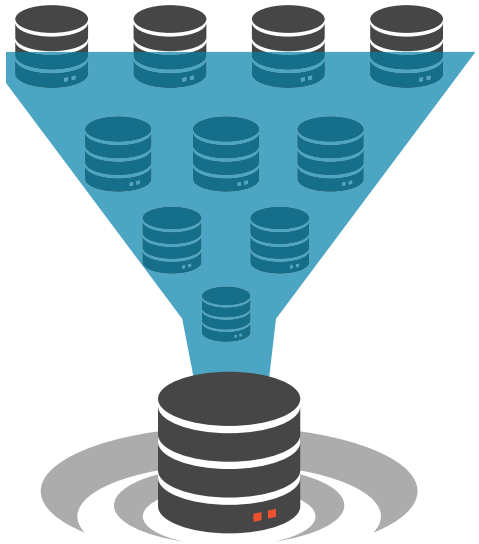
Proper indexing of data at the collection point (using part identifiers, cycle identifiers, synced timestamps and/or unique indexes for each machine cycle across the different collection systems) will help later when performing analysis. With all this data aligned, a clear and comprehensive picture will emerge of what happened through every step of a part's assembly and test.

Sciemetric Studio reporting and analysis tools, organized, and viewable on a part-by-part basis by serial number.

Inside of a silo, too

As with corresponding data that is contained in different silos, different sources of data for a given part that does lie within the same silo should all share a unique identifier. This again, makes it easy to tie together all the relevant data for a single part, for that complete and comprehensive view.

The efficient way to achieve this and make information easy to find is to structure your data storage hierarchy as a replica of the physical world of your plant floor. Keep it simple for your quality engineers and operators to locate what they need, on demand, to quickly track, assess and correct an issue.



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.

THE DIGITAL TWIN

Bear in mind the role of your part production data plays within the larger Digital Twin/Industry 4.0 landscape.

The Twin is a complete and simultaneous digital replica of a physical asset or process. It provides a framework to capture data and eliminate data silos from product design, through to manufacturing, service and even post-service.

Everything presented in this ebook represents a practical, frontline application.

Remember that ALL data produced across a plant floor has its role to play. Whether it is part production data generated by each cycle of a process/test station, or other machine data, and historians.

Part and machine data are two sides of the same coin. Sometimes, just one will do. Other times, you need to consolidate both. This requires reliable, consistent methods with which to find and match these disparate data sources.

3 | Different Types of Manufacturing Data Tools

Let's explore a few of the software solutions available in the modern plant.

OEE (Overall Equipment Effectiveness)

OEE has long been considered a gold standard for measuring manufacturing productivity. At its simplest, an OEE system monitors machines to predict issues before downtime occurs. OEE is a useful tool for managing the health of a machine, managing its maintenance schedule and getting to the root cause of a tooling problem.

MES (Manufacturing Execution System)

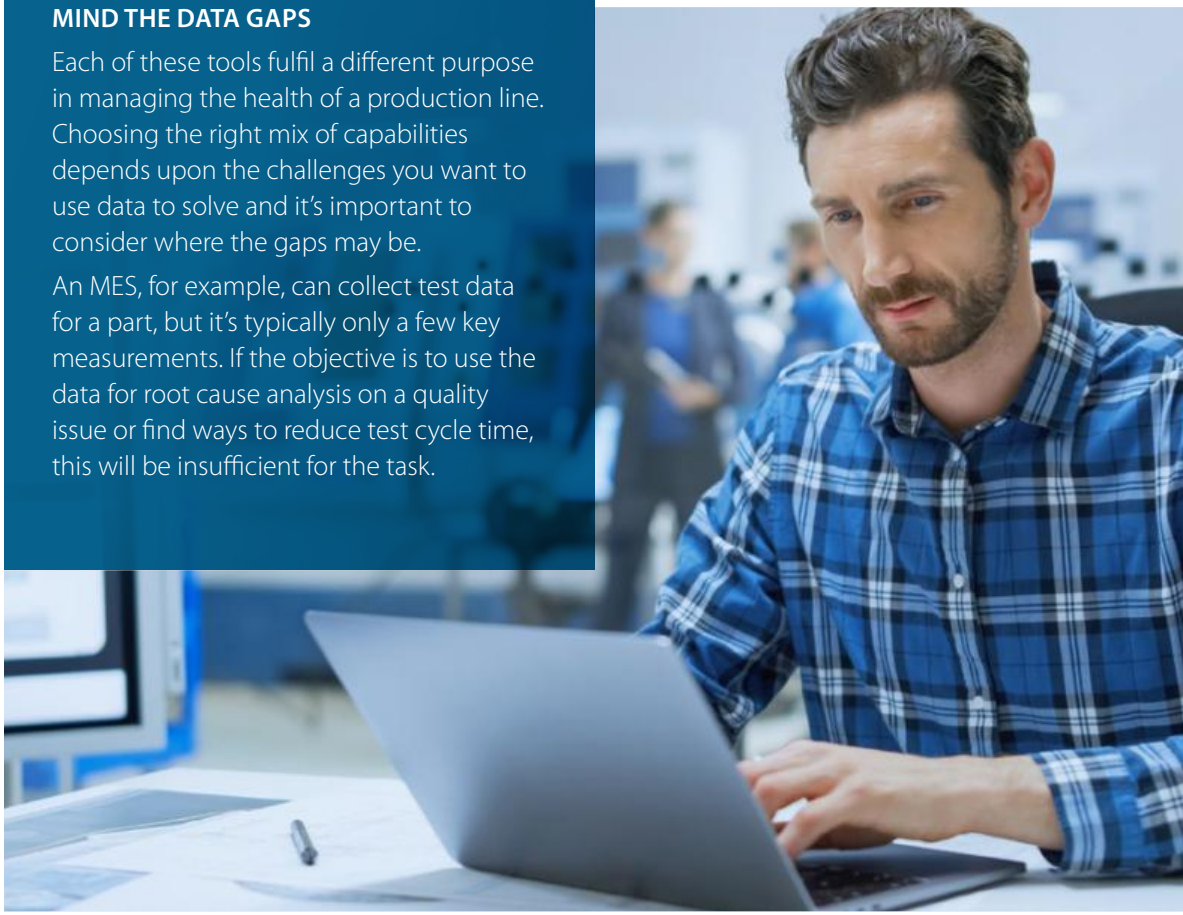
MES delivers a more comprehensive focus on manufacturing processes and efficiencies than OEE. MES does so by capturing data related to machines and people in product quality and throughput.

A typical MES system tracks and documents the transformation of raw materials to finished goods with the goal to understand how current conditions on the plant floor can be optimized to improve production output.

MIND THE DATA GAPS

Each of these tools fulfil a different purpose in managing the health of a production line. Choosing the right mix of capabilities depends upon the challenges you want to use data to solve and it's important to consider where the gaps may be.

An MES, for example, can collect test data for a part, but it's typically only a few key measurements. If the objective is to use the data for root cause analysis on a quality issue or find ways to reduce test cycle time, this will be insufficient for the task.



Operational Historians

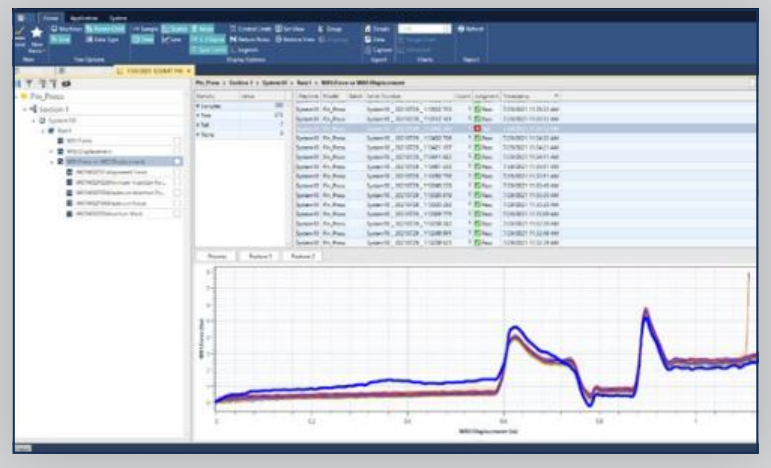
Many plants also rely on process data that is time-based, instead of tracked by the serial number of the part or assembly in production, using database software applications called operational historians. Historians capture plant management information about production status, performance monitoring, quality assurance, tracking, birth history, and product delivery.

Part-Focused Test Data Acquisition & Analysis

This type of system provides data on all elements of a test process or operation, focusing more on what is happening to the serialized part than machine performance. It is used to provide a more detailed account of the processes a part goes through during the manufacturing process.
Data is collected using sensors such as load-cells, temperature, position and pressure sensors, microphones or displacement gauges at critical-to-quality stations. This data can then be made available for analysis. When the data points deviate outside the set test limits, this signals a problem likely to impact product quality. This rich data can also later be mined to trace root cause of a quality issue, resolve issues quickly, or optimize production.

The Power of Sciemetric's In-Process Digital Signatures + SPC-Enabled Real-Time Alerts

Sciemetric's manufacturing data solutions are designed to meet the needs of the manufacturers we work with every day. To do this, we combine part-focused test data insights in the way of in-process digital signatures with SPC capabilities and real-time alerts. Our solution is designed to alert you as soon as there is a deviation on a monitored process and then provide you with a fast, clear path from analysis to answer so you can quickly identify the root cause of a problem and make changes to your process to avoid the problem in the future.



Sciemetric Studio's unique waveform data visualization allows you to quickly isolate anomalies in your data to identify faulty parts and processes.

4 | Checklist: What to Look for When Choosing Manufacturing Data Solutions

Important factors to consider when choosing a manufacturing data management and analysis tools:

- **Data consolidation:** All the data related to a specific part, assembly or finished product should be organized in a way that is easy to search and analyze, ideally that mimics the production line . This forms a "full birth history" of a part or assembly that is traceable and retrievable by serial number.
- **Accessibility:** Quality and production staff should have access to both the data and tools for analysis—data is not trapped in silos or accessible only through specific workstations. Whether it's recent or archived data, it should be easy to access and use it.
- **Real-time insight:** Data should be accessible in production real-time. More importantly, it should be easy to retrieve and run analysis against to quickly identify the cause of issues.
- **Quick reporting:** No one wants to have to spend a lot of time creating reports. It should be easy to get the info needed, whether productivity metrics, top issues or other metrics. Dashboards and real-time alerting systems that send you notifications if processes are drifting out of control, making sure you can act quickly to resolve problems.
- **Data visualization:** The best data management tools for manufacturing allow for data visualization. This makes it much easier to identify outliers than trying to sort through a spreadsheet of numbers. Using data visualization techniques, it's easy to create a common baseline against which to compare all parts. The more visualized data you have to compare, the easier it becomes to understand what anomalies to watch for and what they signify.

  For example, digital process signatures can be converted into histograms that can be correlated with other data types associated with the part to illustrate the profile of a good part and the range of acceptable deviation.
- **Continuous improvement:** Capabilities like being able to trend your historical data across stations or use your past production data offline (without disrupting live production) to perform "what if" analysis, helps you do things such as set better test limits and identify new tests or parameters to make better products or reduce cycle times.

5 | How Sciemetric Can Help You Get Started with Data Collection & Analytics

Sciemetric has worked with hundreds of manufacturers worldwide for over 40 years, helping them monitor, measure, and analyze data gathered from processes on their production lines. We will help you identify your critical-to-quality processes and implement measurement, data acquisition, and analytics to give you full insight into your production.

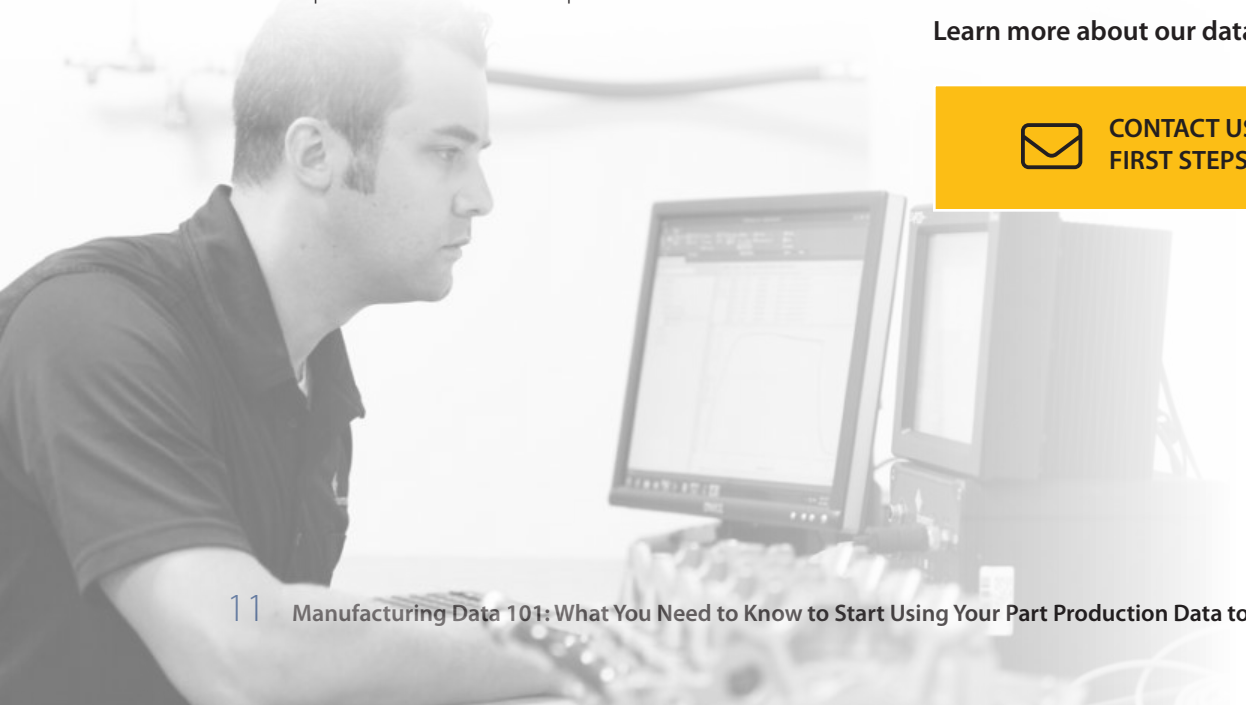
Sciemetric's solutions are scalable to suit your needs, and we will help you make the most of your existing line/station design and technology investments—without a costly rip-and-replace. We can connect and measure virtually any test or process across a production line or in a plant.

You can rely on us to help you use data for practical day-to-day manufacturing challenges:

- Trace root cause and fix issues affecting quality, quickly and efficiently
- Improve first-time yield and cut costs
- Avoid downtime and boost efficiency
- Drive continuous improvement on your line
- Equip your team with the ability to intelligently and quickly respond to quality and throughput issues

Learn more about our data solutions ›

CONTACT US TO TAKE YOUR FIRST STEPS WITH DATA



HOW WE'VE HELPED OTHER MANUFACTURERS

OEM, agricultural machinery manufacturer unlocks its data to overcome costly production downtime

Read the case study ›

Automotive OEM uses production data to overhaul quality on a global scale and become less reliant on end-of-line testing

Read the case study ›

Automotive OEM uses data analysis and visualization to eliminate bottleneck and improve FTT in hours; 11.5% increase in FTT, and 21% reduction in cycle time

Read the case study ›

Want to learn more about how you case use part production data on your manufacturing line?

Download our companion ebook, ***A Guide for Manufacturing Managers: 7 Common Tasks Made Easier Using Your Part Production Data***

Download the ebook ›

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