

DIGITAL MANUFACTURING DATA READINESS ASSESSMENT

Sight Machine works with global manufacturers looking to use production data to predict machine failure, optimize processes, increase output, and improve sustainability. During our work, we've discovered that shortcomings in the condition of the data and the related infrastructure supporting making it ready for use result in unfulfilled expectations.

In order for data to support digital manufacturing initiatives, it is critical to understand its readiness for integration with other production data sources. The ability to join, blend and integrate multiple sources of manufacturing data into digital twins of production processes, lines, plants, and parts is a foundational requirement to become a data-driven manufacturer. Unfortunately, most manufacturers don't understand the condition or readiness of their production data until after their project has begun.

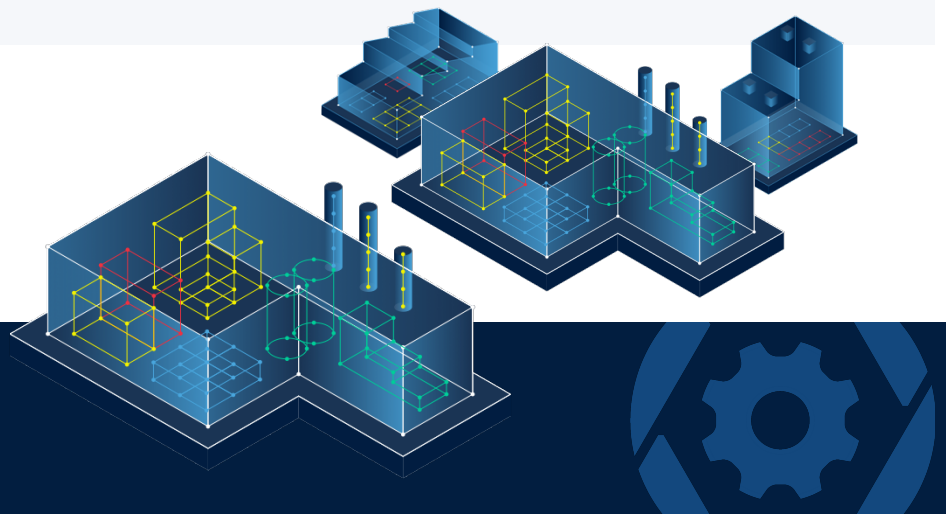
Through a decade of experience and numerous engagements, we've found that performing a comprehensive data assessment is the most crucial step for ensuring a project is successful in delivering and scaling value. The results of this assessment allow manufacturers to properly scope project objectives, expectations, and timelines. Most importantly, by going through this assessment process, manufacturers gain organizational alignment on what is required to enable the real-time use of production data. Performing a readiness assessment is the first step in building a digital manufacturing data and transformation strategy.

The Attributes that Determine Readiness

At Sight Machine, we've developed a process for assessing production data to better understand its ability to deliver business impact. The Sight Machine Data Readiness Assessment examines the attributes we've found to be most critical for integrating production data in real time with other sources. These include:

1. **Accessibility:** The data can be accessed by a repeatable, automatic method
2. **Format/Protocol/Schema:** The data is in a consistent, readable format for ingestion into analytic applications
3. **Labeling:** The data can be tied to physical sources involved in production
4. **Data Reliability:** There is a systematic method for joining data sources
5. **Process Alignment:** Resources are available for mapping data to processes and physical sources
6. **Security:** All data sources can be securely connected to the cloud for management, transformation, and analysis

To support real-time manufacturing analytics capabilities, a data source must be ready in all six areas. By assessing the readiness of each source, a manufacturer will be able to properly scope project timelines and budget.



WHAT DATA SOURCES SHOULD YOU ASSESS?

The Data Readiness Assessment is a valuable tool for analyzing the ability of individual data sources to support real-time manufacturing analytics capabilities. To properly analyze and optimize manufacturing processes, manufacturers need to integrate data from multiple sources involved in and affecting production. For production analysis, typically, these sources fall into seven categories, inclusive of energy and other relevant external data sources utilized in and affecting the production environment.

DATA CATEGORY	TYPICAL CHARACTERISTICS
Machine and Sensor Information	Time series information typically acquired from a Historian or SCADA system. Typical formats include: <ul style="list-style-type: none"> • Time stamp (to the second or sub-second) of the recording • Sensor name • Sensor reading
Product/Batch Information	The type of product/batch being produced on a machine or process. This can include batches of input materials, the output batch number, or other serialization/SKU information. Frequently this is associated with time stamps from other sources, but can also require process-specific business logic. This is typically captured through three methods: <ul style="list-style-type: none"> • The product name/batch is a tag on the machine that can be captured with machine and sensor information OR can be inferred through set points on the machine • From an ERP, MES, or scheduling system, if this is utilized, there is typically the need to understand business rules to associate this information with machine data • Associating product type with a batch
Downtime Classification	Associate downtime reasons with downtime events (detected with machine data). This typically comes from one of the following sources: <ul style="list-style-type: none"> • Fault codes on the machine • A downtime tracking or maintenance system • Industrial PC or HMI connected to or near the machine
Quality, Defect, or Scrap Information	Quality data and associating defect or scrap information is added to the batch or timestamp of machine production and used as a categorical variable in analysis. This should be a predefined list of defect codes. In many organizations, this may be a defect code hierarchy. Common data sources are: <ul style="list-style-type: none"> • MES or ERP Quality modules • InfinityQS • LIMS Lab Information Management System • SPC software
Energy/Resource Consumption	Integrate energy data with production data to track consumption at each phase of the production process. Common sources include digital meters or utility data integration for: <ul style="list-style-type: none"> • Power • Gas • Water
Maintenance	Maintenance data is used to track asset health and schedule adherence, and to differentiate between scheduled and performed maintenance vs. unplanned downtime events. Data sources include: <ul style="list-style-type: none"> • Computerized Maintenance Management System (CMMS) • Enterprise Asset Management (EAM) • Maintenance Management System (MMS)
Local Climate Conditions	Internal and external climate data sources provide context for the overall production environment and process. Common data sources include: <ul style="list-style-type: none"> • HVAC telemetry • Weather service temperature/humidity

Assessing Your Data

The Data Readiness Assessment examines a data source's condition across each of the categories above, allowing a manufacturer to determine if the data falls into one of three levels:

■ LEVEL 1: The data source is ready to be used for real-time manufacturing analytics efforts.

■ LEVEL 2: Development resources can be applied to ready the data. This has implications for project timelines and budgets.

■ LEVEL 3: Data access and utility may require additional research, process changes, or IT infrastructure to be suitable for real-time analysis. This has implications for project timelines, budgets, and the use cases that can be addressed.

LEVEL 1

1. ACCESSIBILITY

Data is accessible from the internet as it is generated (can be streamed or micro batched to the cloud)

ACTION NEEDED:

None! You're ready for digital manufacturing

LEVEL 2

Data is captured and stored as it is generated but requires capabilities for transfer

ACTION NEEDED:

Develop file transfer capabilities to move files to accessible location

LEVEL 3

Data can't be retrieved in an automated fashion due to technical (e.g., unconnected devices) or policy (e.g., security/cloud policies not in place) issues

ACTION NEEDED:

- Get IT buy-in to address policy issues
- Evaluate infrastructure and security needs

Notes:

2. FORMAT/PROTOCOL/SCHEMA

Data is defined and structured in a way that your modeling application can support

ACTION NEEDED:

None! You're ready for digital manufacturing

Data is structured in a manner that is not currently supported, and drivers to make it usable do not exist

ACTION NEEDED:

Software development to transform data into a structure supportable by your application

No consistent, defined, or documented structure (e.g., manually entered on a spreadsheet or proprietary format)

ACTION NEEDED:

Process change or system upgrades to enhance or remediate your data structure

Notes:

3. LABELING

Data is clearly associated with a well defined asset hierarchy (e.g., machine, product, component, line, etc.)

ACTION NEEDED:

None! You're ready for digital manufacturing

The physical sources of the data are partially labeled or labeled manually. Naming conventions are inconsistent or multiple conventions are used

ACTION NEEDED:

System development or tools to automate assignment of physical sources, value-add processes, and metadata tags

Physical source information for data is unavailable or not captured. Labels and metadata do not exist

ACTION NEEDED:

Investigate how to add asset IDs to your PLCs or capture process information

Notes:

4. DATA RELATABILITY

Time stamps or serialization exist, enabling the data to be connected with other sources and with the ability to describe how business logic moves through the platform

ACTION NEEDED:

None! You're ready for digital manufacturing

Time stamps can be inferred or data contains partial serial number elements, but only partial visibility into material flow through the platform

ACTION NEEDED:

Develop business logic to define relationships with other data sources

No consistency in time stamps or serialization of the data

ACTION NEEDED:

Add serialization equipment and/or synchronize system clocks with NTP across processes

Notes:

5. PROCESS ALIGNMENT

Personnel who understand the data's relationship to production processes are available

ACTION NEEDED:

None! You're ready for digital manufacturing

Personnel not available but documentation exists on process-data relationships

ACTION NEEDED:

Resource personnel to build institutional knowledge of data

Personnel who understand the data-process relationships are not available, and documentation does not exist

ACTION NEEDED:

Data forensics to examine data and build knowledge base

Notes:

6. SECURITY

Security on data endpoints is centrally controlled and access credentials are strong. Software updates are routinely applied and the latest versions of encryption technology are available for data transfer

ACTION NEEDED:

None! You're ready for digital manufacturing

Security on data endpoints is maintained outside of corporate/central oversight. Software updates may be behind. Secrets need to be rotated manually

ACTION NEEDED:

Apply relevant software updates. Review and document encryption risks. Draft SOP so manual handling/rotation of secrets can be done securely

Data source includes software past End of Life or has no ability to be updated. No or trivially weak encryption for data out of source. No authentication or widely shared weak secrets present

ACTION NEEDED:

Work with IT/security teams on remediations. Segmentation of networks may be required

Notes: