

# 3 LEVELS of using MACHINE DATA for ManuFacturing Intelligence

**LEVEL 1**

**Machine Level :**  
Metrics of Efficiency & Quality

**LEVEL 2**

**Plant Or Unit Level :**  
Asset Utilization & Profitability

**LEVEL 3**

**Corporation Or Global Level :**  
Sustainability of Business, Energy and  
Power Utilization & Reliability of the  
Product Manufactured.



# Introduction

Traditional ERP and CRM software help manufacturers manage their supply chain, plan their production and deal with fulfilling their obligations to customers. Manufacturers also have monitoring software that track and monitor their shop floors and provide the necessary tools for operators to ensure that the machines are operating smoothly. Software solutions solve problems at two ends of the spectrum: **planning**, that has a lead-time of days to months and **monitoring** that deals with the immediate problem at hand.

Manufacturing generates a vast amount of machine data, most of which is not utilized. This information can provide vital insights into what actually happened when a product or a component was created and will provide traceability in the future. An example of this would be the ability for a manufacturer to respond to a component failure by going back and extracting all information about the conditions when the component was created.

This can include questions like:

- *Which assembly line and machine created this component?*
- *What was the standard operating procedure and vital parameters recorded?*
- *Are there additional components created as a part of this batch? Should I recall the entire batch?*
- *Were there anomalies in the setup, maintenance and operating procedures in the machine that caused this problem?*

The reasons why machine data remains untapped are:

- Plants and shop floors and assembly lines contain a wide mix of machinery, right from sophisticated CNC machines to relatively simpler specialized machines for building specific components. This diversity has resulted in a lack of standardization in the manner in which you can connect to these machines and extract information.
- Machines might lack the necessary instrumentation that measure parameters that are vital to the business.
- There exists a **“last-mile”** problem. There is no standardization in the way machine data can be transmitted in near real-time to software that can process this information.
- The information being generated by machines is non-standard, unstructured and granular. Too much data is being generated which makes it hard to store, process and utilize. Manufacturers may have in-house Data Warehouses but they do not scale to meet the data demands of machine data.

The advent of cloud computing has changed the way in which we look at compute and storage resourcing.

You can now utilize (theoretically) infinite compute and storage resources and pay for what you use. The advent of big data has meant that massive computing and storage resources can be utilized to process and generate insights from unstructured data from disparate resources.

The advent of the “*Internet of Things*” or IOT has caused a shift in the way in which we generate information. Smart devices can now measure parameters in real time. These connected devices can communicate with and transmit information in near real-time in a standard, secure and fault-tolerant manner.

The implication of cloud computing, big data and IOT for the manufacturing industry is profound.

- Smart connected devices can now stream information about vital machine parameters in real time for monitoring. Think of it as machine telemetry.
- This information can be stored for as long as you wish. It can subsequently be mined to extract patterns and trends across your shop floor and across your manufacturing plants.
- Patterns can be leveraged to optimize efficiency, understand how machines are being used and provide traceability for every product being manufactured.
- Such solutions require minimum investment in IT. Software will be available as a service and you would only pay for what you use.

## Machine Data in Manufacturing

Manufacturing in itself is a massive, estimated to be a 2+ trillion dollar sector in the US alone. The area that can benefit from improvements in data analysis in the manufacturing sector would be manufacturers that build end products that are used by consumers as well as components that form a part of the overall supply chain, used to build end products. Such an area presents an opportunity for productivity improvements. It is estimated that monitoring the shop floor alone can result in a **5-15%** productivity improvements. It is also known that specialized equipment used for metal cutting spend less than 25% doing what it is supposed to do: cut metal. These machines generate large amounts of data but this data is not collected centrally and is therefore not utilized.

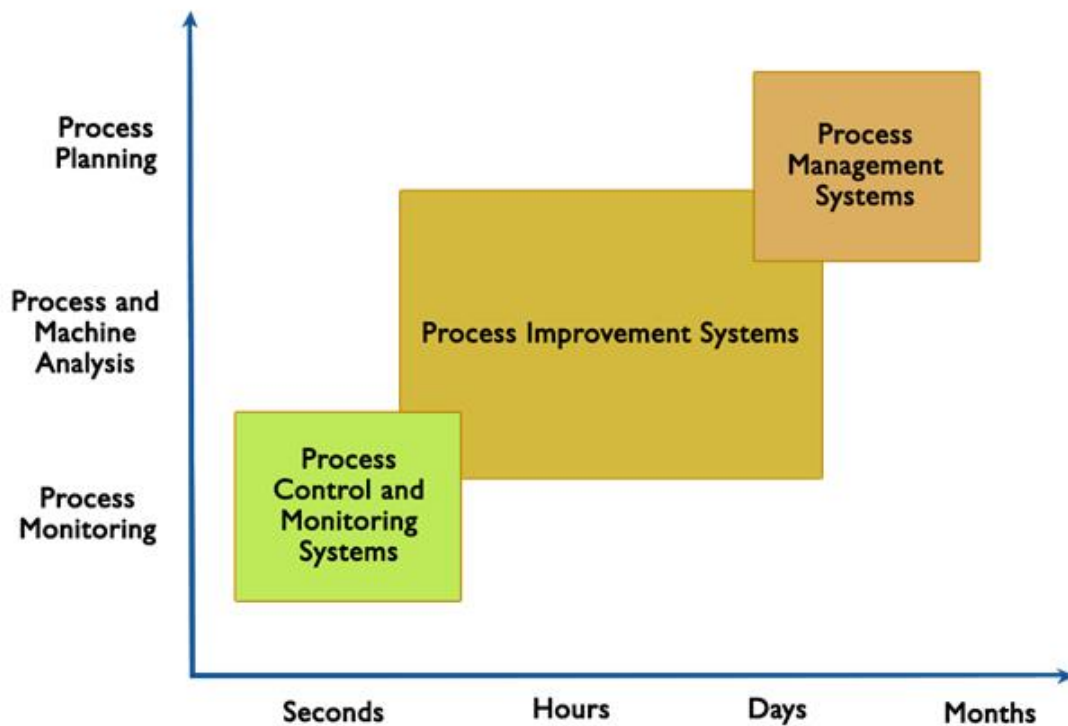
There are **three** layers of detail in which in which manufacturers look for optimizations.

- **Machine Level:** Metrics of Efficiency & Quality at the machine level
- **Plant Or Unit Level:** Asset Utilization & Profitability of the unit or plant
- **Corporation Or Global Level:** Sustainability of the Business, Energy and Power Utilization & Reliability of the Product Manufactured.

Manufacturers answer these questions using existing systems, processes and human knowledge, basically in a business as usual manner. However there are opportunities to improve the manner in which these questions can be answered, driven by data.

Manufacturers have invested in supply chain, enterprise resource planning and customer relationship management software to improve efficiency of the processes. They have also invested in software that closely track, monitor and operate machinery aimed at the machine tool operators.

The area that remains underinvested is collecting insights from the machine data itself. The diagram below illustrates this.



The complexity of collecting machine data lies in its size. Manufacturers have relied on traditional systems like excel sheets, files and MIS systems, which deal with a small set of data, perhaps several hundred megabytes in size. Collecting all data about a machine results in data several magnitudes in size. Traditional data warehousing and analytics systems cannot deal with this magnitude.

McKinsey recently published a report on manufacturing big data. An extract is given below.

Manufacturing Big Data : Annual Data				
	Basic		Advanced	
Samples per second	10	hz	100	hz
Data Items Per Sample	10	items	50	items
Size Per Data Item	50	bytes	50	bytes
<b>Size Per Sample</b>	<b>500</b>	<b>bytes</b>	<b>2,500</b>	<b>bytes</b>
Bandwidth per device	5	kbps	250	kbps
Daily Data	432	MB	21,600	MB
Annual Data	158	GB	7,889	GB
<b>Annual Data Stored for:</b>				
Small Shop (10 devices)	2	TB	79	TB
Medium Shop (30 devices)	5	TB	237	TB
Large Shop (100 devices)	16	TB	789	TB
Enterprise (500 devices)	79	TB	3,945	TB
<b>US Machine Tool Market (1.2M machine tools)</b>	<b>189</b>	<b>PB</b>	<b>9,467</b>	<b>TB</b>

It is estimated that a small shop with 10 devices will annually generate 2 terabytes of data (assuming 10 samples per second with each sample containing 10 data points). The areas of focus for manufacturing are given below. Of specific interest are sections 5 and 6.

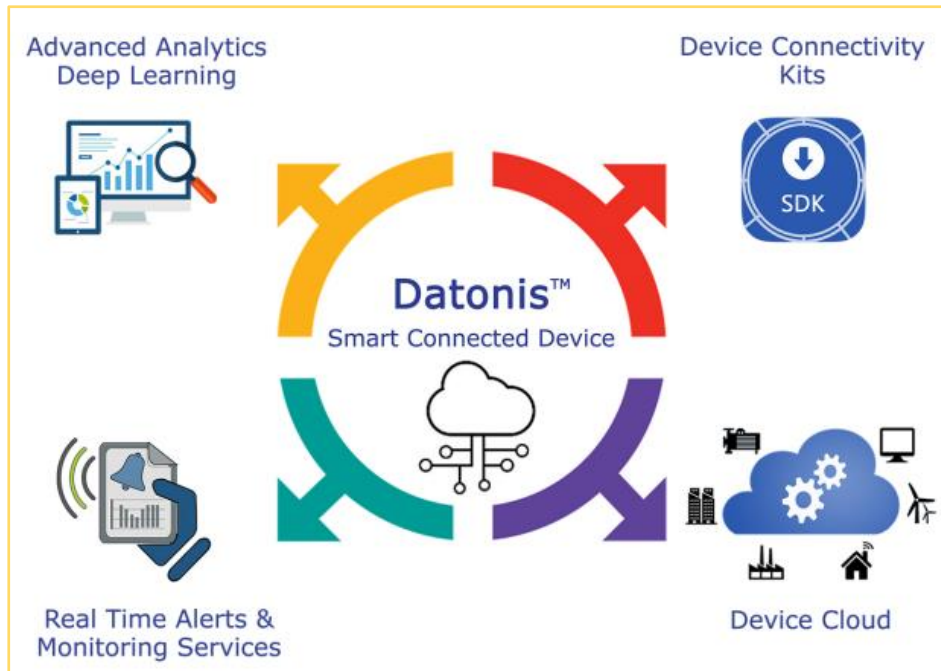
### We have identified the following big data levers across the manufacturing value chain

	R&D and design	Supply-chain mgmt	Production	Marketing and sales	After-sales service
<b>1</b> Build consistent <b>interoperable, cross-functional R&amp;D and product design databases</b> along supply chain to enable concurrent engineering, rapid experimentation and simulation, and co-creation	✓				
<b>2</b> <b>Aggregate customer data and make them widely available</b> to improve service level, capture cross- and up-selling opportunities, and enable <b>design-to-value</b>	✓			✓	
<b>3</b> Source and share data through <b>virtual collaboration sites (idea marketplaces)</b> to enable crowd sourcing	✓			✓	
<b>4</b> Implement advanced <b>demand forecasting and supply planning</b> across suppliers and using external variables		✓	✓	✓	
<b>5</b> Implement <b>lean manufacturing and model production virtually (digital factory)</b> to create process transparency, develop dashboards, and visualize bottlenecks			✓		
<b>6</b> Implement <b>sensor data-driven operations analytics</b> to improve throughput and enable mass customization			✓		
<b>7</b> Collect <b>after-sales data from sensors</b> and feed back in real time to trigger after-sales services and detect manufacturing or design flaws			✓	✓	✓

SOURCE: McKinsey Global Institute analysis

**Altizon** provides a platform to harness this information and make data driven decisions to improve the effectiveness of your production.

## The Altizon Datonis™ Platform:



**Datonis™ is an Industrial internet platform focused on making Enterprises IoT (Internet of Things) Ready**

Leverage the power of Datonis™ for creating Condition Monitoring, Predictive Analytics, and Operational Dashboards & for driving Consumer Insight. With the Altizon platform:

### 1. Connect Anything and Visualize



Collect critical data and manage diverse equipment and machines through readily available Device Management Kits. Use RESTful APIs for seamless integration with line of business and custom built applications

## 2. Process Everything



The highly scalable platform enables complex real-time stream processing for advanced condition monitoring solutions and consumer insight. Use the extensible rules engine to generate real-time alerts and notifications.

## 3. Learn Forever



Create intelligent connected devices using the built in deep learning algorithms of Datonis™, making predictive maintenance a reality.

## 4. Deploy Anywhere



Leverage the advanced capabilities of the cloud for your rapidly scaling operations. We also provide you with the option of hosting your instance on enterprise cloud or a private data center to suit your business needs.

# Use-Cases

Some of the use-cases that showcase the value of collecting and analyzing machine data.

### ✓ *Superior Troubleshooting: Deeper problem detection and cause analysis*

On-boarding a machine onto the platform a critical part of the installation of the Altizon system. As a part of this process:

- The critical parameters of a machine that need to be collected are identified.
- The method of connectivity to the machine is established. This can be wired, wireless or manual.

- Related machines can be grouped to form a higher level of abstraction that represent a shop floor, an assembly line and a plant.
  - This enables drill downs starting from all the plants you own, to an individual plant, to an assembly line and right down to the individual machine itself.

The level of information that should be gathered from a machine is defined. This information can be automatically collected or manually input, although the former is preferred. Here is a subset of the data that should be collected at the machine level.

- Details about the shift and the job on the machine.
- Product and Tooling information on the machine.
- Product and work order details.
- Positions, alarms, vibration, temperature, acoustics.
- Real-Time rate/cycle time
- Runtime and downtime data
- Parts per cycle

Customized alerting can now be set up on the parameters captured. Based on this, you will get a real-time, continuously updating view of your plant and shop floor. This is extremely beneficial to senior leaders of the organization to know what is going on.

## ✓ *Improved Asset Tracking*

Manually scheduling of production can get the job done but several inefficiencies exist. Typically orders are received and production plans are made but tracking is done manually. This will result in the under-utilization of resources, poor productivity and an inconsistent backlog.

A 360° feedback mechanism is essential to plan your production better.

- The ability to understand the order backlog at each facility.
- The ability to understand the workload.
- The ability to know the historical patterns and trends for each machine and know if the machine is due for preventive maintenance.
- The ability to know causes of downtime and thereby improve productivity.
- The ability to view underutilized assets and plan better.

The [Altizon](#) system will merge real time metrics for a machine with order data to provide a comprehensive 360° view of your resources. This will help leadership adapt better to a changing environment.

## ✓ *Product development and Cause of failure*



The Altizon system stores all the information collected during the manufacturing of a part for historical analysis. This means that the manufacturer can zero in on the cause of failure.

If a part fails, the manufacturer can pull in all information about the part, the various operating conditions in which the part was made, all sensor data and the machine and the production information about the part. With this, the manufacturer can answer the following key questions:

- *Does this part failure also have an impact on other parts that have been made at the same facility?*
- *Do I need to recall the entire batch of the product?*
- *What were the operating conditions when the part was made? Were there any deviations in the operating conditions?*
- *Were there any deviations from the operating process that resulted in this failure?*
- *Is this a recurrence of a historical failure that was not spotted? Do I need to make changes to the production facility?*
- *How can I improve the system as a result of this?*

## ✓ *Test Forensics*

Manufacturers run a battery of tests on the components that they build that generate large amounts of data. This information is typically not utilized beyond the immediate test run. The Altizon solution can collect and store this information that can result in the following benefits:

- Complete history of all tests carried out, right down to each and every data point measured.
- The ability to understand the effectiveness of the test data and to know what works and what does not.
  - Optimizing the tests to be carried out can make testing more focused and will cut down the need to run all the tests against components.
- The ability to see patterns in the failures and to zero in on the cause. A big facet of test analysis is that it is local. Historical trends will ensure that you will have the data at hand to know if the same situation has occurred before and to get to the root of the problem.

## ✓ *Monitoring and optimization of the Supply Chain*

Manufacturers have software for managing their supply chains but there are several insights that can be obtained from inventory and supplier information that is usually not leveraged.

- Manufacturers will track inventory sent in by suppliers but there are several interesting patterns that can emerge from this data.
  - What is the existing inventory level per supplier?

- Does this tie back to the Purchase Orders raised? Has there been any purchase price or purchase quantity variance?
- Is there duplication in POs raised?
- Can there be any optimizations made to the delivery times or payment terms that can save the company money?
- Can dynamic pricing strategies be adopted to ascertain the best purchase price?
- Manufactures can link this information to wider market data.
  - Has any regulatory compliance changes with my retail partners affected my supply chain.
  - By having a repository of inventory and supply chain data, a manufacturer can ascertain if stocks are low and recommend a vendor based on a vendor dashboard.

The Altizon solution can be set up to provide these insights by leveraging all structured and unstructured information about your supply chain.

## ✓ *Consumer Insights*

Manufacturers are building increasingly sophisticated products and would like to add value by providing services that will add efficiency to their customer operations. Altizon can provide a solution for customer insights.

- An Altizon adapter can be bundled with the product that measures operating parameters and conditions, which is continuously transmitted back to the manufacturer.
- This data can then be analyzed and can form the critical consumer feedback loop that can improve the product.
- Manufacturers can add value added services over and above the product itself. This could consist of preventive maintenance, better utilization of the asset and bundling of allied products.

## Conclusion

The **Altizon Solution** can be leveraged for a variety of needs, starting from monitoring and analytics to gaining insights into your information from a variety of sources including your customers. The solution is fully customizable to the specific business need and operates as a service, on a ***pay as you use model***.

For more details on Altizon and its solution stack, please contact us at [sales@altizon.com](mailto:sales@altizon.com)