How Manufacturers Can Unlock Business Value via IoT Analytics

Increasing adoption of the Internet of Things presents manufacturers with tremendous business opportunities. By understanding the needs of customers both inside the organization and across the stakeholder ecosystem, manufacturers can effectively gather and apply insights from instrumented devices at the edge of their networks to generate monetization opportunities that inform cost-containment or revenue-generation initiatives.
Executive Summary

With Internet-connected “things” growing at an exponential rate\(^1\) in the manufacturing space, readily available low-cost computational and storage capabilities, and the opportunity to generate real-time consumer insights from data at the point of origination, a strong case has emerged for analytics.

But first, it is important to understand the fundamental difference between Internet of Things (IoT) analytics and traditional analytics. Unlike traditional analytics where data is analyzed after being centralized, in IoT analytics data is analyzed at the point of origination (at the device level) as well as at the centralized level, depending on the analytics type and application.

Manufacturers now have an opportunity to monetize insights (worth billions) at different levels internally and externally in the hierarchy of the manufacturing ecosystem. This comes in the form of saving costs as well as opportunities to generate additional revenue. To leverage IoT’s potential, manufacturers need to understand why they need to use IoT analytics and what they need to do from an infrastructure and skills perspective, identify the information needs and then start converting proliferating data from raw bits and bytes into meaningful insights and foresights.

IoT Analytics at the Network’s Edge

The IoT is an intelligent network of interconnected and instrumented objects with unique identities that have the ability to sense, interact and communicate with each other about their states and environment using embedded communication and processing capabilities/technologies.\(^2\) Analyzing data and applying insights generated by such networks can help manufacturers make data-driven business decisions, drive innovation, develop customized products and services, and identify new areas for business growth.

As noted, the fundamental difference between IoT analytics and traditional analytics lies in the former’s ability to generate insights across various levels of an Internet Protocol (IP) network, while the latter analyzes distributed data at a central location. This presents a unique ability to generate insights at the point of consumption and present a truly distributed decision-making approach.

A Different Approach to Data Analysis

The computational capability of distributed “things” within the IoT network, their ability to communicate/collaborate with each other and their capacity to apply the analytics insights/outputs at the local level differentiates IoT analytics from traditional analytics. The need to bring data to a central location is eliminated due to the presence of intelligence and computational capability embedded at the lowest levels of the network.

IoT analytics utilizes the ability of the sensory and supporting hardware, actuating devices/controllers and hierarchical intelligence to analyze local data to draw locally usable insights/predictions and make/implement local decisions (see sidebar). Only the insights, not necessarily the raw data, are shared with the higher or central levels for their use in more meaningful analytics at those levels.

Edge analytics processes (i.e., at the edge of the network) kick in to analyze data at its point of origin and transmit the results to the relevant level in the IoT network hierarchy. Edge
analytics greatly improves the time-to-value of the data (fresh data analyzed in real time), reduces network bottlenecks, reduces service latency, improves response time and analyzes only actionable data. It also allows manufacturers to analyze the huge volumes of IoT data in a scalable, efficient way and is ideal for those who need to drive automated decisions and do not require “heavy duty” analytics. For instance, such analytics can alert a manufacturer to switch off a valve once a leak is detected.

The basic principle of edge analytics is to analyze locally, consume locally and pass on only the relevant information/insight to other levels of the IoT network hierarchy as per the need to consume the information or insight at that location.

Edge analytics will be driven by the business need of manufacturers. Ideal use case scenarios include applications that require a great deal of bandwidth such as smart lighting, parking spaces and offshore oil rigs. As edge analytics transmits only the results, manufacturers need to examine and understand what data they can afford to discard and what they need to store for further analysis.

One word of caution: edge analytics can create unintended security vulnerabilities and information siloes since a layer of technology is deployed at the network’s very edge in isolation from other elements of the enterprise information architecture. Manufacturers must ensure that edge analytics is part of their holistic data strategy to ensure that data is accessible and integrated across the network and end-to-end security, from the device level, is deployed to cover the whole ecosystem.

Monetization Potential
The monetization potential of IoT analytics extends beyond traditional end customers to the larger ecosystem of partners and stakeholders. The ability to achieve localized analytics and consumption of insights leads to a monetization potential that goes beyond the traditional arch of the organization.

Achieving IoT Information Monetization
Consider the example of the vehicle described earlier: The insights on the performance of tires under different conditions can be used to provide an advisory service on tire life enhancement to vehicle owners of the tires, and to tire manufacturers as a service that provides information...
useful towards improving tire designs. Extending this analogy to multiple aspects of the vehicle and other related products increases the monetization potential.

Combining IoT data with analytics provides manufacturers with a 360-degree monetization opportunity. This can be best illustrated by considering the automotive stakeholder ecosystem, illustrated in Figure 1 (see previous page), which comprises two spheres:

- **Inner sphere**: This consists of players directly connected with the key components of vehicles such as telecom players, hardware players, OEMs and end customers.

- **Extended sphere**: Players not directly connected with the vehicle but who provide support to the vehicle ecosystem in direct or indirect fashion, such as auto insurance providers, finance providers and retailers.

Insights at different levels in the hierarchy can be used to serve the needs of players across the manufacturing ecosystem, saving money for some and providing opportunities to generate additional revenue for others.

There are two potential sources of monetization from IoT analytics:

- The opportunity for cost savings and revenue improvement from better product sales (i.e., more indirect and internal product/service monetization).

- The opportunity for revenue generation through the sale of data, insights and/or advice to benefit the ecosystem stakeholders.

**Savings Potential**

A combination of business and operational analytics can help manufacturers fine-tune their performance metrics and drive financial improvements. For instance, predictive analytics can significantly optimize costs for manufacturers. Cost savings of between 2% and 4% from a 50% penetration of IoT in manufacturing can deliver $500 billion (assuming a global cost base of manufacturing at $25 trillion). Rio Tinto, a mining major, saves over $300 million by deploying “autonomous mining.” Similarly, customers of contract manufacturer Flextronics can quickly react to irregularities in supply chain components by performing real-time data correlation, enabled by analytics and enhanced data visibility.

**Market Potential and Opportunities**

The IoT analytics market is expected to grow at a CAGR of 27.5% and touch $16.35 billion by 2020, up from $4.85 billion in 2015. According to IDC, 55% of discrete manufacturers have undertaken IoT initiatives (research, pilots and adoption). Manufacturing is expected to account for more than one-fourth of the total IoT market. Oil and gas and energy equipment manufacturing would be leading this wave of adoption.

Manufacturers are being inundated with information due to the rising levels of instrumentation and automation (see Figure 2). Microsoft estimates

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**Data Produced by IoT Devices**

<table>
<thead>
<tr>
<th>25 GB/hour</th>
<th>150,000 data points/second</th>
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<tbody>
<tr>
<td>A modern, fully instrumented car.</td>
<td>A typical wind farm.</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>51,200 GB/hour</th>
<th>500 million data readings/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>A fully instrumented jet engine.</td>
<td>A smart meter project.</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>500 GB/day</th>
<th>40% of all data by 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>A single turbine compressor blade.</td>
<td>Produced by sensors.</td>
</tr>
</tbody>
</table>

Source: Simafore, RTInsights, Cisco

Figure 2
that $371 billion in additional revenue can be generated by taking advantage of this data (see Figure 3).\textsuperscript{12} Another estimate by McKinsey pegs the value created by IoT applications at $1.2 to $3.7 trillion in 2025, mostly through improvements in inventory optimization, operations management and predictive maintenance.\textsuperscript{13} Importantly, a paradigm shift to preventive and predictive maintenance from traditional corrective maintenance in the next five years is expected to provide additional revenue generation opportunities.\textsuperscript{14}

### Crucial IoT Analytics Considerations

While IoT analytics is the path for manufacturers to pursue, there are numerous dimensions that need attention in order for the approach to achieve the desired outcomes.

Customers’ demand for high levels of service, experience and personalized products is pressuring manufacturers to quickly overhaul their business and production processes. For instance, Harley-Davidson reconfigured and equipped its facility in York, PA, with sensors and location awareness to reduce the time it takes to produce customized motorbikes from a 21-day cycle to six hours.\textsuperscript{15}

A key distinction is that “customers” extends to two types: first, the traditional end customers, and second, ecosystem players that serve and support these end customers. It is this second category that is making IoT analytics essential and relevant to manufacturers.

Production activity is complex; every small activity/task has a significant impact on the final yield. To improve yields, manufacturers must take a granular approach to diagnosing and correcting issues in the production process. At a high level, manufacturers can also do an in-depth analysis of a richer and greater volume of data to find the truth contained therein. Analyzing the rapidly rising manufacturing data in a centralized fashion is neither necessary nor feasible. Instead, manufacturers can utilize the ability of their networks to generate distributed intelligence and consume it as necessary.

Manufacturers should also consider three fundamental use cases that reflect manufacturing’s unique challenges:

- **Connected products:** These are products that are embedded with three core elements: physical components, “smart” components and connectivity components.\textsuperscript{16} The embedded sensor(s) utilize(s) the connectivity to communicate and exchange data about the state of the product with other products and systems in its environment.\textsuperscript{17} This enables improved functionality, reliability and utilization of these products.

- **Connected supply chain:** A production line, when connected to suppliers, enables all stakeholders to understand interdependencies, material flows, information and process cycle times. IoT systems enable remote tracking, monitoring and reporting of material consumption as it moves through the supply chain. Manufacturers can then identify and resolve issues before they happen by accessing predictive analytics using real-time data generated by the supply chain.\textsuperscript{18}

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### Additional Revenue from IoT Data

<table>
<thead>
<tr>
<th>$162 billion</th>
<th>Employee Productivity.</th>
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<tr>
<td>$117 billion</td>
<td>Operational Improvement.</td>
</tr>
<tr>
<td>$55 billion</td>
<td>Product Innovation.</td>
</tr>
<tr>
<td>$38 billion</td>
<td>Customer Facing Activities.</td>
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*Source: Microsoft Figure 3*
• **Informed manufacturing:** An intended state of operations where all relevant insights are made available at the right time, in the right form, to the relevant stakeholders (people, process, products and infrastructure) across the manufacturing supply chains.19

**Prioritizing Requirements**

First and foremost, manufacturers must identify and understand their customers’ needs, and the impact information has on them. Customers come in different shapes and sizes - internal or external, traditional or nontraditional, physical or virtual. Second, by understanding the specific needs of different types of customers, manufacturers will have a better idea of the type and granularity of information/data required to meet them through the use of IoT analytics. This will help manufacturers better understand the ecosystem of their stakeholders who consume the insights generated by IoT data. Further, manufacturers must also identify the essential insights/information/data elements that form an integral part of the processes that cover the ecosystem’s stakeholders and their business processes.

Manufacturers must have a strong data strategy; the best approach here is to start with the business problem. Also, manufacturers that focus on improving their data capabilities and process agility will realize more value than those that do not. Utilizing IoT data will require organizational changes to be carefully thought through. Taking action in three important areas can help:

- Develop capabilities that can mine data to identify opportunities and solve problems.
- Develop and implement appropriate analytics that are relevant to your business.
- Develop an in-house capability and a culture of insights/information/data-driven execution and analysis of the processes, making this an absolutely essential part of your day-to-day operations.

**Getting the Data/Information Right**

A key component of IoT analytics is to find the right kind of information or data. The data/information needs are driven by the kind of insights required by individual stakeholders. The data/information needs change at different levels of the manufacturer (mostly at a functional and regional level) and the larger stakeholder ecosystem.

IoT analytics strategy is typically defined by a combination of design of the IoT network for companies’ products/organization, an understanding of the existing IoT that plays into this ecosystem and the analytics needs. All of this needs to be achieved as an integrated process and not separately or sequentially since they are tightly connected and drive one another. An essential part of this is to perform a clear mapping of all data elements and the potential insights utilized by key stakeholders.

To achieve long-term IoT success, manufacturers need to focus on solving critical business problems, contextual data, security and intelligent assets. Contextual data, especially, provides clarity and meaning to the opportunity or problem that manufacturers are trying to address.20 Manufacturers need to hone their skills to find data that is of high-value, easy to access, available in real time, provides information about a significant portion of their business processes and customers and, importantly, provides inputs which, when properly analyzed, can help effect meaningful change.

The next step is to bring the data into shape. This starts with automating the collection of data and compressing it before it is transmitted to a storage device. Manufacturers must use a common data model that can combine unstructured data with structured data to make it easier for them to run big data analytics. Similarly, standardized and interoperable interfaces across the organization will help promote integration and scalability.

**Advancing the IoT Analytics Value Proposition**

To increase the odds that IoT analytics will succeed within a given manufacturer’s ecosystem, we suggest the following:
• Detail business-critical insights and their application at multiple points in the ecosystem.

• Identify key stakeholders and their needs to orient analytics for the purpose of addressing business challenges. Identify the processing and decision-making required at every level and stage of the IoT network (this is primarily focused on reporting and advanced analytics).

• Lay down an approach for making IoT analytics distributed both in terms of information analysis and usage of insights, as needed. This includes detailing the strategy, including the use of edge analytics.

• Make data/information/insights an integral part of systems and processes within the organization and extended ecosystem.

• Close the loop on insights by establishing decision-making logic based on insights drawn from advanced analytics.

Manufacturers must consider utilizing edge analytics where appropriate, based on their business needs. According to IDC, by 2018, 40% of data created by IoT devices will be stored, processed, analyzed and acted on at the device level.21 Manufacturers must focus on harnessing the low-cost computational power and capabilities of smart devices to run analytics.22 Extending cloud capabilities to the edge of networks can help to move analytics to the source of data production and enable real-time processing of the data.23

By taking a distributed and hierarchical approach, the results and insights from the analysis of data can be moved to the next level in the hierarchy. This can be used to drive automated decision (by devices) or manual decision-making depending on the requirements of the process. Manufacturers can choose from descriptive, predictive or prescriptive analytics, or a combination of all of these, based on what best suits their business processes.

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Manufacturers must also focus on making the application of analytical insights an integral part of their systems and processes. To do this, it is essential to include an intelligence layer that connects the decision-makers with the shop floor to deliver real-time analytics and insights.24 To take action on the insights that are driven by data, manufacturers must define new processes in an easily understandable format for managers and frontline workers. This way, decision-making at all levels will be quicker and based on insights generated by data.

Moving Forward: Realizing the Value of Insights
An essential part of benefiting from IoT insights is to take them to their highest value form. The monetization value of information, or an insight derived from the information, grows with its ability to be forward-looking. “What would

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Analytics Value Graph

Source: Vitria
Figure 4
happen rather than what happened” or “What to do rather than what would happen” is the direction of increasing value of analytics. The value hierarchy is informative → reactive → predictive → prescriptive in the direction of increasing value.

To derive maximum value, manufacturers must embed appropriate analytics across each stage of the value chain (see Figure 4, previous page). Ideally, manufacturers need to ensure data produced by devices and sensors is absorbed quickly and analyzed in real time. Adding historical and contextual data can provide a base for running advanced analytics. At this stage, predictive analytics can be used to predict anomalies, patterns and failures by taking into account data such as equipment condition and present plant utilization. Finally, manufacturers can use prescriptive analytics, the step that creates the greatest value, to suggest the best action they can take to improve their key operational metrics.

Manufacturers must focus on building a multitude of services (internal or external) that are based on the insights and their delivery through various channels (mobile, Web and internal systems) for different stakeholders. This will help them create services ripe for monetization (cost-saving type/revenue-earning type). Another essential element for realizing the value is to focus on the medium of delivery of insights and the right economic models around it.

Footnotes


Ibid.

Ibid.


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