Capitalizing on Sensor Data Opportunities: How to build a path to business analytics advantage
About This Report

This is a report on the findings of the IW/SAS Sensor Data and Business Analytics Survey*. The objectives of the survey were to determine the extent of product-embedded sensor usage and sensor-generated data strategy development among the senior readership of IndustryWeek magazine.

On July 23, 2013, IndustryWeek effectively e-mailed invitations to participate in an online survey to print subscribers; 500 completed surveys were returned.

*Percentages for responses do not always add up to 100 percent due to rounding and multiple responses.
Manufacturers have been using sensors in their plants for years to automate processes, alert operators to significant or unexpected events, and gather data to monitor and measure machine performance. Many manufacturing leaders probably think they know all they need to know about sensors. They would be wrong.

Embedded-sensor use is exploding, albeit quietly in many cases. iPhone users were surprised to learn a few years back that their devices had sensors that were documenting their movements, and none other than the CEO of GE has said he doesn’t yet know all of the ways his company will use the data it is collecting from sensors, but he’s sure sensors will be driving a bigger part of future business.

Sensors offer manufacturers competitive opportunities in multiple areas, including efficiency improvement, more rapid and customer-driven product development, more targeted after-sale service and up-selling, and clearer future-focused market insight. Yet, our research indicates that manufacturers are lagging in sensor adoption, which means they not only are in danger of losing relevancy in a marketplace that demands the latest product technologies, but also losing ground to competitors that are early adopters.

In addition to the direct benefits of product-embedded sensors, i.e., meeting customers’ expectations, there are important business analytics benefits. Sensors offer unprecedented access to granular data that can be transformed into powerful knowledge for making decisions that lead to the best possible outcome for the organization. To maximize this opportunity, though, manufacturers need an integrated business analytics platform. Otherwise, sensor data will just add to information overload and escalating noise.

In this report, which is based on a survey of 500 IndustryWeek subscribers, we detail what types of companies are using sensors and how they are using them; describe how sensors can make manufacturers more competitive; and provide guidance on how to best prepare for making the inevitable influx of sensor-generated data a continuously flowing stream of opportunity instead of an unexpected flood that disrupts and distracts.

Seventy percent of respondents hold executive-level or manager positions, while the rest are individual contributors with no direct reports. Respondents mostly work in Operations/Production (30 percent) or General Management (19 percent); 14 percent work in a Product Engineering/Product Design capacity; 9 percent in Quality; 6 percent in Supply Chain Management; and the rest in Sales, IT or “other” functions. The top industries represented are Industrial Machinery (16 percent), Automotive (8 percent), Aerospace and Defense (8 percent), and Metals/Mining (6 percent). Other represented industries include Consumer Packaged Goods, Electronics, Consumer Durables, Oil and Gas, and Telecom/High Tech/Networking/Computer Equipment. Thirty-two percent of represented companies have annual revenues of $1 billion to more than $10 billion. The rest have annual revenues of less than $100 million to $999 million.
Sensor Adoption Soars, With Big Companies Leading

A common observation about the Internet is that it changed business forever. In hindsight, the Internet was just a prerequisite to other business-altering technologies. Like a rapidly moving tornado, it cleared a broad path for new industries such as mobile devices, social media and cloud computing. These technologies were widely adopted only in the past decade, yet the competitive gap between the haves and have-nots is huge and growing huger.

Now comes the Internet of Things, powered by what some estimates put at trillions of globally deployed embedded sensors within the next six years\(^1\). This has multiple implications for manufacturers that could affect operations, product development, marketing and sales, and strategic decision-making.

Our research shows that the world’s biggest manufacturers are leading in embedded-sensor use (companies of $1 billion and more in annual revenues), which causes a skew in the data: High product volumes equate to a large number of sensors sold by a relatively small number of companies. Adoption by all manufacturers will come quickly, though. According to Samuel Ropert, Lead Analyst at IDATE, 15 billion things (machines, connected devices and objects) were connected to the Internet in 2012 (more than three times the 4 billion in 2010), and by 2020 there will be 80 billion such connections\(^2\). Analysys Mason forecasts that the number of machine-to-machine (M2M) device connections alone will grow to 2.1 billion by 2021\(^3\), driven more by customer demand than by traditional cost-saving goals such process automation.

Some sectors of manufacturing lead in collecting data from product-embedded sensors; although most surveyed manufacturers are not using them at all (see Figure 1). Most companies that are using sensors started doing so within the past five years.

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\(^1\)Kharif, Olga, “Trillions of Smart Sensors Will Change Life,” Bloomberg.com, Aug. 5, 2013
\(^3\)M2M device connections, revenue and ARPU: worldwide forecast 2011-2021, Analysys Mason, May 2012
Why and How Manufacturers are Using Sensors

Overall, 68 percent of surveyed manufacturers are not using embedded sensors and are not planning to start using them within the next two years. This assessment might seem to counter evidence of rapid adoption and/or R&D investment among leading companies, but it also mirrors predictions about other business-altering technologies that are now commonplace. In a 2012 SAS-sponsored survey of IndustryWeek’s readership, respondents underestimated how quickly and to what extent their companies would be investing in social media, business analytics, mobility, increased computing power, and cloud computing in the following two years.4

It’s likely that once manufacturers understand the competitive implications of not using embedded sensors coupled with increasing affordability, adoption will rise rapidly. According to our survey, one in five companies not using sensors don’t know enough about the benefits to their companies or their customers, or they don’t know enough about sensors themselves. Unfortunately, these companies are missing opportunities for efficiency improvements, increased sales through innovative product offerings, and data-derived intelligence to help guide strategic decision-making through business analytics.

Even among manufacturers using sensors, we see vast opportunity for using sensor-generated data to better understand how customers are using products, deliver more post-sale services, and gain insight into new product or new market opportunities (see Figure 2).

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**FIGURE 2: HOW MANUFACTURERS USE SENSOR-GENERATED DATA**

Fewer than 20% using to identify new growth opportunities

- Monitoring product performance for reasons other than delivering standard or contracted services, i.e., safety or regulatory needs: 62%
- Delivering contracted post-sales services, i.e., maintenance/repair: 49%
- To better understand how customers use our product(s): 30%
- Delivering standard post-sales services, i.e., system upgrades: 27%
- To gain insight into potential new product or market opportunities: 19%
- We are collecting the data but not using it: 8%
- To support our sales efforts: 6%
- Other: 2%

Signs that a manufacturer is not using sensor-generated data to its fullest potential include:

- Flat service contract/extended warranty programs that do not recognize differences in customers usage.
- A service contract/extended warranty program is in place, but there’s no strategy for using the data to better understand product reliability, risk, use cases, and customer tendencies.
- Slow to respond to changing customer-use patterns for marketing or service.
- Organization is often reacting to or surprised by product issues.
- Company’s service products’ protection lags improvements in product performance.
- Company’s market share is eroding and products features lag versus the competition.
- Asset maintenance based on defined time intervals or usage patterns and total cost of ownership is rising relative to the competition.

Over the longer term, companies not using sensors to their full potential will lose ground to competitors that are, says Josh Becker, Principal Industry Consultant at SAS, a leading provider of business analytics platforms.

“They can experience brand stagnation, loss of brand equity, erosion of after-market business to third parties, accelerated product commoditization, excessive operational expenses, limited or poor product reliability, potential regulatory implications, excessive maintenance costs, and inability to catch up to the Big Data tidal wave,” Becker says.
Sensors by Sector: Driving Innovation, Changing Behavior

Medical Devices: Preventing Asthma Attacks

“AT&T has demonstrated a wireless sensor called Asthma Triggers to detect the levels of harmful chemicals in the air and feed the data over an AT&T network to smartphones, computers and tablets. By using the sensor, asthmatics can gain a better understanding of their surroundings before waiting for symptoms to occur, AT&T suggested in a company video.”


Consumer Goods: Fresh Food & Regular Exercise

“With a dizzying array of interactive technology, including such varied applications as edible sensors to avoid spoiled food and the Nike+ FuelBand to monitor physical activity, our daily routine is becoming easier to track and manage with devices that can use data and the connected web to provide personalized and customized information.”


Energy Management: Saving a Billion Kilowatt Hours and 100% Growth

“While Nest is sold in more than 4,000 retailers across the United States and Canada, the company’s thermostats have been activated in over 90 countries. [Creator Tony] Fadell says the Nest thermostat has created savings worth more than 1 billion kilowatt hours of energy, and the company is experiencing over 100% growth year over year.”

— Gabrielle Karol, “Father of the iPod Innovating Within the Nest,” Fox Business Small Business Center, Sept. 17, 2013, smallbusiness.foxbusiness.com
What Others Say About Sensors

Drowning in Data

“We are swimming in sensors, and drowning in data. Sensory data is growing at such a rate that our ability to make sense of it is highly constrained.”


Nimble Machinery

“In a modern factory, sensors not only help guide increasingly nimble machines, but also provide the information necessary to manage the operation of the factory as a whole. Products can be tracked from inception to the point of delivery and, in some cases, even beyond. The moment anything goes wrong in the process—i.e., the humidity inside a spray booth isn’t optimum for a paint—a sensor can detect it and issue an alert to the machine operator or even to the plant manager’s cellphone.”


New Product Development

“The top motivator for M2M adoption in the consumer electronics and manufacturing sectors is not to save cost but to gain competitive advantage... Differentiation of the end product is not enough. These manufacturers must create value-added services to include with their products that are not easily copied. Examples might include various warranty, asset tracking, security and predictive maintenance services. M2M can enable all these value-added services for manufacturing businesses.”

— The M2M Adoption Barometer 2013, Vodafone, conducted by Circle Research, smallbusiness.foxbusiness.com
Integrated Business Analytics Platform:  
A Foundational Necessity

Many manufacturers already feel overwhelmed with the amount of data entering their enterprises, and proliferation of sensors will compound the challenge. Getting ahead of this wave with an integrated, enterprise-wide business analytics strategy can position companies to extract the strategic knowledge that resides in the data.

An integrated business analytics platform makes manufacturers more competitive by enabling them to exploit existing value chains to the greatest extent possible (i.e., shaping demand for their goods or services) and generate new value chains that can drive substantial profit or significantly cut costs (i.e., leveraging embedded sensor information to accurately predict failures and then creating service contracts that will return high margin with low risk).

Manufacturers increasingly are recognizing the importance of business analytics software and investing in it (see Figure 3).

**FIGURE 3: ENTERPRISE TECHNOLOGY INVESTMENTS 2012 VS. 2013**  
Investment in data management and analytics solutions up almost 40%

<table>
<thead>
<tr>
<th>Technology Area</th>
<th>2012 Findings</th>
<th>2013 Findings</th>
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</thead>
<tbody>
<tr>
<td>Software solutions for managing and analyzing data</td>
<td></td>
<td>41%</td>
</tr>
<tr>
<td>Mobile tools, such as tablets, smart phones and GPS devices</td>
<td>30%</td>
<td>36%</td>
</tr>
<tr>
<td>Increased computing power</td>
<td>29%</td>
<td>35%</td>
</tr>
<tr>
<td>Cloud computing and/or information storage/back-up</td>
<td>21%</td>
<td>27%</td>
</tr>
<tr>
<td>Software/hardware solutions for storing information/data</td>
<td>23%</td>
<td>26%</td>
</tr>
<tr>
<td>Sensors to monitor operations (i.e., machinery, energy usage)</td>
<td>21%</td>
<td>20%</td>
</tr>
<tr>
<td>Server virtualization or rationalization</td>
<td>17%</td>
<td>23%</td>
</tr>
<tr>
<td>Data warehouses</td>
<td>14%</td>
<td>18%</td>
</tr>
<tr>
<td>Other</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>None of these</td>
<td>16%</td>
<td>19%</td>
</tr>
</tbody>
</table>

Let’s take a closer look at what an integrated business analytics platform is.

Most manufacturers have at least three primary technology platforms within their enterprises, and it’s common for them to be managing many software products and vendors within each platform, particularly within analytics. Enterprise IT departments find it challenging to manage this in a manner that meets today’s business requirements, anticipates tomorrow’s, and does both at the lowest total cost of ownership.
Operational and productivity platforms have always been acknowledged as different and discrete. The analytics platform, however, typically consists of a set of “capability standards,” i.e., using a group of vendors for data integration (extraction, movement, cleansing, and transformation), another group for analytics (descriptive, predictive, and prescriptive), and yet another group for visualization (user interfaces, interactions, charts and graphs, and desktop and device delivery).

“As analytics grows in importance in manufacturing, many IT organizations are recognizing the need for downsizing the number of analytics vendors within their organization,” Becker says. “They’re also recognizing that the functions of data sourcing, analytic discovery and sharing results are very interconnected; and therefore, they need to think about analytics more holistically, and as a platform.”

Becker says the benefits of this more holistic approach for manufacturers are more opportunities to improve operations and a maximized return on their investment in analytics.

“Decisions are automated and predictive, rather than manual and reactive. Inputs and outputs from various functional areas within the organization are automatically shared, which drives the most efficient use of the vast amounts data being generated.”

With an integrated business analytics platform (see Figure 4) in place, scaling up to strategically apply sensor-generated data to operational and product/services-development decisions is faster and more effective, which increases competitive advantage on multiple fronts.

“In many areas of manufacturing, traditional improvement methods have reached a ceiling,” Becker says. “Embedded sensors offer a deeper—arguably the deepest—level of insight as to how products are operating and how customers are interacting with those products. So, it’s critical that manufacturers leverage embedded sensor data to reach new levels of quality and reliability, enrich the total customer experience, maintain relevancy to consumers who now expect connectivity, and—in some industries or countries—comply with strict regulations that mandate connectedness.”
Looking Ahead

Sensor technology will continue to evolve. If sensors follow the same pattern as the game-changing technologies that preceded them, their capabilities and application will soon stretch far beyond what can be imagined today. It’s a certainty that sensors will continue to produce insightful data that manufacturers can use to shape their futures.

An integrated business analytics platform today can provide the foundation needed to manage and strategically analyze all incoming data, whether coming from sensors or other sources. The amount of data that companies are capable of collecting is only going to increase, and as it does, so will knowledge on how best to lead and manage. Winning companies will have the business analytics tools they need to extract that knowledge and turn it into action. Will your company be among them?

For more on how predictive analytics and data mining can reveal new insights and create new opportunities, go to www.sas.com/reg/wp/corp/28224 or call SAS at +1 (919) 677-8000.
“Organizations that do not view embedded sensors and the data they generate as a key strategic initiative will become less competitive.”

— Josh Becker, Principal Industry Consultant, SAS