MAKE THE IIoT AND DIGITAL TRANSFORMATION A REALITY

SIX ANSWERS to Questions You Didn't Know to Ask

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Executive Summary

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Surprising to many, technology related issues like scalability and cyber-security are not the greatest challenges facing companies considering the adoption of Industrial Internet of Things (IIoT) platform technologies. Instead, the top two challenges are financial: building the business case and funding.

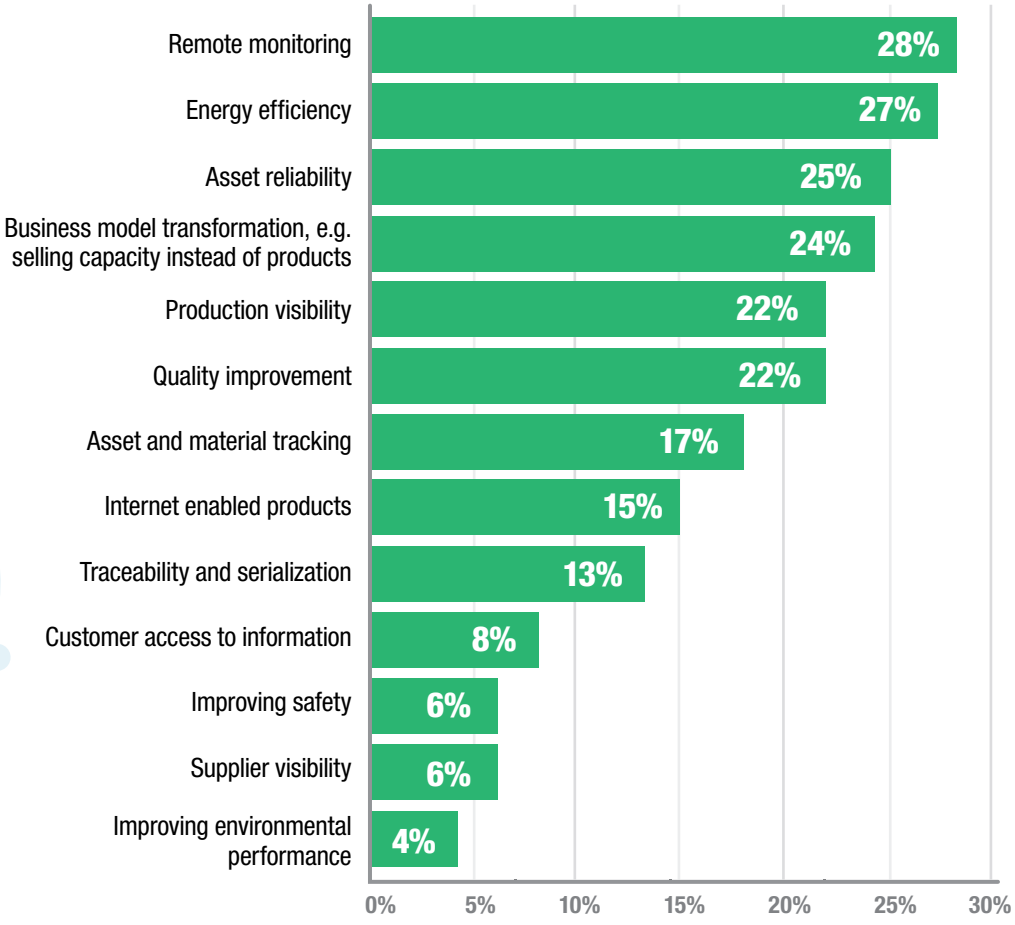
LNS Research analysts have attended hundreds of conference sessions, client meetings, and vendor briefings focused on this topic, and the reason why building a business case for these technologies is so difficult boils down to one very simple idea.

You don't know what you don't know.

Most executives intuitively see the potential for the IIoT to enable multiple use cases, including improved asset reliability, optimized production operations, increased product quality, remote monitoring, or enabling new business models, to just name a few. As a rule, these use cases fall into two categories: new technology for old use cases and new technology for new use cases.

"Building a business case is difficult because you don't know what you don't know."

Top IIoT Use Cases



Executive Summary *(Cont.)*

The latter is much easier to justify and where much of the IIoT investment is going today. New service offerings or products are exciting and it's relatively easy to build a business case for them. Marketing, product, and technology teams come together and estimate the market size, anticipate pricing models, and develop prototype products with realistic costing. When these factors come together harmoniously the new project is approved, which is why we have seen so many examples of new smart connected assets over the past year, like mining equipment, packaging equipment, test equipment, robotics, pumps, valves, bearings, motors, automation, and many more.

However, when you ask the same companies if they apply these same technologies to their operations or are now manufacturing smart products in dumb plants, the response is predictable, "Wow, I never thought about it that way."

Which brings us to the second set of use cases, applying new technology to old use cases. As mentioned above, executives intuitively believe that these new IIoT technologies should enable improved asset and production performance. However, when asked to go a layer deeper, and build a business case that highlights areas of asset and production performance that are underperforming, most executives come up short.

Building such a business case requires executives to know what they don't know. In the end, this leaves only two paths forward. Buy on faith, or wait and see. Not surprising, most companies have waited. Fortunately, not all have.

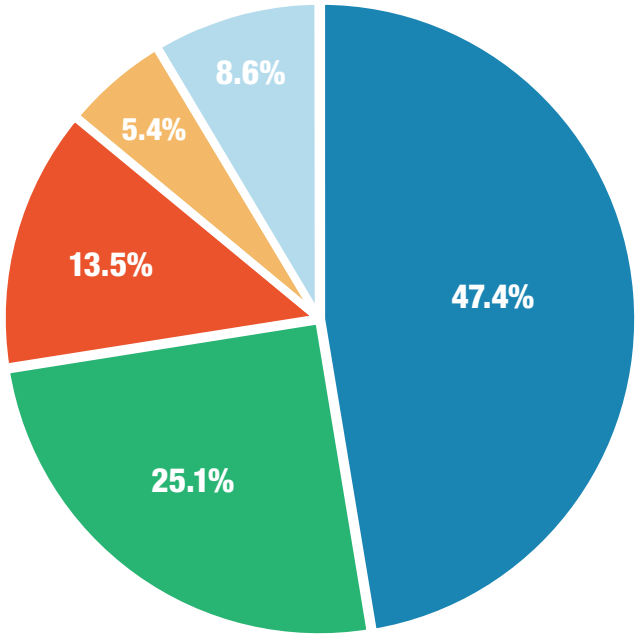
In this eBook, we will present qualitative research highlighting what early adopters have discovered after deploying new IIoT platform technologies to old use cases. This gives companies still waiting a chance to know what they don't know.

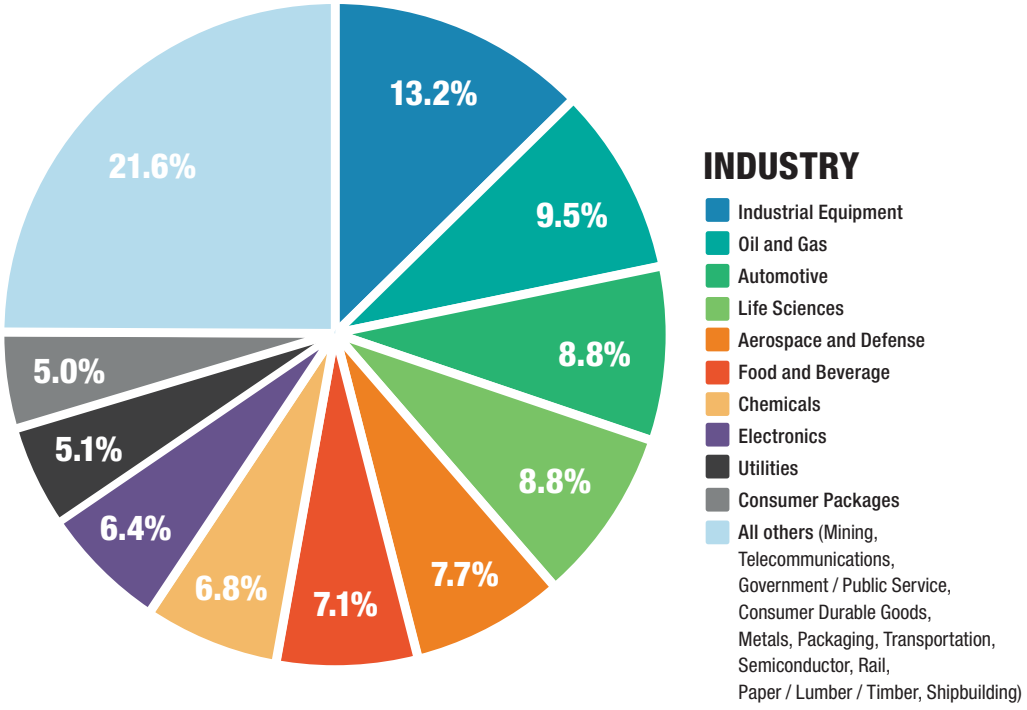
INTRODUCTION

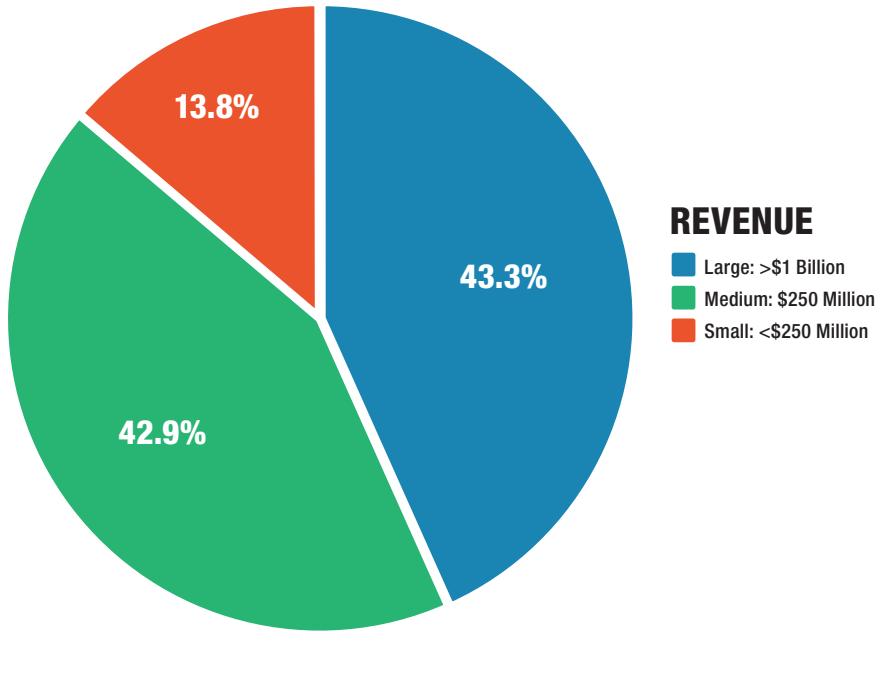
IIoT Adoption and Challenges

IIoT Adoption and Challenges

From January 1, 2016, to April 30, 2017, over 1000 respondents from industrial companies have completed the LNS Research general demographic and technology survey. Of these respondents, 130 have completed the more detailed IIoT survey. Nearly two-thirds of respondents come from North America and Europe, but no region makes up a majority of respondents. Across industries, there is a broad range across process, batch, and discrete, with no industry making up more than 15% of respondents. Regarding company size, there is an almost even split between large and small companies at 43%, with the smallest percentage of respondents being medium sized businesses.







IIoT Adoption and Challenges *(Cont.)*

The IIoT broadly refers to the concept that as scalable computing, ubiquitous connectivity, and pervasive sensing becomes a reality for industrial environments, companies will need to embrace modern technology architectures and platforms that enable more flexible and user-centric mash-up applications with big data analytics.

In support of this new vision, LNS Research has defined the concept of an IIoT platform to bring together connectivity, cloud, big data analytics, and application development capabilities. Starting in 2014, many industrial automation and software vendors have invested heavily to deliver on this vision of "platform as a service offering," and in turn, industrial companies have responded.

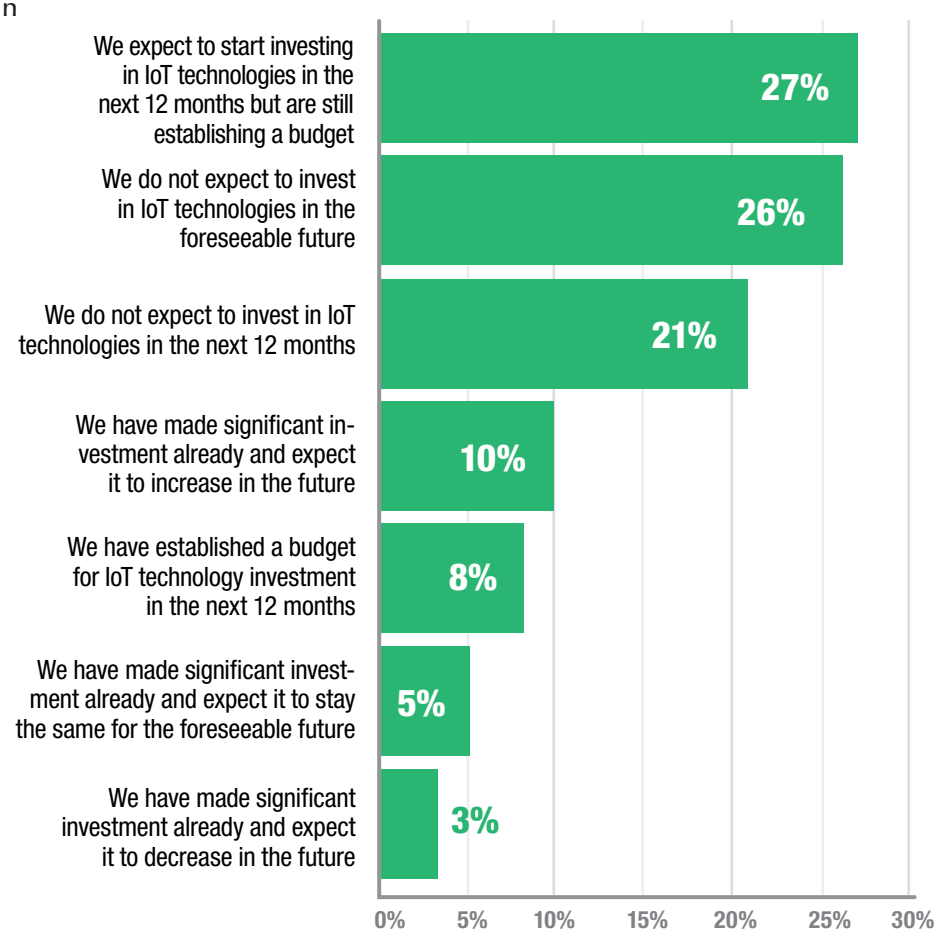
INDUSTRIAL INTERNET OF THINGS PLATFORM by LNS Research describes the connectivity, network styles, and applications frameworks to support smart connected operations and smart connected assets; within and across a plant, facility or production network in a manufacturing or other industrial operations setting.

Click to learn more about the **Industrial Internet of Things Platform**

Over the past several years interest and intention to invest in IIoT platform technologies has steadily increased. We have now reached the point where a majority of industrial companies (53%) have either already invested in IIoT platform technologies or plan to do it this year.

This growth represents an impressive increase in market momentum; just two years ago nearly as large a share of companies didn't even know what the IIoT was.

Adoption Plans for the IIoT

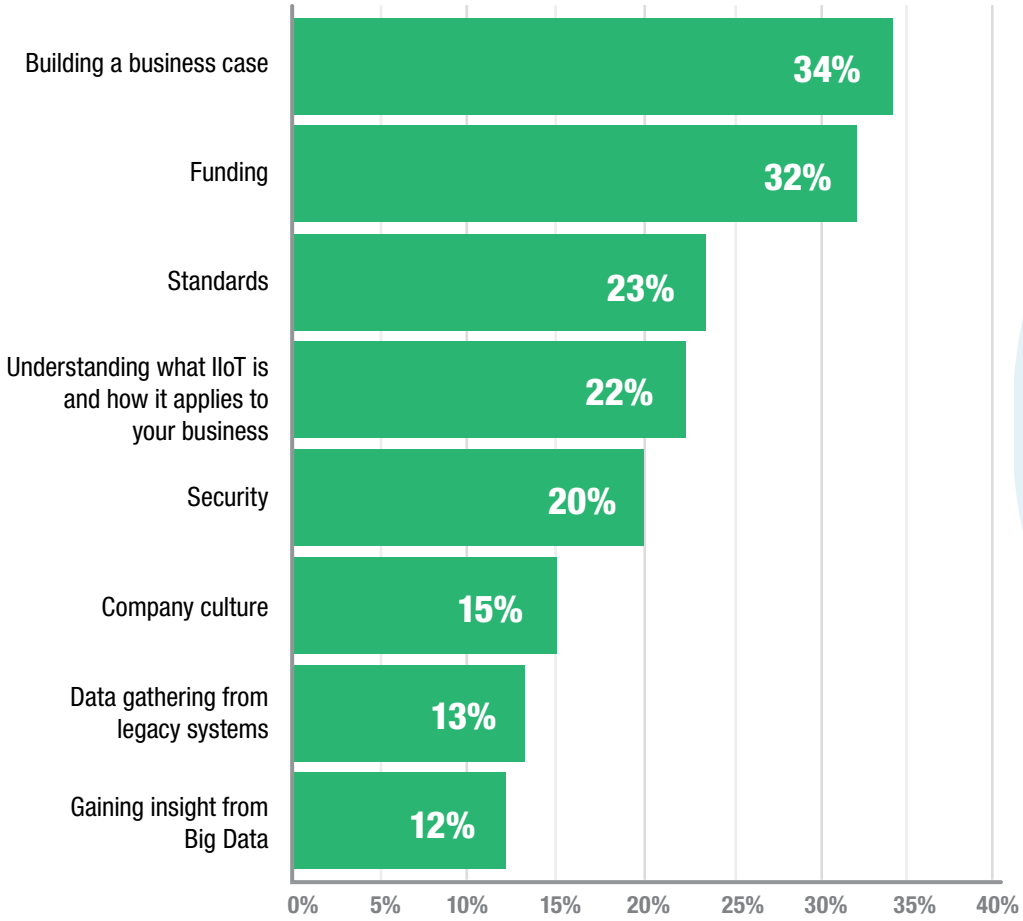


IIoT Adoption and Challenges *(Cont.)*

With nearly one-fifth (18%) of the market already invested in the IIoT and another one-third (35%) of the market currently planning to invest in IIoT technologies this year, IIoT technology is quickly moving from the realm of early adopter to becoming mainstream. The challenge companies face in this second early wave of IIoT adoption is not technical. Instead they struggle to build the business case and secure funding.

So why is building the business case the top challenge? On its face, the business case for the IIoT seems like it should be easy. If the cost of technology is dropping rapidly and the ease of deployment is growing just as fast, shouldn't a positive ROI be the story's natural conclusion?

Top Challenges for Investing in the IIoT



IIoT Adoption and Challenges *(Cont.)*

The gap in this reasoning is partly cultural and partly the consequence of operating industries that are often mature. Industrial companies are naturally conservative, and many of their operational leaders have an engineering mindset. This posture means that these individuals, and in a sense their companies, are predisposed to doubt the results of new algorithms that do not have a basis in principles relevant to the problem being analyzed. Additionally, for decades, industrial companies have had a laser focus on improving areas of operations like, productivity, reliability, quality, safety, and energy efficiency. Subsequently, any successful IIoT business case is based on additional savings that weren't already discovered with traditional technologies and methodologies like MES, EMI, ERP, BI, Lean and Six Sigma.

These realities have left industrial companies with two choices:

1. Build a business case for the IIoT based largely on faith that doing something is better than nothing. These companies hope new mash-up applications like the Digital Twin or new Big Data analytics like Machine Learning and Artificial Intelligence will reveal previously unknown and undiscovered opportunities for improvement.
2. Do Nothing.

This new research will help companies create another option. By looking at specific use cases and examining what previously unknown discoveries other companies have made using IIoT technology, companies yet to adopt IIoT technology can make an educated guess as to what unknown discoveries they may find in the data, and build their own business case accordingly. Resulting in:

3. Know what you don't know.

USE CASE 1

Re-Defining Critical Assets – Pumps, Valves, and Motors

USE CASE 1: Re-Defining Critical Assets – Pumps, Valves, and Motors

Conventional wisdom in maintenance and reliability advises companies to take a risk-based approach to maintenance strategies. In other words, it prescribes managing critical assets with condition-based maintenance (CbM), and managing less critical assets with time-based maintenance (TBM) or a run to failure.

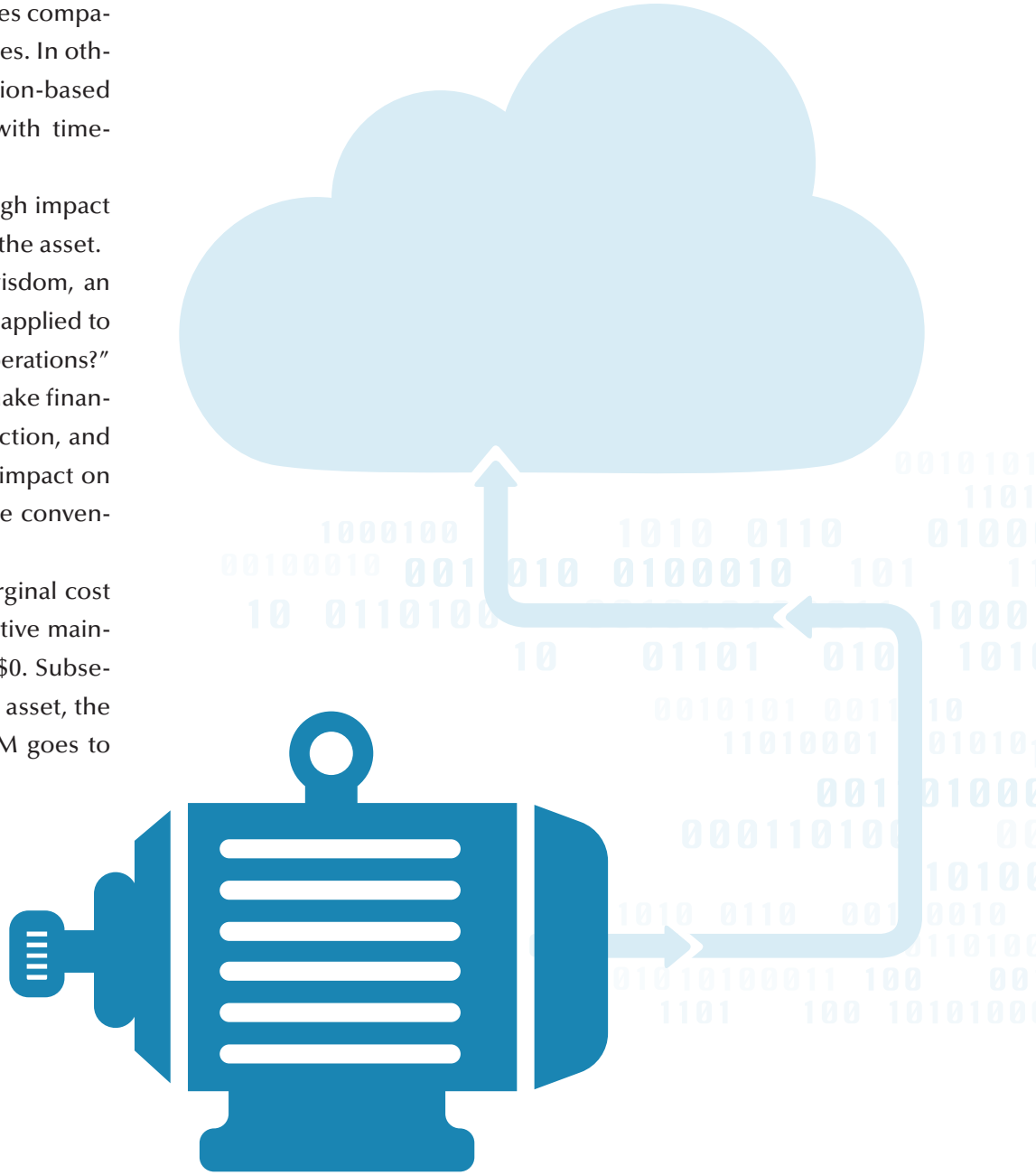
Often criticality of an asset is determined simply, through impact to operations if the asset fails, or to a lesser extent cost of the asset.

For someone interested in challenging conventional wisdom, an interesting question might be, "Why aren't CbM strategies applied to all assets, since every asset has some cost and impact on operations?"

Grizzled veterans will quickly point out that it doesn't make financial sense to spend $10,000 on sensing, wiring, data collection, and analytics software, to manage a $2,500 asset with limited impact on production downtime, which is the original genesis of the conventional wisdom.

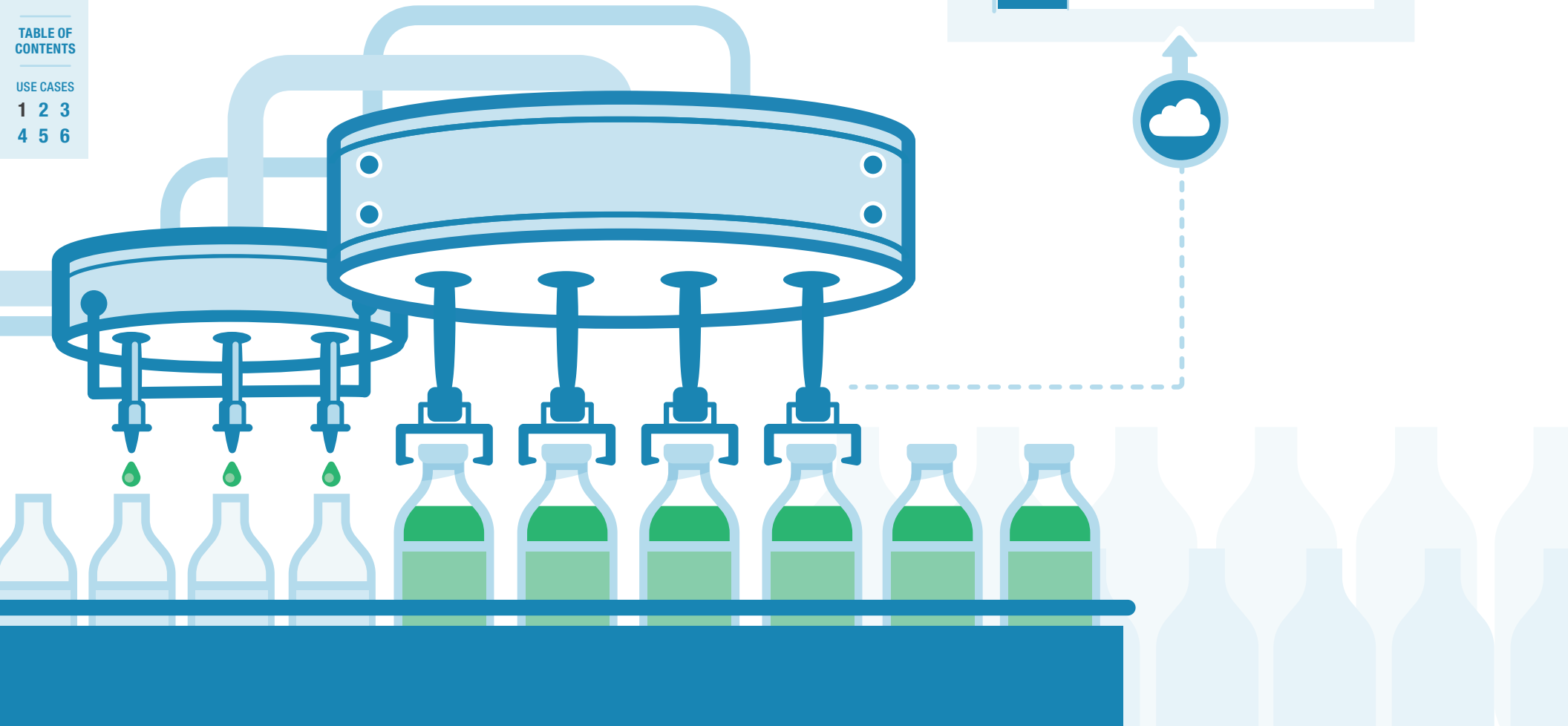
However, by taking an IIoT platform approach, the marginal cost of applying CbM (and extending to predictive or prescriptive maintenance approaches) to additional assets drops to nearly $0. Subsequently, as this cost drops to nearly $0 for each additional asset, the share of assets that have a positive ROI for applying CbM goes to nearly 100%.

Because of this phenomenon, we have seen early adopters of IIoT platform technologies begin applying CbM to many assets in operations that were never given the benefit of such an approach before, and the results have been impressive.



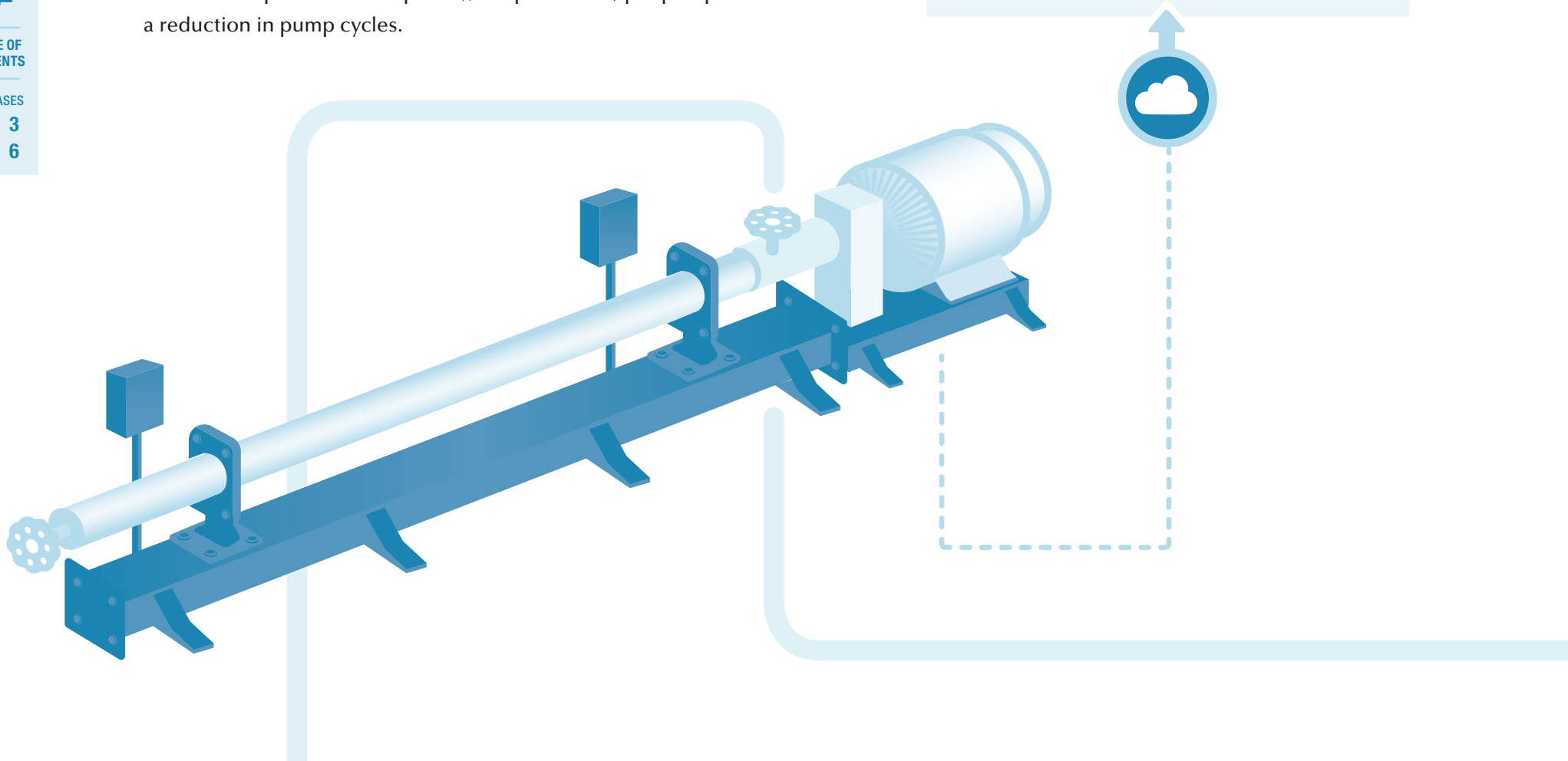
Small Motors in High-Speed Bottling Plants

A Typical Bottling Plant fills thousands of bottles per minute and has hundreds of small motors. These motors typically aren't monitored individually and follow a break-fix/replace approach. A large bottling facility that recently adopted IIoT technologies and began monitoring these motors learned that micro stoppages from these motors accounted for one of the top-down time sources in the plant. By applying improved maintenance approaches to these motors, unplanned downtime of the plant was reduced by over 10%.



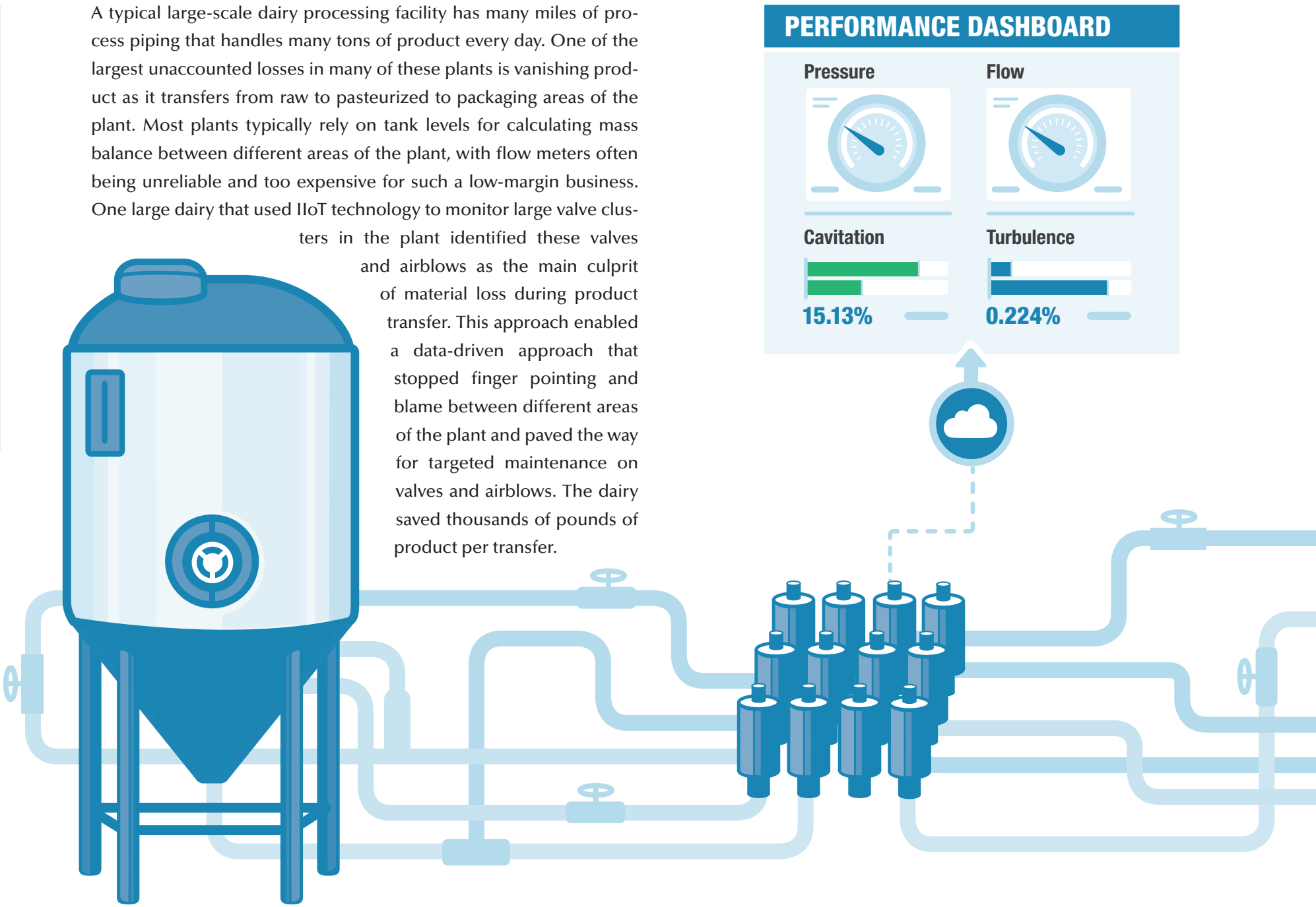
Horizontal Pumps in Upstream Oil and Gas

Horizontal pumps in upstream oil and gas have always been critical assets, being large energy consumers and essential for productivity of the well site. However, because of bandwidth and connectivity issues, pumps were often run with a "set it and forget it" approach, with few or no updates after installation by machine manufacturers or oil field service providers. With new IIoT approaches, which include edge and cloud analytics, companies can optimize pump performance over time as the well changes. Operators that have taken this approach, either themselves or through a service provider, are reporting dramatic improvements. One operator reported a 43% reduction in power consumption ($60k per month) per pump due to a reduction in pump cycles.



Valve Clusters in Dairy Facilities

A typical large-scale dairy processing facility has many miles of process piping that handles many tons of product every day. One of the largest unaccounted losses in many of these plants is vanishing product as it transfers from raw to pasteurized to packaging areas of the plant. Most plants typically rely on tank levels for calculating mass balance between different areas of the plant, with flow meters often being unreliable and too expensive for such a low-margin business. One large dairy that used IIoT technology to monitor large valve clusters in the plant identified these valves and airblows as the main culprit of material loss during product transfer. This approach enabled a data-driven approach that stopped finger pointing and blame between different areas of the plant and paved the way for targeted maintenance on valves and airblows. The dairy saved thousands of pounds of product per transfer.



USE CASE 2

A New Approach to Clean-in-Place Systems

USE CASE 2: A New Approach to Clean-in-Place Systems

Any facility that is FDA regulated is familiar with the daily (perhaps less frequent with extended run) ritual of clean-in-place (CIP). A fast and efficient CIP process is one of the ways a facility can quickly improve OEE and gain immediate increases to availability. An effective CIP process is also one of the areas where these companies can dramatically decrease or increase the risk associated with product safety.

Typical CIP processes are not quick, efficient, effective, or well documented. Companies usually manage the CIP process locally through HMI/SCADA systems, and record results either manually or in data historians. The process must hit time, flow, temperature, and concentration targets and the line is presumed clean and ready for production, with perhaps some swabs as spot checks for contamination.

LNS Research is aware of at least one large and innovative beverage company that is using the IIoT to rethink CIP. Rather than having plants locally assume that a production line is clean after a CIP activity is complete, the company will use the IIoT to provide global visibility of CIP and move to a model that measures cleanliness continuously, with the CIP ending when the line is clean.

Typical turnover times are four hours per line. The company anticipates 50%+ reductions in turnover times, while simultaneously and dramatically reducing food safety risks by having a central repository of CIP performance.

USE CASE 3

Creative Use of Social, Geospatial, and Asset Data

USE CASE 3: Creative Use of Social, Geospatial, and Asset Data

Infrastructure around the world is experiencing tremendous change and growth given well documented mega trends in demographics and technology. Transportation and utilities are ripe with opportunity for Digital Transformation via IIoT technologies, and many of these organizations have already started projects.

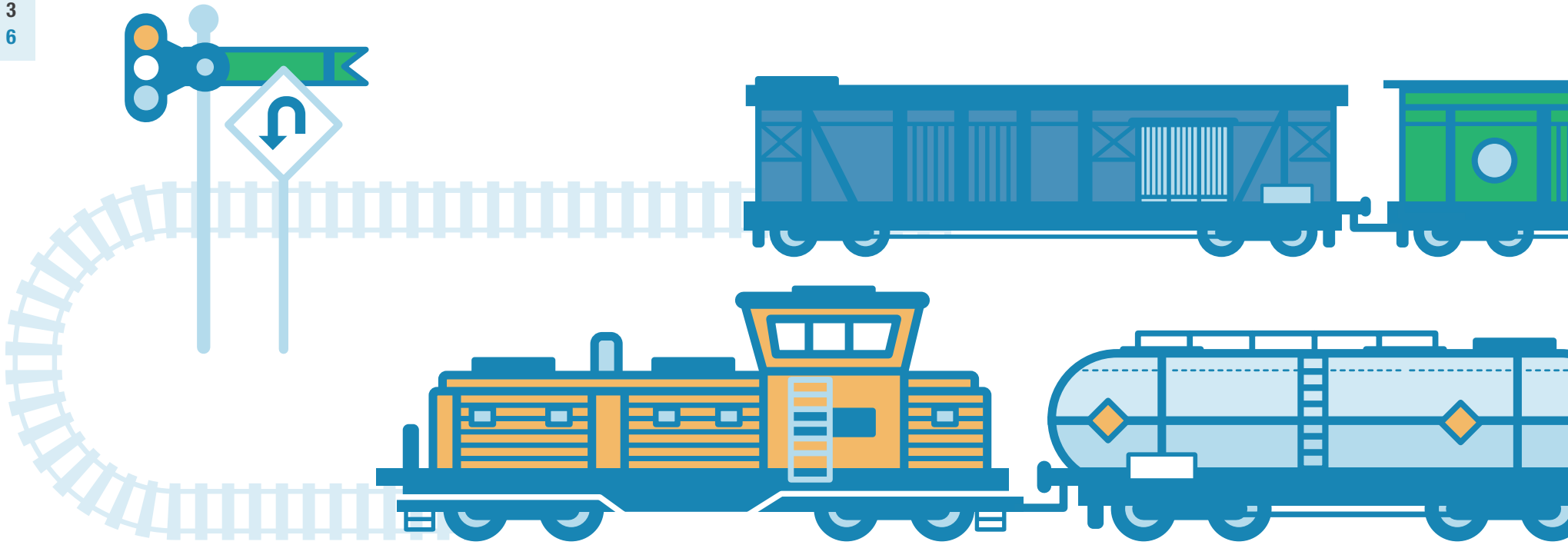
Given the distributed nature of these assets and the degree to which these industries interact with the public; they represent a unique opportunity for Big Data analytics to deliver new insights by combining traditionally disparate data sources like social, asset, and geospatial.

Rail: Don't Forget to Turn the Train Around

One of the largest rail systems in Europe recently spent two years implementing an IIoT pilot project sensing, connecting, and analyzing data from across the network. This rail system has an annual maintenance and repair budget of over €1B.

The system is already projecting more than 8% savings on maintenance, and one of the ways they plan on achieving this is simply by turning the train around. By examining logistics, GIS, and asset data the company discovered that too many trains were running the same routes in the same orientation, which created uneven wear and increased maintenance activities.

Sometimes the prescriptive insights from Big Data analytics are surprisingly simple to implement – like turn the train around.

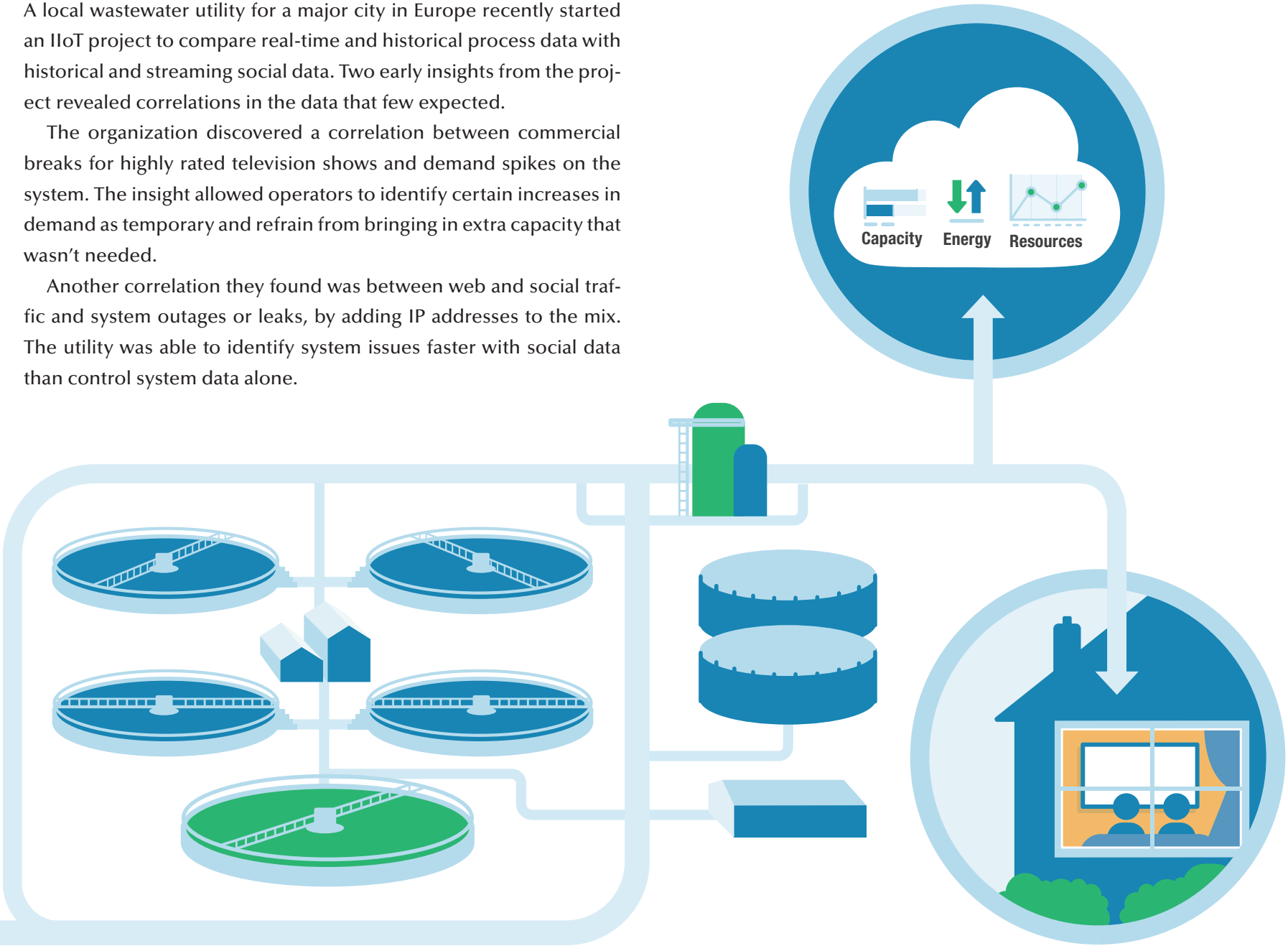


Waste Water: Anticipating the Big Flush

A local wastewater utility for a major city in Europe recently started an IIoT project to compare real-time and historical process data with historical and streaming social data. Two early insights from the project revealed correlations in the data that few expected.

The organization discovered a correlation between commercial breaks for highly rated television shows and demand spikes on the system. The insight allowed operators to identify certain increases in demand as temporary and refrain from bringing in extra capacity that wasn't needed.

Another correlation they found was between web and social traffic and system outages or leaks, by adding IP addresses to the mix. The utility was able to identify system issues faster with social data than control system data alone.



USE CASE 4

Managing Recipe Variation

USE CASE 4: Managing Recipe Variation

Anyone that has ever home brewed beer knows it can be a touchy process, fraught with seemingly mysterious relationships between live cultures, bacteria, time, temperature, ingredients, equipment, elevation, and much more.

Given all the possible sources of variation in recipes, sometimes even top brewmasters can make mistakes.

One of the largest craft brewers in the US recently engaged in an IIoT project using ML/AI and historical process data to solve a batching problem that was resulting in a major quality issue and the loss of entire batches.

The brewmasters thought the problem was the relationship between pressure and temperature; it turned out to be an issue with the timing of batch processes determined by natural variances in yeast. Using ML/AI the brewmasters built a model to alter the recipe and optimize batches on previously unknown relationships.

With the new process established, they eliminated lost batches for this quality issue and recaptured two weeks of extra capacity per lost batch.

USE CASE 5

Safety – Machines and Processes

USE CASE 5: Safety – Machines and Processes

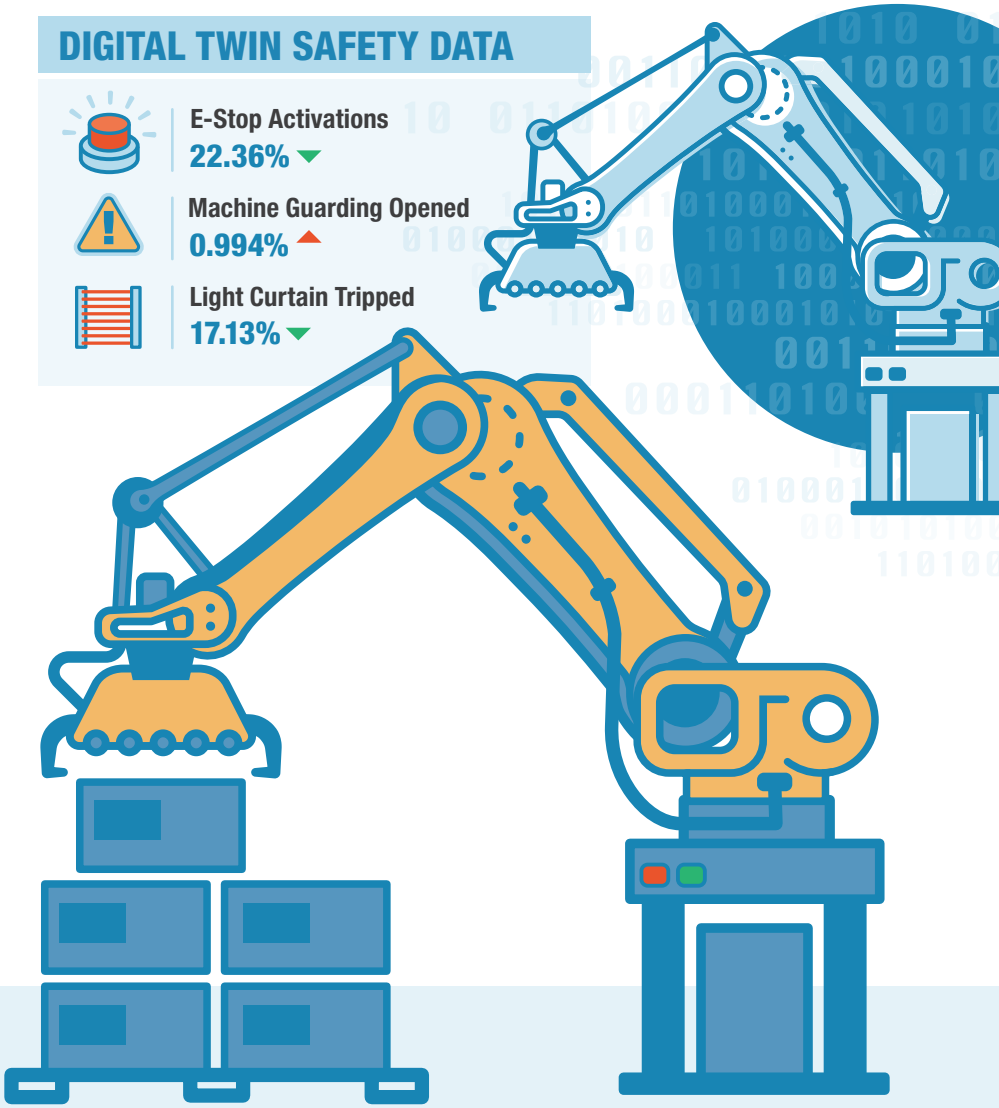
Go to any plant cafeteria today and the number one metric displayed is time since last lost time accident (LTA).

Over the past 20 years, safety has moved from being an afterthought to a core value for most industrial companies. During this time, industrial companies have invested heavily in building sophisticated risk-based models for managing both machine and process safety. The challenge most companies have faced with using these models in practice is that there has not been any way to easily compare actual results to those anticipated by these models. This is dramatically shifting with the deployment of IIoT technologies and Digital Twin mash-up applications.

LNS Research is now aware of multiple machine builders that are enabling Digital Twin applications to compare predicted and actual safety performance of machines, i.e. e-stops, machine guarding, light shields, operator alarms, and more. Such applications are allowing industrial companies to identify when safety systems are being used significantly more or less than anticipated, both of which dramatically increase the risk of injury.

- When safety systems are being under-utilized, it typically indicates that operators and or supervisors have found a way to disable or short-cut around safety systems, typically in an effort to increase productivity, ease of use, or both.
- When safety systems are being over-utilized, it typically signals maintenance, operator, or calibration issues; causing the machine to exceed engineered operating conditions.

Through the use of a Digital Twin, industrial companies identify these operational issues, but more importantly they establish a method to address them with offline training in mixed reality applications that don't suck up capacity from the "real" machine.



USE CASE 6

Smart Products and Disrupting Quality Testing

USE CASE 6: Smart Products and Disrupting Quality Testing

Quality testing and validation comes at a cost and is often a significant contributor to the total cost of quality incurred by a company. Because of these costs, quality best practices dictate that instead of testing every finished product, industrial companies should monitor the production process itself. They test the capabilities of a process and then assume if the process stays within controls limits the finished product stays within specification. Furthermore, they reduce finished product testing to a small fraction of total production just as a failsafe. Of course, no system is foolproof, and anything short of 100% finished product testing can still result in quality issues making it to the field.

As with other areas of operations, the IIoT and smart connected products are changing this game. When end-products have intelligence and connectivity built in, there are opportunities to use these capabilities to dramatically reduce the cost of quality testing and in fact, build quality testing into the production process.

LNS Research is aware of at least one leading smart connected products company that is using new connectivity and intelligence capabilities in the end product to conduct quality testing during production and eliminate previously undetected dead on arrival (DoA) failures from reaching the customer's doorstep.

Recommendations

Recommendations

Although many of the examples in this eBook have been within the context of a specific industry, the benefits are certainly transferable.

- **Pumps, motors, and valves** are used in every batch and process industry.
- **Smart products are becoming a reality** for every discrete manufacturing industry.
- **Every company has a wealth of data** in disparate systems that are not being analyzed holistically.
- **Safety matters** no matter the context.

Applying the use cases from this eBook in your business requires creativity, but well within the realm of possibility.

The IIoT is real, and many companies have already made the investment or are in the process of doing so. For companies that have not and are struggling to build a business case, do not buy on faith. Look to peer companies that are already reaping benefits. Then use the examples in this eBook to make an educated estimate on how your company will benefit from IIoT platform technologies and what the real financial benefits will be from new insights.

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