IndustryWeek

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IoT Implementation Trends in Manufacturing: Survey Results from the Front Line

IoT Implementation Trends in Manufacturing

While a small fraction of manufacturing companies has fully integrated IoT into their business, a significant majority of manufacturers are interested in or are currently deploying IoT projects. The trend toward an IoT-centric manufacturing business appears poised to accelerate.

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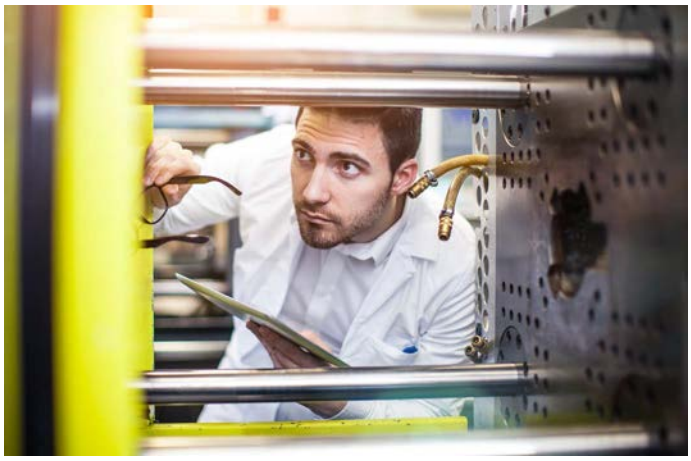
EXECUTIVE SUMMARY

This report highlights the findings of the 2018 *IndustryWeek* IoT Implementation Trends: Focus on Manufacturing research study, sponsored by Siemens. Completed in August, the study explores where (which department), why, and how manufacturers are deploying Internet of Things (IoT) projects.

Demonstrating that IoT is no longer an abstract concept, three out of four respondents (73%) are currently researching or implementing a project or have implemented at least one project. Of the minority that report having no meaningful involvement in IoT, over 80 percent report an openness to considering it. They're looking for best practices case studies and research to prove IoT success, as well as investment from their top management.

Of the companies that have implemented at least one IoT project, nearly nine out of 10 respondents (86%) report that their experience with IoT met or exceeded their expectations and that they are currently pursuing additional projects.

Given the relative newness of IoT, it's a little surprising that nearly half of the companies that have deployed an IoT project appear to be largely forging ahead on their own. They are sourcing their IoT solutions from various vendors, via multiple contracts, rather than seeking out a single solution integrator partner (one contract) or a complete solution from a single supplier plus a separate system integrator (two contracts).



Similarly, just under half report that their IoT journey has been moderately challenging, with over a third of respondents reporting it has been "very" or "extremely" challenging.

The survey shows that manufacturers are convinced that implementing IoT is critical to their future success, but many struggle to identify the business case for and best practices involved in executing an IoT project or an ongoing IoT transformation.

RESEARCH METHODOLOGY

The purpose of this study was to explore IoT implementation trends in manufacturing. In August, Informa Engage e-mailed invitations to participate in an online survey to subscribers of *IndustryWeek*. To encourage a prompt response and increase the response rate overall, a live link to the survey was included in the email invitation to route respondents directly to the online survey. In addition, the invitations and survey were branded with the *IndustryWeek* name and logo, and each respondent was given the opportunity to enter a drawing for one

of four $100 Amazon gift cards. Follow-up emails were sent to non-respondents.

Between August 22, 2018, and August 29, 2018, Informa Engage received the 277 completed surveys, upon which this report is based. Response percentages do not always add up to 100 percent due to rounding and the allowance for multiple responses on some questions.

INTRODUCTION

Get Ready for the Tipping Point

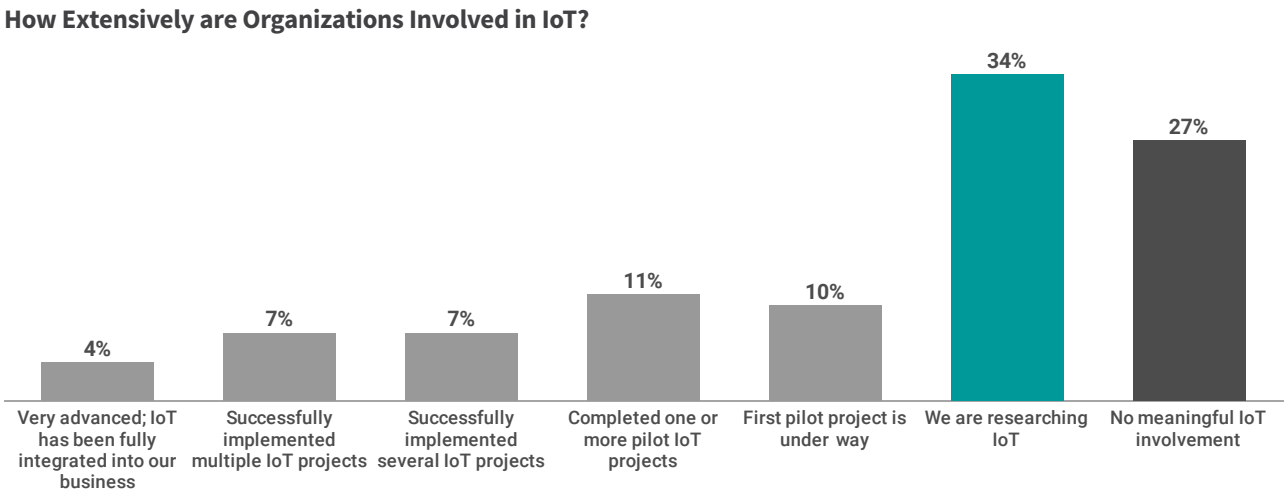
The introduction of IoT technologies to manufacturing is *unlike* any technological advance in recent history. Where other technologies targeted improvements to individual functions—CAD for design, MES for manufacturing and ERP for business automation—IoT comes with the promise to transform every aspect of the manufacturing business—and ultimately to facilitate the creation of new, disruptive business models.

With such a vast opportunity—and major risk if competitors are first to unlock the potential of IoT—manufacturers are eager to implement IoT. However, many are still determining where and how to start, while those that have completed at least one IoT project are working to identify next steps in their roadmap toward digital transformation.

To gauge how fully manufacturers have embraced the opportunities of IoT, *IndustryWeek* conducted this research, sponsored by Siemens. The goal was to take a snapshot in time of where, why and how manufacturers are implementing IoT projects, and to gain a sense of future practices.

High-Level of Interest

While still in the early stages, research shows that the transformation of manufacturing by the IoT stands poised to accelerate. Early adopters are beginning to share IoT proofs of concept to the companies that are waiting to confirm whether the seemingly



[Fig. 1] *Though a minority have fully integrated IoT into their business, interest level in IoT is high.*

outsized promises of the IoT can be realized. They also are turning their attention toward applying IoT to more value-added ends, which will increase their competitive advantage over those who've yet to implement a single IoT project.

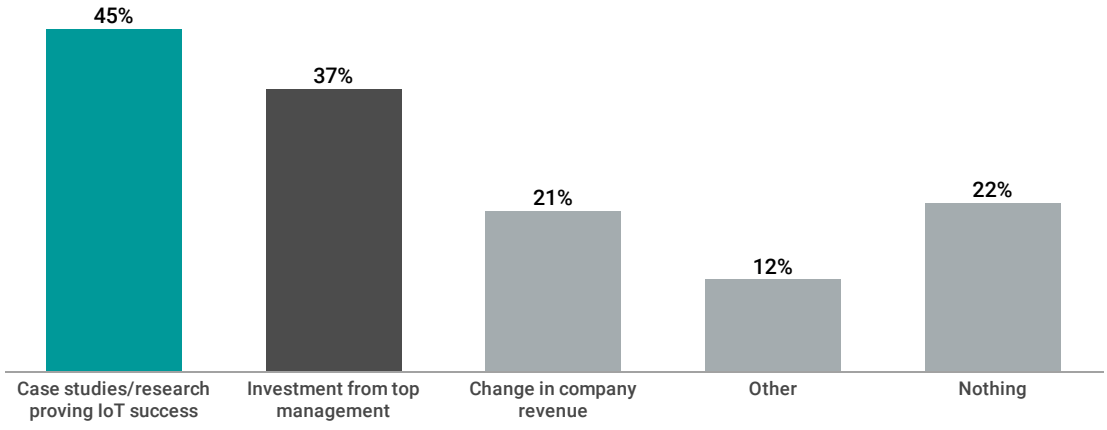
Only one in four respondents report that their companies have "no meaningful involvement" in IoT projects. That means a significant majority are at least currently researching or implementing a project or have implemented at least one IoT project. Perhaps more pertinent, 29 percent of respondents have completed one or more IoT projects, while 4 percent report having fully integrated IoT into the business. Though not yet reached, the tipping point is in sight, and the race to grab first mover advantage is under way.

Hungry for More Information

Companies that are not currently pursuing IoT show interest in learning more about the benefits IoT projects can deliver. Nearly half (45%) reported that case studies and research proving IoT success would spur them to consider pursuing IoT. They're looking for benefits that specifically derive from IoT, as well as guidance in the form of industry best practices and research, so they can identify a specific need and potential ROI for IoT projects.

Still others are awaiting a signal from their top management in the form of investment or a change in company revenue before pursuing IoT. This suggests that they think significant investment is required to launch an IoT project, an assumption that other research findings refute.

What Do Companies Need Before Pursuing an Initial IoT Project?



[Fig. 2] *Most companies sitting on the IoT sidelines are waiting for more proof that IoT will deliver value, while others await investment from company leadership.*

IIoT STRATEGY

How Companies Deploy IoT

With its cross-functional impact, IoT is thought to be challenging manufacturers' traditional organizational structures. However, as might be expected, the triumvirate of IT, Operations and Engineering are the departments most often given primary responsibility for IoT projects and budgets.

For primary responsibility for IoT projects, IT is named by little more than a third of respondent companies, while Engineering and Operations are each named by about a fifth of the respondents.

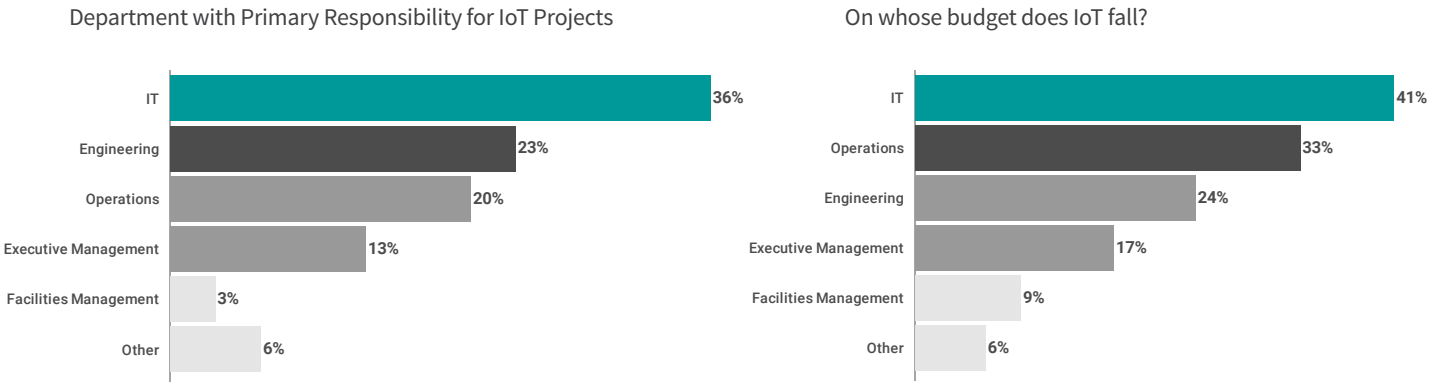
For budgetary responsibility, the results are more interesting. In at least 30 percent of projects, respondents report that more than one department is responsible for the IoT project budget.

Taken together, these two responses suggest that companies that have implemented IoT projects are not dwelling on which department leads a project or manages its budget. Particularly with the budget, they allocate it across departmental lines.

Also, given that other research results show that the vast majority of respondents say their IoT project met or exceeded expectations, it would seem that departmental ownership is not critical to IoT success. Rather, companies should decide and move on with a project.

Another view of the responses suggests that operational leaders lag behind their IT colleagues in taking the lead on IoT projects. This is a bit of a surprise. Because many IoT projects are designed to improve factory operations, it would be expected that Operations would lead them. Having IoT projects that benefit Operations led by IT could be problematic because it might crowd out the Operations department's in-depth domain knowledge, which is crucial to the success of an IoT project in operations.

Who Owns IoT?



[Fig. 3] *IT, Engineering and Operations departments are most often chosen to lead IoT projects and to manage IoT project budgets.*

What Changes are Needed?

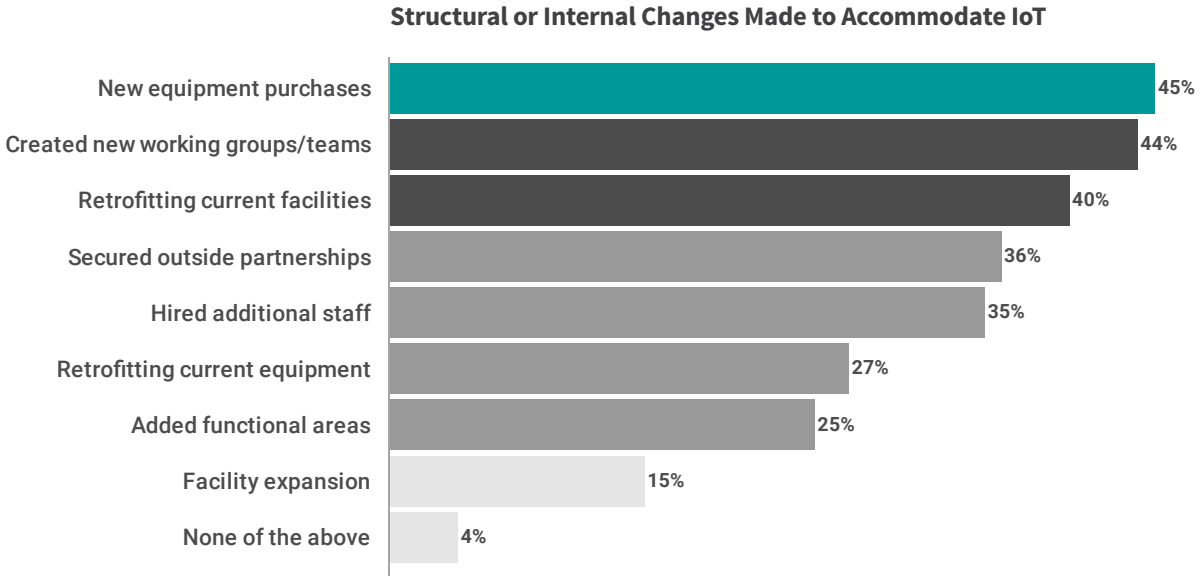
Perhaps not surprisingly, the vast majority of respondents (96%) with active IoT projects have made structural or internal changes to accommodate IoT. However, it should be noted that implementing any new technology requires at least some amount of change.

While most respondents indicate that they purchased new equipment as part of their IoT project, more research is needed to determine details about the type of equipment purchased. The cost and complexity of "new equipment" could range from inexpensive, easy-to-use sensors to expensive, complicated machine tools.

Related responses suggest that a more conservative investment approach is more common. Two-thirds of respondents say they retrofitted current facilities and equipment, which likely is much less disruptive and expensive than purchasing new equipment. Having invested in machine tools and equipment, manufacturers are understandably not interested in replacing them any sooner than necessary. These results show that companies do not have to invest in new equipment to attain IoT's benefits. Retrofitted products and facilities will achieve the same benefits, while extending the life of legacy equipment.

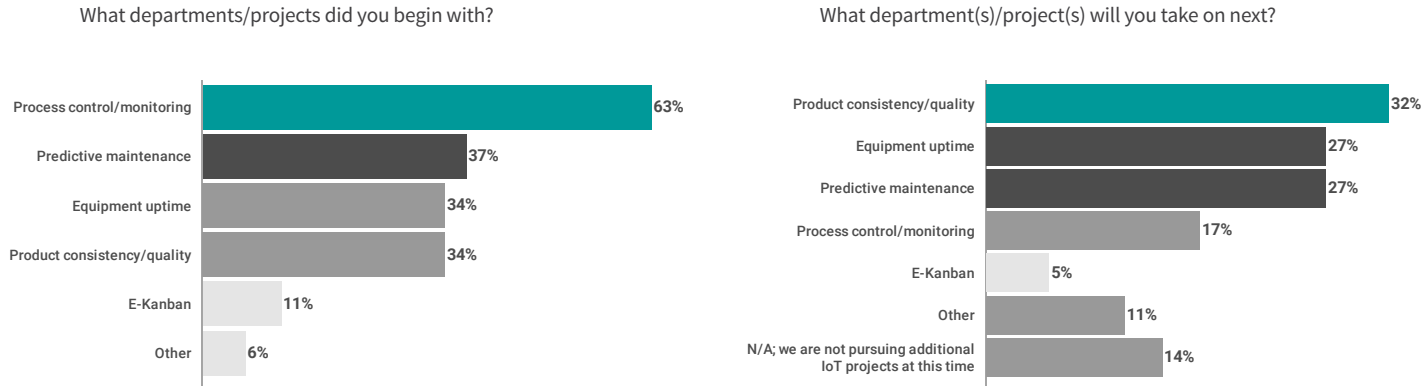
Where to Begin?

Most respondents say their first IoT project focused on improving factory performance, with a solid majority (63%) beginning in process control and monitoring. About a third of the respondents say their first project was in either predictive maintenance or equipment uptime. By combining the latter



[Fig. 4] *Retrofitting current facilities and equipment is the most significant change respondents say their companies made to accommodate IoT.*

Where to Begin an IoT Journey



[Fig. 5] *Improving factory performance is, by far, the most often selected for initial IoT projects. Subsequent projects focused on product consistency and quality.*

two, because they both are metrics that measure essentially the same goal, we find that 71 percent targeted the goal of reducing equipment downtime.

With unplanned downtime and asset failure as the main challenges that affect profitability in the manufacturing industry, these areas are a good place to begin an IoT journey because the ROI is readily apparent.

The target for the second or subsequent IoT project shifted to improving product consistency/quality, noted by 32 percent of respondents. Equipment uptime and predictive maintenance were mentioned by 27 percent of respondents as their "next" IoT project, while process control/monitoring dropped to 17 percent. The latter is not surprising, since it had been targeted by so many for their first project.

THE IoT IMPACT

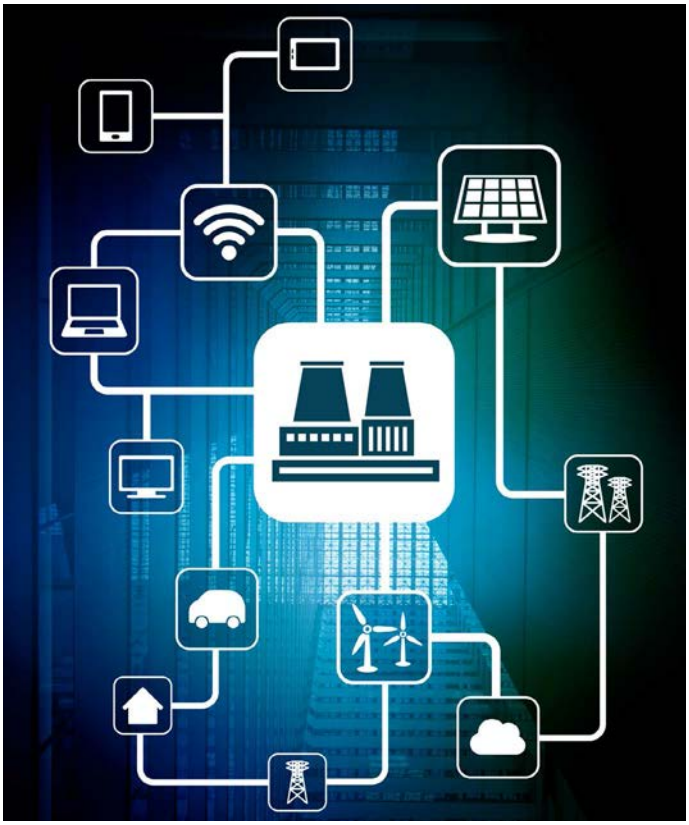
The Promise of IoT is Being Proven

Given the departments/processes targeted for improvement by respondents' IoT projects, the measures of the success or impact of IoT projects cited by most respondents, not surprisingly, are reduced downtime and lower operation costs, both cited by over half of the respondents. A rise in productivity and better understanding of equipment usage each were cited by just under half of the respondents.

Interestingly, other more business-oriented strategic measures are also noted by the respondents, suggesting the potential future targets of IoT projects. These include: better customer service response times (38%), increased revenue (30%), streamlined business process (28%), and quicker time to market for new products and service (20%). While these

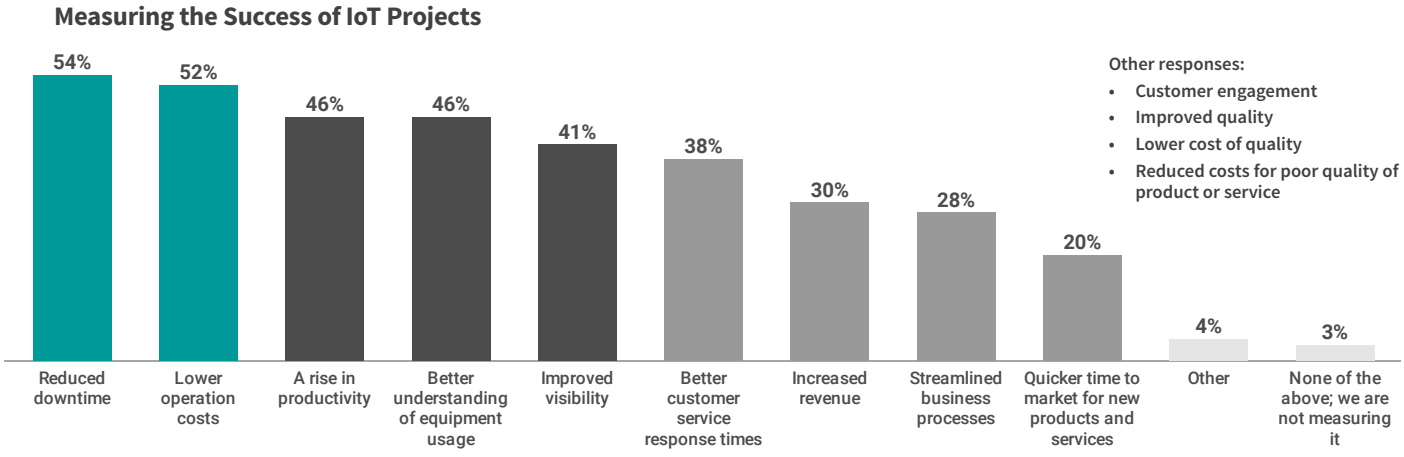
business metrics are achieved by fewer respondents, compared to the plant floor measures, imagine the gains that can be achieved if a project specifically focused on improving them.

This suggests that companies are beginning their IoT journeys on the plant floor and will likely move toward applying IoT toward achieving strategic business goals.



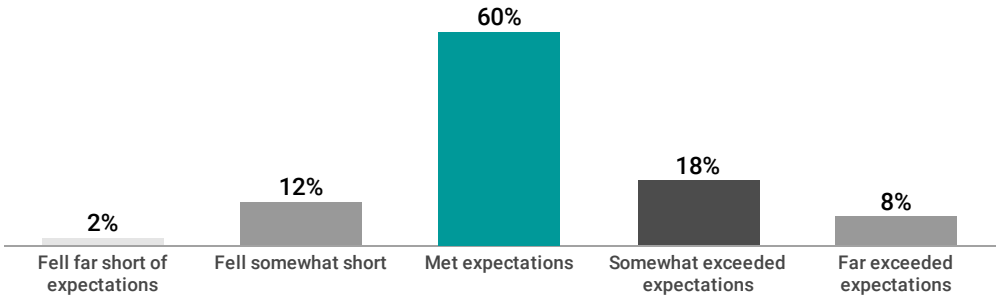
Impressions of IoT

Most respondents who have completed at least one IoT project say their experiences with IoT met or exceeded their expectations, with over half saying it met expectations. Only 12% say the experience fell somewhat short, and 2 percent say it fell far short of expectations.



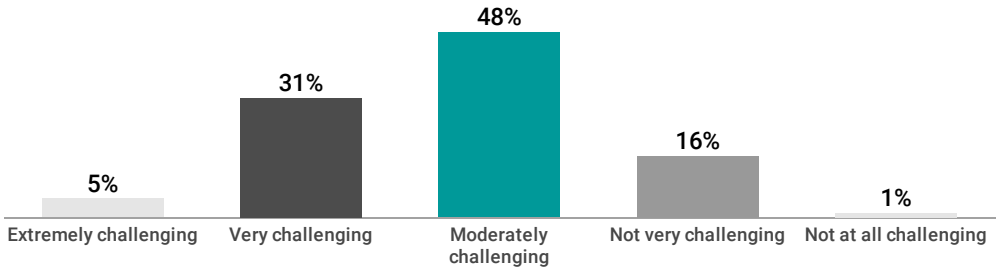
[Fig. 6] *Though initial projects are most often measured by factory performance metrics (not unusual, since improving factory performance is the most often cited goal of IoT projects), respondents report impacts to strategic business goals, such as increasing revenue, improving customer response time, and speeding time to market for new products and services. A separate survey conducted by* IndustryWeek *and MESA International similarly found that strategic business priorities are cited by fewer manufacturers as the objective for current smart manufacturing initiatives. ("Smart manufacturing" is the term the association uses to encompass discussions about IoT, Industry 4.0, digital manufacturing, etc.)*

IoT Projects Met Expectations



[Fig. 7] *A significant majority say their IoT project met or exceeded their expectations.*

IoT Projects are Challenging



[Fig. 8] *Asked how challenging the IoT journey had been so far, nearly half described it as "moderately challenging."*

PARTNERS, VENDORS & DEPLOYMENT MODELS

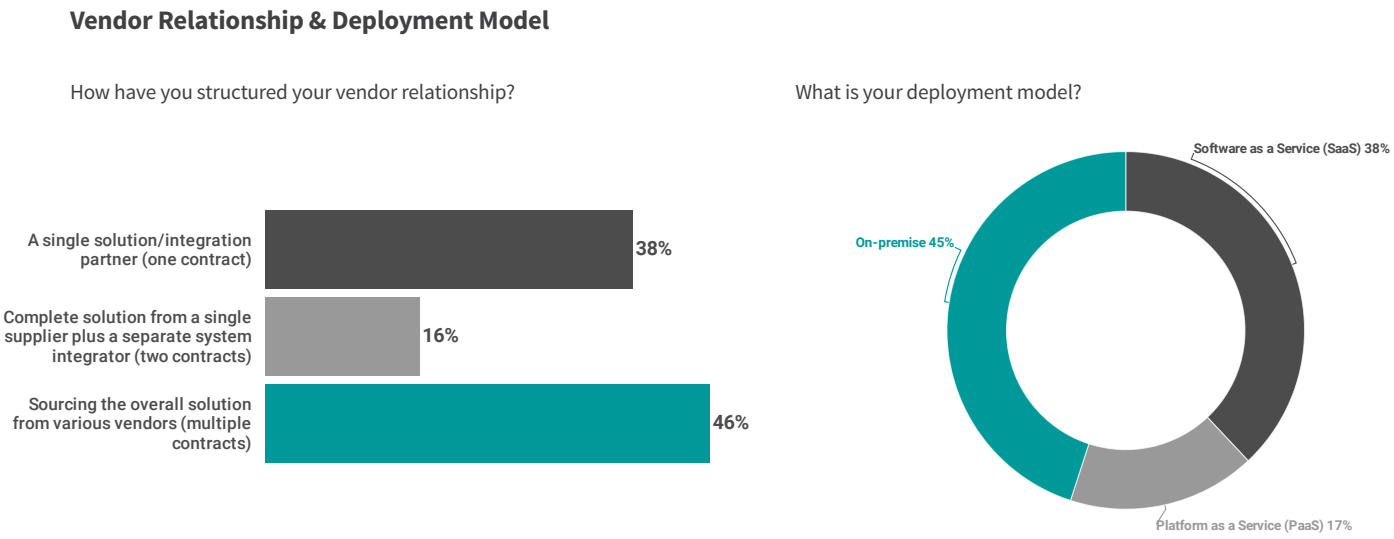
Early Results Indicate Evolution

Given the perceived complexity of IoT, it seems odd that over a third of companies that have completed at least one IoT project did so "exclusively with internal staff/resources." Still two- thirds worked with partners to implement IoT, most commonly Siemens (19%) and Cisco (13%).

This response is similar to those of two other questions. Asked how respondents structured the vendor relationship, nearly half (46%) indicated that they sourced the overall solution from various vendors, using multiple contracts, while four of 10 chose a single solution/integration partner (one contract). Sixteen percent obtained a complete solution from a single supplier and used a separate system integrator (two contracts).

For the other question, which asked about respondents' deployment model, most respondents used on-premise deployment (45%). Another third used Software as a Service (SaaS), and 17% used Platform as a Service (PaaS).

These results suggest that companies are reticent to rely on outside partners to deploy their IoT projects.



[Fig. 9] *A company's IoT maturity may affect its vendor relationship and deployment model.*

More research is needed to determine whether a company's IoT maturity affects this choice. It's possible that companies choose in-house approaches for their early IoT projects so they can learn more about IoT before bringing in a partner or committing to SaaS or PaaS.

MOVING FORWARD

Making the Business Case

A significant finding uncovered in the research lies in the comparison of how two groups of respondents answered similar questions. Those who had yet to initiate an IoT project were asked: "What challenges keep you from initiating an IoT project?" Those who had completed at least one IoT project were asked: "What challenges keep you from pursuing additional IoT projects?" The difference between the two groups' response shows a change in thinking following the implementation of at least one IoT project.

Though the sample sizes are small, the top two responses of those who had no meaningful involvement in IoT included "no perceived need" (cited by 44% of respondents) and "lack of interest" (sited by 26%). These responses dropped by half when asked of companies delaying pursuit of an additional project, 20% of whom cited "no perceived need," and 13% of whom cited "lack of interest."

Perhaps more notable, 22 percent of respondents that have not yet initiated an IoT project cited "questionable ROI" as a challenge, while only 7 percent of respondents that have completed at least one project cited that reason.

Clearly, implementing an IoT project largely removes concerns about ROI—especially when considering that 13 percent of respondents noted that they were still "awaiting ROI from first projects," or cited

"IT ownership issues" as the hold-up of additional projects. (Note that the latter does not reflect on the success of a project, but rather raises a question of how to organize projects moving forward).

Yet another interesting finding: The percentage of respondents that cited "difficulty building a business case" was half that for companies that had completed at least one IoT project compared to those that hadn't, 7 percent to 16 percent.

From the results, we can conclude that simply completing an IoT project allays concerns about identifying potential ROI or building a business case.

CONCLUSION

The Iterative Approach to an Industrial IoT Revolution

There's good reason the Internet of Things is heralded as part of the 4th Industrial Revolution. As with previous comparable eras, the new technology is fundamentally transforming the way manufacturing businesses operate, from the plant floor to the executive suite. IoT, when fully implemented, redraws traditional organizational boundaries, including the following, by:

- More effectively integrating information between the plant floor to the executive suite
- Integrating more tightly each step of the value chain, from design and raw material sourcing to delivery and field service
- Dissolving the boundaries between operational technology and information technology, as well as the departments and personnel that oversee them

Because the IoT challenges existing business and production practices, it's not surprising that business executives are initially cautious in their adoption—or indeed, confused about where and how to begin. When taking on a strategy that will fundamentally transform the business, it takes bold, yet disciplined leadership to decide where to begin and then how to build toward an IoT-centric business model.

Further, this change must take place within the realities of current business expectations, including a strong return on investment at each step of the way and minimum risk of interrupting production.

A Practical Way to Achieve Digital Transformation

As daunting as this digital transformation might at first seem, this research suggests how to execute a manufacturing digital transformation within the confines of and without major disruption to the business. Manufacturing companies are beginning their journeys with projects that address their biggest business concern: to drive productivity, through increased machine uptime by applying IoT technologies to facilitate predictive maintenance and improve process control. They are choosing first to deploy IoT projects to solve one problem (or related set of problems).

This approach supports the practical focus of manufacturers—keeping the factory running at the highest level of efficiency—as well as their stereotypical hesitance to leverage what they might see as unproven, "bleeding-edge" technology.

By deploying a targeted IoT project, these manufacturers not only make progress toward solving an age-old problem but also learn more about what IoT can do and how it works—and could work for them to address other problem areas. As important, as they see and experience the gains from an initial IoT project, they gain the confidence to deploy more IoT projects. They see the ROI from and the business case for IoT. In addition, they see that IoT projects deliver results in other strategically important business goals, such as growing revenue, improving customer service, and speeding time to market for new products and services.

A similar iterative approach seems likely to be happening with many manufacturing companies' IoT deployment strategies, though the survey results are not definitive. Over a third of respondents selected

a single-solution partner to implement their IoT project, suggesting that many companies feel the need to leverage outside expertise. Still, 46 percent of survey respondents chose to source their overall solution from various vendors and 45 percent select an on-premise deployment model. This suggests a tendency of the more cautious companies to retain control over their first project in-house by relying on in-house resources.

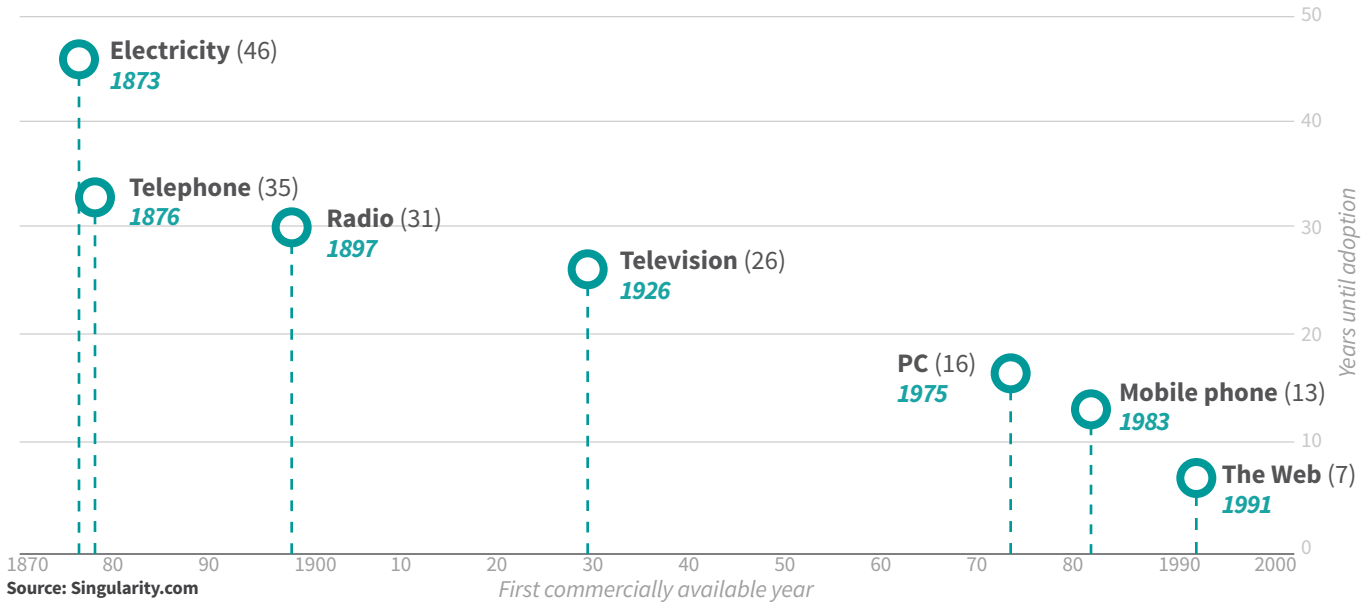
It remains to be seen, but seems plausible that, as manufacturers grow their in-house knowledge, they will seek outside experts and vendors to facilitate projects, as well as consider SaaS and PaaS as their deployment model. Considering the degree of challenge that respondents experienced (with over half saying that their IoT project was "moderately challenging" and nearly a third saying it was "very challenging), it's likely that they would seek outside help. Also, this approach would be in keeping with business' tendency to identify and focus on their core competencies, while working with partners to execute non-core functions.

A Roadmap to the IoT Revolution

In some ways, describing IoT as part of a revolution is both accurate and misleading. There's no doubt that IoT will transform and disrupt manufacturing businesses, as with a revolution. However, the word suggests an abrupt change, and history shows that previous Industrial Revolutions took place over decades.

That said, trends show that technologies are adopted much more quickly today than they have been historically. The speed at which IoT technologies are adopted remains to be seen, but it's likely faster than what we expect.

Adoption of New Technology is Accelerating
Years until used by one-quarter of American population.



Source: Singularity.com

[Fig. 10]

Showing the Way to a Digital Future

As the companies in this survey deploy IoT, project by project, and learn more with each one, they are building the foundation for the transformation of their businesses. In doing so, they are showing the way for other, more cautious companies. That is: A company's first IoT project needn't be a wholesale business transformation. Instead, try a targeted project, learn from it and repeat.

This is the way revolutions happen. Even an earthquake, that earth-shattering, destructive force that in an instant reshapes the geological landscape, is itself the result of near constant, incremental shifts of tectonic plates over decades.

Some vendors and partners recognize the need for such a practical iterative approach to executing an IoT business transformation. They're developing modular, end-to-end solutions that companies can deploy one after the other, as early projects deliver ROI and as staff gains confidence in the technology. Significantly, many of these solutions also help companies deploy an IoT project in months, or even weeks, not years.

The survey shows that a significant number of companies and industries are making the incremental changes that will become the digital or IoT revolution, and that interest in deploying an IoT project is high.

The leading companies represented in this research are demonstrating that IoT will indeed deliver on its promise and offer a successful approach for others to follow in their own journey.

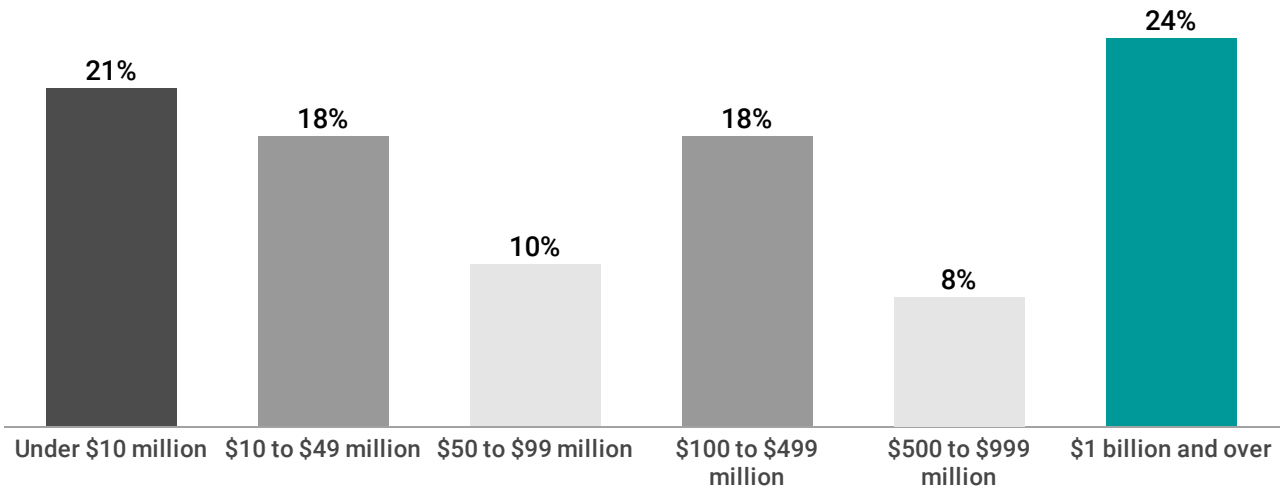
RESPONDENT DEMOGRAPHICS

Survey respondents with IoT involvement represent a wide variety of industries and a balanced cross-section of company sizes.

By industry, no single industry is over represented. Machinery respondents topped the list at 8 percent of respondents, followed by manufacturers of computer & electronic products and electrical equipment and appliances, each with 7%. Rounding out the top five were manufacturers of fabricated metal and food, beverage and tobacco, each 6%. In all, over 30 manufacturing industries are represented.

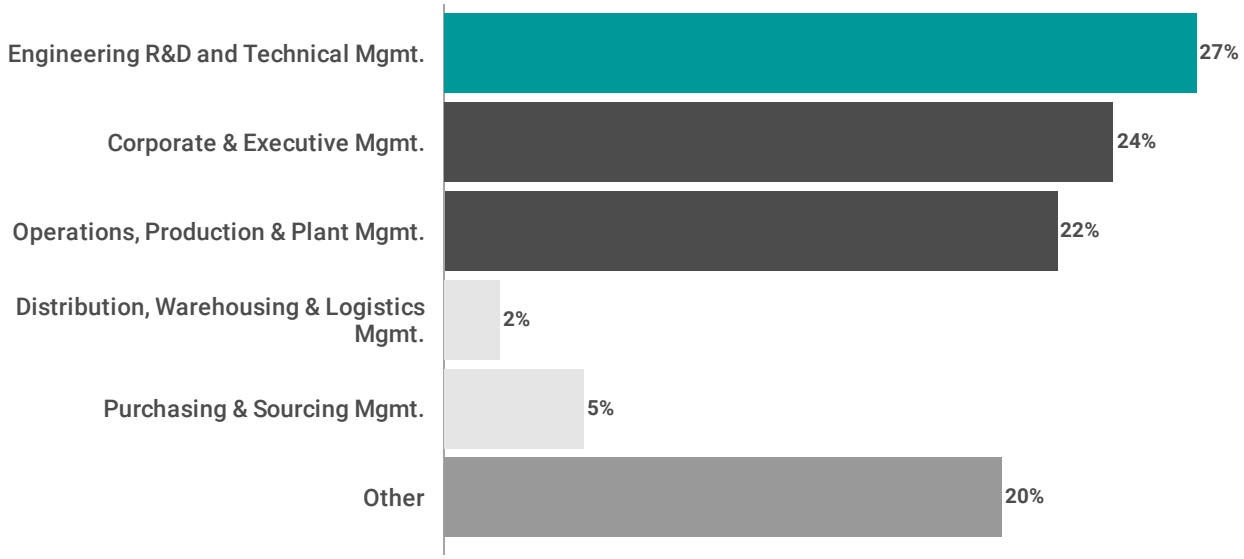
Looking at annual sales, nearly one-quarter of respondents (24%) report annual revenues of $1 billion or more. Roughly one of five (21%) report annual revenue of under $10 million.

Total Annual Sales Volume of Companies Reporting IoT Involvement



[Fig. 11]

Respondent's Job Titles



[Fig. 12]

A variety of job titles are represented within the sample, with three groups comprising 73% of respondents: Engineering R&D and Technical Management (27%); Corporate & Executive Management (24%); and Operations, Production & Plant Management (22%).

Significantly, 20 percent of respondents are from a wide variety of titles, which demonstrates the business-wide involvement and impact of IoT projects. Other job titles heralded from Quality, Safety, Product Management, Sales, Marketing and Maintenance.

ABOUT THE UNDERWRITERS

SIEMENS

Siemens MindSphere

MindSphere is the cloud-based, open IoT operating system from Siemens that connects real things to the digital world, and enables powerful industry applications and digital services to drive business success. For more information, visit **www.siemens.com/mindsphere**.

IndustryWeek

About IW Custom Research

This research project was led by IW Custom Research, a unit of *IndustryWeek* magazine, which provides insight into executive opinions and manufacturing trends. In print, online and in person, the *IndustryWeek* community is the leading resource for manufacturing operations knowledge. For more information, visit **www.industryweek.com**.