IoT NOW

ANALYST REPORT

MANUFACTURING

Is IoT delivering factory floor efficiency?

Analyst Report

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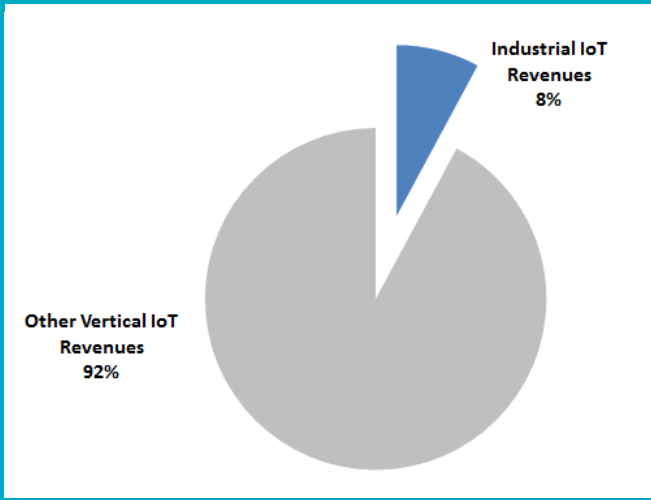

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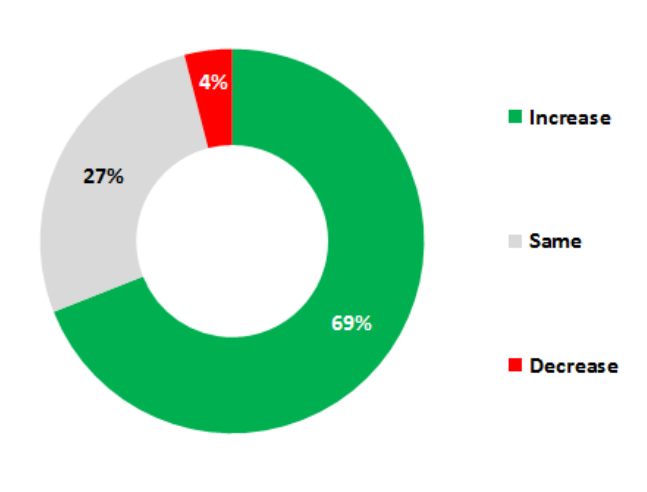

ANALYST REPORT

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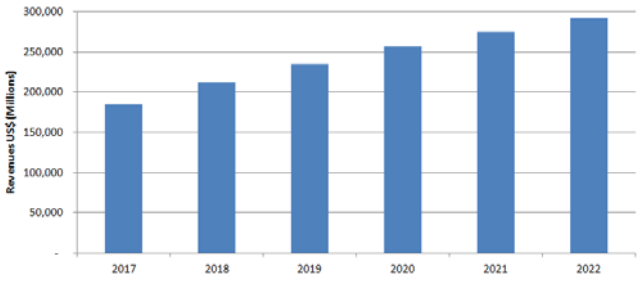
IoT enables automated monitoring and more analytical approaches to operations by manufacturers

Strategy Analytics views the Internet of Things (IoT) as a significant opportunity. It can and will bring great benefits to businesses of all kinds in the coming decade. However, to refer to it as a market in the trillions of dollars is overly optimistic. Claims that the IoT market has progressed from tentative to mainstream are not supported by Strategy Analytics enterprise deployment research as yet

The benefits of IoT are increasingly being recognised by business decision makers. There remain many challenges and roadblocks to IoT, but none are insurmountable with the right partnerships, the appropriate understanding of business motivations and requirements and an ability to articulate the benefits beyond technobabble.

Over the next ten years, Strategy Analytics forecasts global IoT revenues to grow from US$185 billion in 2017 to US$292 billion in 2022, as illustrated in **Figure 1**.

Figure 1: Global IoT Revenue Forecast 2017 – 2022



Source: Strategy Analytics

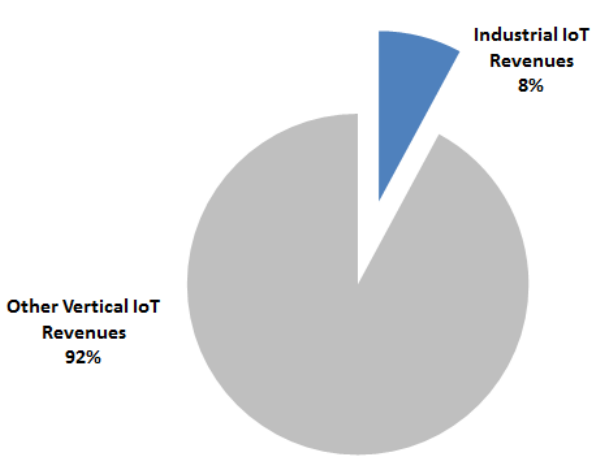
Those revenues are made up of hardware, connectivity and services; and it is the deployment of services in IoT where Strategy Analytics sees the major revenue opportunity. In 2022, Strategy Analytics' forecasts that IoT service revenues will account for 65% of total global IoT revenues. That's not to say hardware and connectivity components lack value, but rather that there is tremendous potential for enterprise software, value added resellers, system integration and consulting firms, who can help businesses plan, test, deploy and maintain an IoT deployment.

The IoT landscape

The industrial and manufacturing segment includes manufacturers of goods and equipment who take a number of raw materials, and through the use of machines and production lines, create a finished product composed of those primary materials.

In the context of our forecast for the global IoT market, we believe the Industrial vertical market represents an opportunity of around 8% of the market as illustrated in **Figure 2.** ▶

Figure 2: Global Industrial IoT Revenues in 2025



Source: Strategy Analytics

The Industrial vertical is clearly competing with other major segments, such as security, automotive, primary processing, utilities and other vertical markets; some of which will generate larger IoT revenues in 2025, such as automotive which is set to account for 15% of revenues, or more than US$50 billion. So while the industrial market isn't going to be the largest IoT vertical market, there is a significant opportunity in adding additional instrumentation to operational functions with IoT, from adding traceability to raw materials in the manufacturing process, to monitoring the production line and preventing downtime through preventative maintenance.

Measuring

In the world of manufacturing, without measurement there would be chaos. Going back to the industrial revolution of the late 1700s, the transition from hand production to machine production ushered in a new era of using machines that conducted specific operations on specific raw materials. The result was higher output and greater consistency than anything that could be produced by hand.

Manufacturing technology has continued to improve, with machines becoming faster, more reliable, more accurate and adopting automation, such that in many cases once setup, a machine needs only occasional human monitoring to ensure the continuation of a manufacturing process.

However while modern manufacturing is almost completely unrecognisable from the early days of the industrial revolution, many of the same problems still exist today. Machines can and do breakdown from time to time, requiring human intervention to find and then fix the root cause of the problem. The supply of raw materials remains as crucial as it ever was; ranging from materials that the machine works on in the creation of finished goods, through to enabling materials such as oils and coolants. Infrastructure remains a crucial element in the industrial world with a continual supply of electricity – or other energy generating material or chemical such as coal, oil or gas – required to power machines, lights, extraction and cooling fans among others. A power failure can often result in the stopping of the production line.

As production volumes have continued to increase, enabled by the development of faster machines and more efficient processes, the need to monitor the manufacturing process has also risen. For example, if a supplier has manufactured a part beyond the agreed tolerance in a specified dimension, it will not fit its intended purpose and be rejected by the buyer. But measurement does not begin and end with certain parts of the manufacturing ecosystem, at least it shouldn't. Therefore it is here where we begin to see why IoT is already firmly entrenched in the industrial market, but also why IoT has a part to play going forwards.

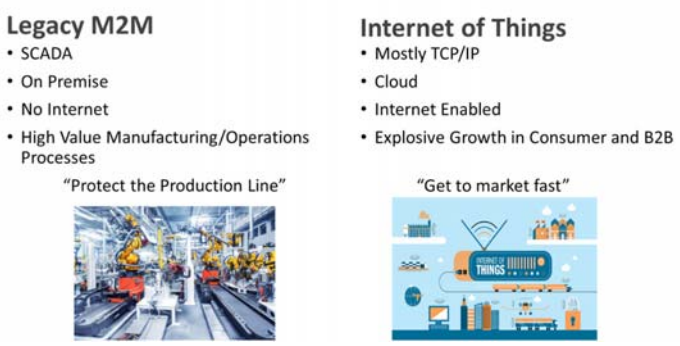
Monitoring and measuring has largely been undertaken to ensure that goods coming in to the production – or manufacturing – system are to agreed tolerances and dimensions, that machines are operating to specific parameters, resulting in goods coming out of the manufacturing system that are also to the parameters agreed with the downstream customer. In an ideal world, all problems would be discovered by the manufacturer of the goods, but issues can be discovered by the downstream customer once they have taken delivery.

The reality is that measurement takes many forms, ranging from manual recordings made on paper, through to digital measurements stored electronically. Paper-based measurements and recordings are susceptible to human error, for example a worker completing a form after a long shift may write a five instead of an eight by mistake, handwriting may be misinterpreted and a worker may simply forget to complete a usage form after using a specific tool while rushing to start a new process. Digital measurements stored electronically may be stored in a format that is incompatible with existing computer systems, or for which the expertise to transpose or convert them to a usable format may not exist within the organisation.

Challenges and opportunities for IoT

The reality is that the Industrial market includes a variety of companies, ranging from small to large, from fully-automated to manually-dominant and those with strong data monitoring and analysis functions, to those who do not. While the implementation of IoT will perhaps be easier for large industrial companies, that is not to say it holds no value for smaller organisations, but rather that smaller companies will have fewer resources available to devote to IoT. ▶

Figure 3: IoT Legacy Challenges in Manufacturing

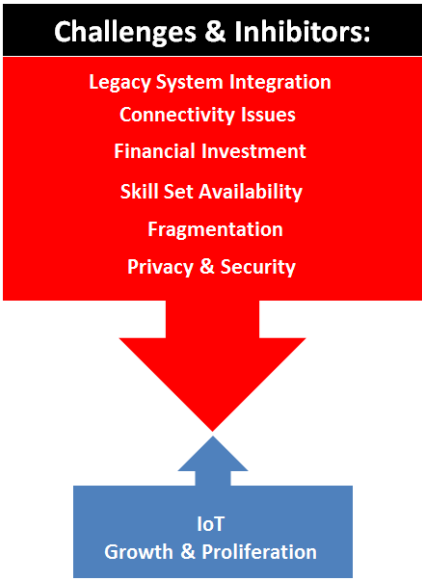


Source: Strategy Analytics

However, industrial IoT does offer a number of opportunities for companies to improve; but on the flip-side it will also present a number of challenges. In this section we outline these challenges and opportunities, as illustrated in **Figure 4**.

In terms of challenges and inhibitors the first challenge is legacy integration and acceptance. The industrial segment is a strong advocate of the "if it isn't broken don't fix it" idiom, where specialist machines that perform a function are maintained and continue to be used for many years, often beyond a period whereby parts are easy to obtain. They remain part of the industrial environment because replacing them would cost hundreds of thousands of dollars, an expense which smaller industrial companies find it very hard to justify when the existing machine works perfectly. In short, the integration of IoT into legacy industrial machines is a challenge.

Figure 4: Industrial IoT Challenges and Inhibitors



Source: Strategy Analytics

The Industrial market tends to favour wired connectivity, so with IoT pushing wireless connectivity this can represent a see change in the network infrastructure design. While the IoT implementation may or may not use cloud-based services – for example, analytics tools – the use of wireless networking may again lead to apprehension concerning the security of the wireless network.

As with all IoT deployments, the issue of financing is key, with pro-IoT advocates within the company asking management to fund trials and ultimately full deployments. The challenge is to convince management for funding based on theoretical benefits which are not yet demonstrable in the actual facility. Quantifying benefits must always be able to show the correlation of operational improvements to the bottom line.

Having gained management sign-off on funding for an IoT deployment, such as a trial, the next question is who will make it happen? At this point the issue of skills arises, specifically whether the company has the skills in place to design, develop, implement, fine tune and maintain an on-going IoT deployment. The level of skills required are considerable, ranging from system architects with a detailed knowledge of manufacturing environments, systems integration specialists who can facilitate the implementation of the hardware into the manufacturing environment, i.e. the shop floor – from sensors/ things, gateways, networking/connectivity, through to backend servers/storage and data analytics tools – to data analysts.

The theme of fragmentation is one of the key issues the IoT industry as a whole must strive to deal with in an effort to simplify selection and planning. However, alliances and partnerships continue to be struck between different parts of the business world in an effort to broaden IoT capabilities and be able to offer a more options when engaging with companies looking to deploy IoT. The challenge in designing and developing IoT solutions for the industrial market is underlined by the varied list of partnerships being formed across hardware and software vendors, telecommunications firms, through to engineering and industrial companies.

In recent years we have been treated to an almost continuous flow of disclosures concerning high profile security breaches ▶

affecting millions of users, so the security of any systems and databases containing information of any kind, be it industrial, medical or consumer, is highly important in the proliferation of IoT. The security of IoT data concerns any device or any part of the IoT process flow where data is transmitted or analysed.

There is also the risk that the network could be susceptible to unauthorised accessed through which production line systems could be hacked. The mantra "protect the production line" rings loud here. If the network can be accessed, machines could potentially be hacked; the production process could be interfered with, and in the worst case scenario, halted. Poorly handled security in an industrial IoT environment could result in a severe lack of trust between partners, upstream and downstream.

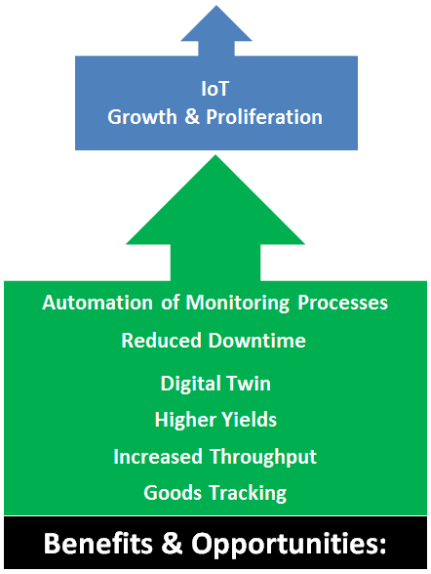
Benefits and opportunities for IoT

However, there are also many opportunities in Industrial IoT, With the implementation of IoT deployments in the Industrial world, such as manufacturing environments, the addition of sensor-laden things promotes the ability to automate processes which were largely manual or relied on manual activities. Replacing a manual process, such as the tracking or monitoring of equipment usage with an automated process, can lead to both time savings as well as a reduction in errors

Replacing manual processes

The usage of a machine or tool that is tracked manually through the completion of a paper-based form at the end of an activity or shift can be replaced by the inclusion of an IoT module in the tool. The sensors in the module are able to detect movement indicating usage, as well as start and stop times for the usage. Shop floor operatives no longer have to remember to complete forms before and after using the tool, which after a particularly long activity may introduce human error in the specific times the tool was operational. While an error in manually recording tool usage times of for example, one minute on a particular day is not a big deal, the cumulative effect over longer period of time could result in the tool being used without having a recalibration or adjustment of some kind.

Figure 5: Industrial IoT Benefits and Opportunities



Source: Strategy Analytics

Predictive maintenance

The use of IoT to enable predictive maintenance is a key illustration of how IoT can improve industrial processes. One of the key industrial issues is that machines fail, and when they fail it doesn't simply impact the job they are working on, it impacts the jobs before and after in the production line or process sequence. There are a number of benefits to predictive maintenance; machines and other equipment are monitored to prevent them failing, materials are not spoiled, and secondary damage does not occur – or is minimized – to other components in the machine because an actual failure has been prevented from occurring.

With sensor data coming in from the manufacturing environment, one use that the data can be put to is to create a digital twin, which is a virtual representation of a physical asset which could be a specific machine from the ▶

manufacturing process. The digital twin allows a firm to use real data coming in from a specific machine for example, and model its operation in varying circumstances.

Digital twins allow the industrial firm to model the behaviour of a physical asset but without any risk to the physical asset. Being able to experiment and test on a virtual machine or system is a key benefit, because in the real-world manufacturing and industrial firms very rarely have spare machines on which they can test scenarios, or have the ability to take a machine out of the production line for testing purposes.

The digital twin is not just confined to use for monitoring, optimising and scenario evaluation for existing machines and environments, but can also be used when a firm is evaluating expansion to a production line or facility. For example, if a firm is looking to increase production capacity by *x*%, digital twins can be used to allow the company to understand what the production capacity targets would translate to in terms of necessary machines and associated facilities and utilities.

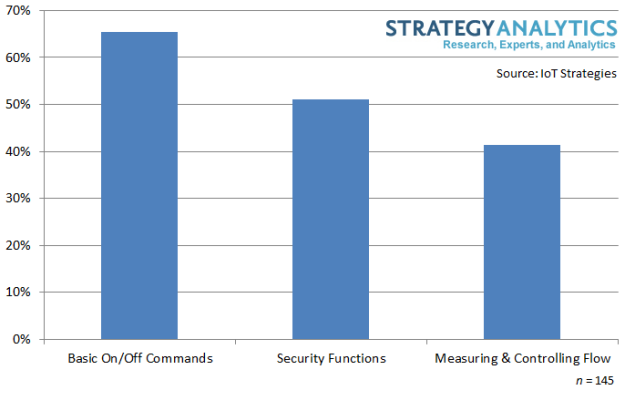
When implemented, predictive maintenance strategies cannot only allow the manufacturer to realize a more reliable operation, but also derive additional benefits as a result. Key among these is obtaining higher yields, which for the sake of this point we define as the percentage of quality assurance (QA) passed goods out of the total number of goods produced. Even though predictive maintenance can be used for manufacturing machines, it can also be used for machines that perform testing procedures on the finished goods. For example if the testing machine has suffered a failure, it may raise a false flag on goods which are perfectly acceptable. Being able to reduce spoiled finished goods, the yield increases as a result of the efficiency of the production line increasing. Therefore the manufacturing operation is spending wasting less time and materials on the production of goods which will not pass QA testing.

Manufacturing environments have little leeway in waiting for a component or raw material to become available for use in production. Being able to track the location and expected arrival of materials in the supply chain is an extremely useful application of IoT such that downstream manufacturers have a greater knowledge of the supply chain and can react to potential problems that may occur in the logistics of their supply chain.

Strategy Analytics 2017 Enterprise IoT Deployment Survey

In 2017 Strategy Analytics conducted its annual Enterprise Survey, in which 1200 respondents located across four countries (UK, US, France and Germany) were asked a variety of questions concerning their activities and spending across a variety of technology themes, including IoT. A key area was the types of IoT applications that firms have deployed and are operating today, the results of which are illustrated in **Figure 6**.

Figure 6: Top 3 IoT Applications used in Industrial Sector



Source: Strategy Analytics

Basic on/off commands were the top IoT applications deployed in the industrial and manufacturing vertical. This is as a strong indicator for how companies are using IoT to increase automation of basic tasks, with the benefit of reducing costs, whether they be energy costs or similar. Such apps do not necessarily have to be directly linked to the manufacturing process, instead being used to manage the facility, for example the control of lighting and heating or air conditioning systems, potentially yielding financial savings through optimised energy usage.

Security functions were listed as the second most popular IoT applications within the industrial vertical, and when considering the financial value of the contents of the premises it is not hard to see why. Raw materials, finished goods, machines, spare parts, and tools to name a few, all have considerable value, therefore their protection and security is of considerable importance to the firm. Any theft or damage to the aforementioned items would almost certainly result in disruption to the ability of a facility to manufacture. When coupled with the fact that often manufacturing and industrial facilities are located in out of town areas, the ability to securely monitor a facility without need – or reduced need – for a physical security presence could present a further opportunity for cost savings.

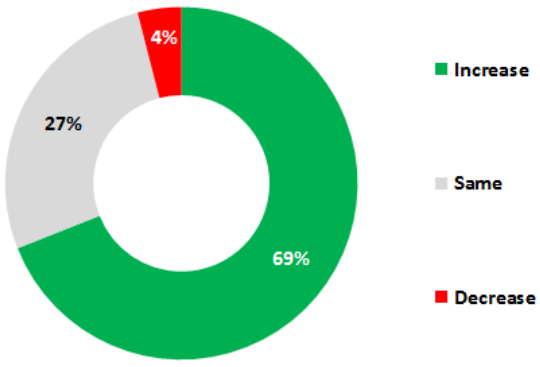
IoT applications that measure and control flow are very important when considering the effect that a bottleneck can have on the production line, particularly if other parts of the production line, such as before and after, are not aware of the bottleneck. This underlines the importance of measurement that we analysed earlier in this report. In a simple in-series production line, that is where one job takes place after the previous one is completed, the production line can only operate at the speed of the slowest part of the process. The ability to know when a process is taking longer than expected allows the production line to be adjusted as a result.

Another of the key applications was compliance with regulations, allowing firms to make sure they are adhering to rules and regulations concerning many aspects of the operation. The industrial world often makes use of dangerous chemicals and extreme environments, and the use of IoT can make it safer for employees and easier to monitor such situations so as the firm does not fall foul of regulations, potentially incurring a financial penalty as a result. For example monitoring the time a specific worker is exposed to a specific chemical each day, or the time the worker is exposed to environments with high temperatures.

Overall the top three IoT applications being used in the industrial world from the 2017 Enterprise Deployment Survey paint a clear picture that IoT is being put to use for relatively simple tasks at this point in time. Of course there are outliers such as large sophisticated industrial operations pushing the boundaries for IoT implementations, but the results from the 2017 survey illustrate how IoT is being used for automation, save costs, measuring and monitoring and to keep firms the right side of GRC requirements (governance, risk and compliance)

When survey respondents in the manufacturing/industrial vertical were asked how their spending on IoT would change over the next five years, the answer was a resounding increase from over two-thirds of respondents. Tempering that enthusiasm somewhat was the fact that just under 30% of respondents expected IoT spending (as a percentage of IT budget) to stay the same.

Figure 7: IoT Spending over the Next Five Years

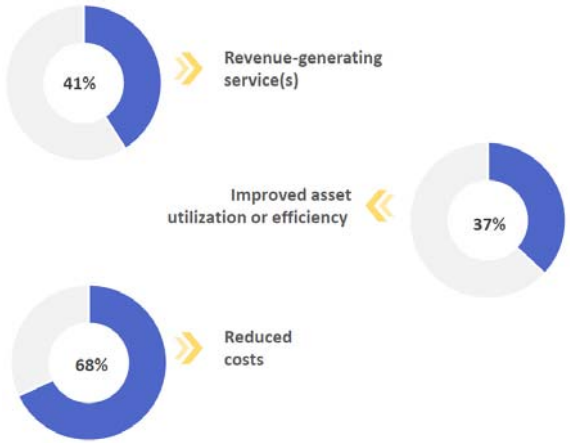


Source: Strategy Analytics

For those who see no increase in IoT spending, it is likely the case that there is limited opportunity for IoT in their particular organisation, meaning there is a limit to how far it can be deployed throughout the organisation. We must also consider that is the cases of decreased or no change (to) IoT spending, the competitive environment will also play a part. If a company's revenues are not growing or shrinking, then expanding funding for advanced technology-driven initiatives such as IoT will likely suffer.

While a big part of the messaging for IoT is to create new revenue generating services, Strategy Analytics' findings for industrial and manufacturing indicates that companies are more focused on deploying apps that can help them save costs, as illustrated in **Figure 8**.

Figure 8: Types of IoT Apps Deployed



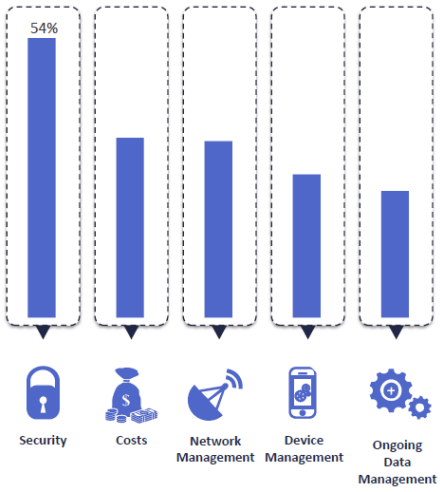
Source: Strategy Analytics

More than two-thirds of respondents are implementing IoT to reduce costs; we see a strong indication that companies are using industrial IoT to help boost margins, which are under significant pressure in the ultra-competitive manufacturing environment. IoT allows a reduction in costs by automating processes that would otherwise need be carried out manually as discussed previously, such as recording machine and tool usage time that allows employees to focus on other higher-value activities. Factory environment monitoring for temperature, air conditioning and lighting can also benefit from automation, through saving energy.

Asset utilisation and revenue generating services certainly show substantial penetration among industrial organisations and we expect them to increase penetration among IoT deployments over the coming years.

There are several obstacles organizations are facing when deploying IoT in a manufacturing and industrial environment. As the data flowing around the network in a manufacturing environment contains important and sensitive information, it is no surprise to see that security is the primary concern when deploying IoT. Security is complex, covering the machines themselves, data flow over the network and data storage location – on-premises or cloud.

Figure 9: Top 5 Obstacles to Deploying IoT in Manufacturing / Industrial



Source: Strategy Analytics

When over half of respondents highlight the same issue – security - it is something very important that the market has to deal with. As has been evidenced in the past few months, security is not just something that affects IoT but all IT systems. The WannaCry ransom attack affected great swathes of global IT only going to underline how susceptible a business is when it relies so heavily on technology.

The Cost aspect is a key concern, with many firms entering into IoT deployments for the first time, costs are estimates and as projects, such as trials or deployments, take unplanned turns, so too can the financial impact of maintaining the trial.

Conclusion

The Industrial market offers many opportunities for IoT, where it can be put to work across a number of functions from automated monitoring to being used to allow firms to take a much more analytical approach to the management of the manufacturing function and the business.

Monitoring and recording functions that were perhaps conducted by hand can be replaced by automated digital monitoring and recording that are not susceptible to human error. Digital transformation can allow a manufacturing firm to draw upon data from all parts of its activities, feeding into analytics processes from which insights are derived that can positively affect the optimisation and efficiency of the company.

However, the growth of industrial IoT is not without its challenges. With the rapid growth of industrial and manufacturing activities in the Asia Pacific region, manufacturing firms in other regions have to compete against thin margins that Asian-based companies manage to achieve. Therefore, with cost a key issue in the profit margin calculation, any expenditure will come under a significant spotlight, whether it is staffing, operational technology upgrades or refresh, through to technology-driven initiatives such as IoT.

The flip-side is that the benefits of IoT for the industrial market will be significant for those firms able to implement IoT solutions; such as the ability to use data driven insight for predictive maintenance resulting in reduced downtime. It is not hard to see the potential to predict a problem before it occurs as being a key selling point for IoT solutions in the Industrial market, with direct benefits of higher yields and increased throughput.

IoT vendors must provide offerings that help firms overcome the challenges of selecting, implementing and using IoT in industrial environments, whether they are financially or technology related. Failure to do so will effectively push IoT into the domain of large scale and well-funded operations and away from smaller, less technically savvy firms.

STRATEGY ANALYTICS
Research, Experts, and Analytics

About Strategy Analytics
Strategy Analytics has been helping Global 500 companies chart prosperous routes through complex technology markets for over 40 years. We have built a singular reputation for providing timely, trusted deep dive market research based on subject expertise and proprietary analytics techniques. Our analysts specialise in tracking, analysing and forecasting markets that include: wireless devices, automotive electronics, consumer electronics, enterprise, entertainment and media, defence systems, telecommunications infrastructure, pricing and services.

Our focused IoT and Automotive teams are industry-recognised sources of global market infrastructure, device, competitive landscape and value chain insights.

Our consulting group conducts custom research projects, applying the company's proprietary analytics and vast data resources to client engagements. We are the only analyst and research provider with an in-house user experience practice and digital home observatory.

Our clients include fixed and mobile operators, vehicle OEMs and their electronics suppliers, wireless device vendors, content providers, software providers, investment firms and regulatory authorities.

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