



ZEBRA

QUALITY DRIVES A SMARTER PLANT FLOOR:

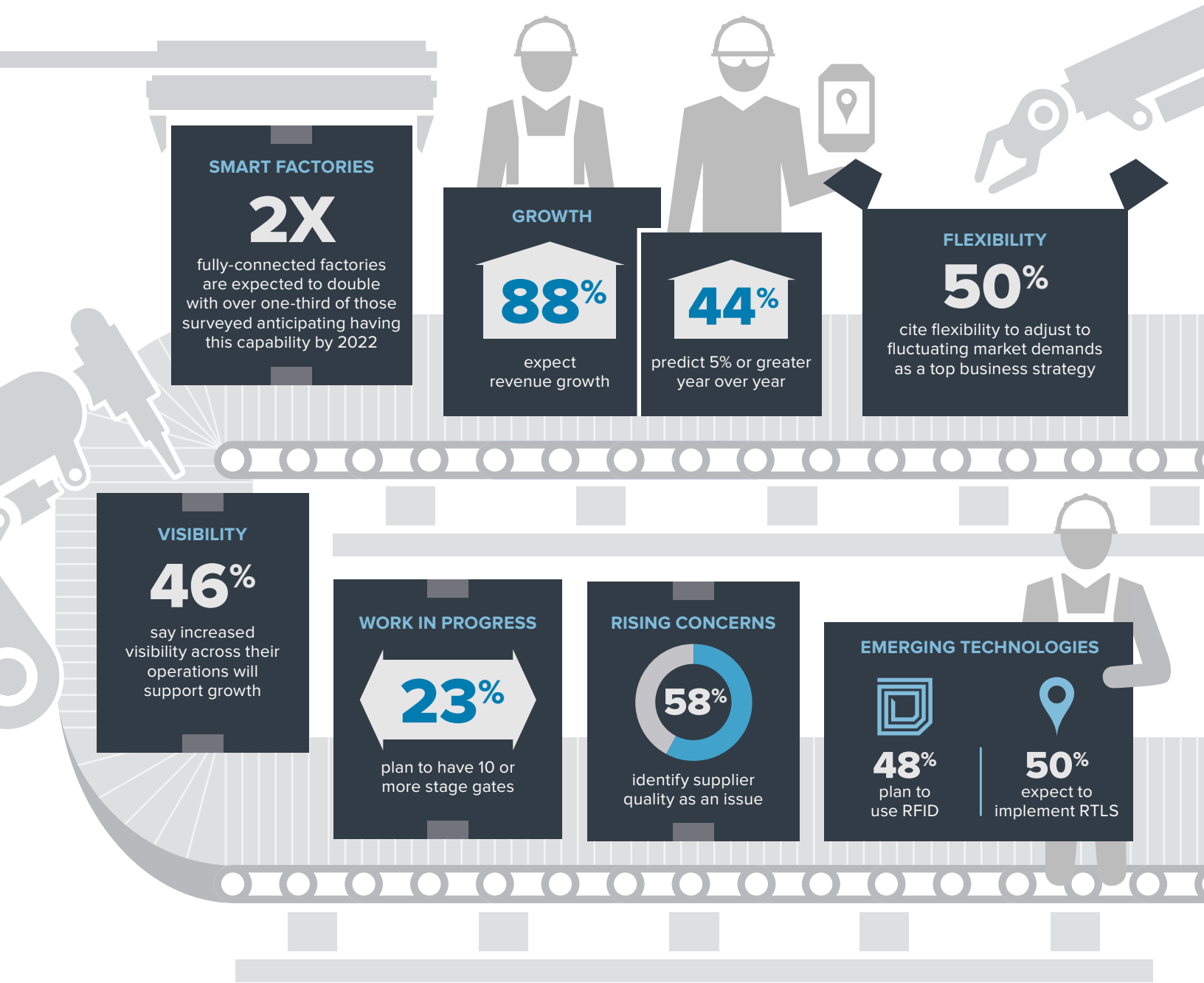
2017 MANUFACTURING VISION STUDY

**MANUFACTURERS ARE CONNECTING OPERATIONS TO GAIN
GREATER VISIBILITY AND IMPROVE QUALITY ASSURANCE**



MANUFACTURING'S FIVE-YEAR OUTLOOK

Respondents identified transformational shifts in the manufacturing industry by 2022.



Zebra's 2017 Manufacturing Vision Study

Zebra Technologies commissioned a global study to analyze trends and challenges that impact manufacturing companies. The survey asked 1,100 executives from automotive, high tech, food, beverage, tobacco and pharmaceutical companies for their insights on adopting technology on the plant floor to increase their competitive position.

QUALITY ISN'T AN OPTION

In the not-too-distant past, manufacturers frequently looked for ways to save money on labor, overhead, and supply costs to effectively compete in the global marketplace. However, the rising number of product variants, the growing price of materials and rising customer expectations are shifting that model. Today, forward-thinking companies are embracing a quality-minded philosophy, and it is paving an alternate route to growth and profitability. New processes and technology advancements are enabling companies to focus on quality and reap the rewards that an automated and connected plant floor can deliver.

According to the survey, manufacturers are introducing quality checkpoints and automation at more stages in the process. After all, checking the status of a product after it's assembled and finding an imperfection not only slows down production and increases costs, but it also makes it significantly more difficult to identify the point-of-failure.

TOP STRATEGIES TO DRIVE GROWTH & IMPROVE FINANCIAL PERFORMANCE

- 1 INCREASE TOTAL PRODUCTION / THROUGHPUT
- 2 IMPROVE ABILITY TO ADJUST TO FLUCTUATING MARKET DEMAND
- 3 INCREASE NUMBER OF PRODUCT VARIANTS
- 4 INCREASE VISIBILITY ACROSS THE ENTERPRISE
- 5 DECREASE COST OF PRODUCTION

STATE OF THE INDUSTRY

The global manufacturing industry is in the midst of a dramatic transformation that will profoundly alter plant floor operations. With a desire to connect every stage of the manufacturing process, including end-to-end supply chain fulfillment, manufacturers are turning to automation to improve quality and gain unprecedented visibility. Driven in large measure by globalization, intensifying competition and, perhaps most importantly, increasingly complex bills of materials due to rising customer demands for product variety — a connected plant floor has become a necessity to ensure high-quality products.

For the first time in decades, investment decisions are no longer being driven by short-term return on investment (ROI) calculations alone, but increasingly on long-term quality performance metrics. Companies simply can't afford to produce defective or sub-standard products and maintain their competitive edge. The cost of poor quality in terms of scrap, reworks, returns and defects is simply too high.

Add to that customer complaints, a lack of customer confidence, and ultimately the loss of brand loyalty, and it's evident that poor quality products can cause irreparable damage to a company's reputation. In their quest to achieve error-free production, suppliers and manufacturers are making incremental changes to their plant floor operations and moving toward a fully connected, smart factory.

THE RISING IMPORTANCE OF IIoT

Manufacturers are adopting Industry 4.0 and the smart factory, in which workers use a combination of RFID, wearables, automated systems and other emerging technologies to monitor the physical processes of the plant and enable companies to make decentralized decisions.* In the factory and across the supply chain, firms are also capitalizing on the Industrial Internet of Things (IIoT) to achieve real-time visibility into their goods, assets, processes and places.

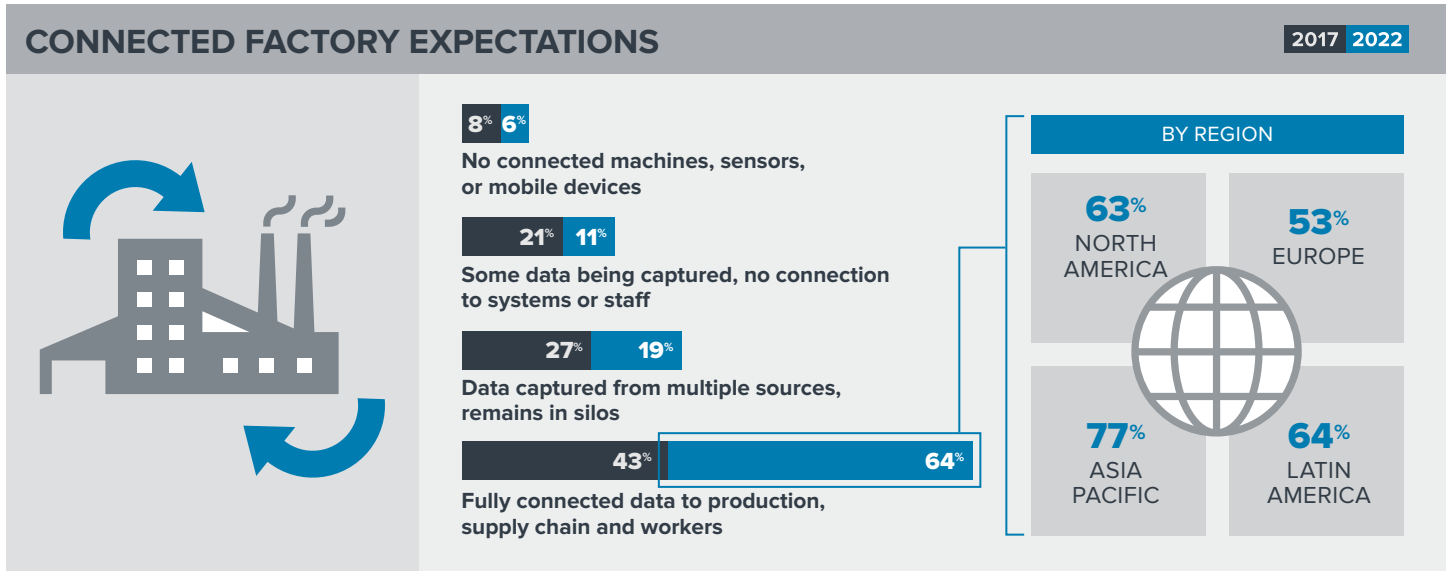
With automation comes instant access to data which is essential to ensuring that the production process operates smoothly. Importantly, data gives suppliers the ability to anticipate the needs of their customers. It also enables manufactures to keep less inventory on hand and eliminate points-of-failure. In fact, 50 percent of respondents stated that improving their ability to adjust to fluctuating market demands is one of their top business growth strategies.

Manufacturers are already realizing the very real benefits of data connectivity: increased visibility into the entire manufacturing process; an accelerated pace in shipping and receiving; faster identification of points-of-failure; and deeper insights into the interworkings of their operations.

*Marr, Bernard. "What Everyone Must Know About Industry 4.0." *Forbes*. Forbes Magazine, 20 June 2016. Web. 10 Apr. 2017

IIoT MOVES BEYOND THE HYPE

At the heart of IIoT is the way companies capture and share data. The ability to have data about inventory needs immediately available in the cloud and available to both plant floor managers and suppliers offers unheard-of visibility that heightens operational performance. Currently, 27 percent of those surveyed are collecting data from production, supply chain and workers, however the data is remaining in silos rendering much of the intelligence it can provide untapped. In the future, that number is expected to drop to 19 percent by 2022, thereby signaling the importance of providing access to this type of critical data to improve productivity and streamline operations.



Technologies that connect assets, inventory and equipment are essential pieces of the IIoT puzzle. Manufacturers are beginning to see the many benefits of having fully connected operations that include the supply chain. The factory of the future needs end-to-end supply chain visibility on the plant floor to improve productivity and increase quality, which is precisely what IIoT delivers. The number of companies supporting a fully connected factory is expected to double by 2022 with over one-third of those surveyed anticipate having this capability.

A WORTHY CHALLENGE

The goal of achieving end-to-end visibility in manufacturing and across the supply chain isn't easy to attain. There are many barriers to adoption, most notably the costs and highly complex processes associated with integrating this functionality into existing systems.

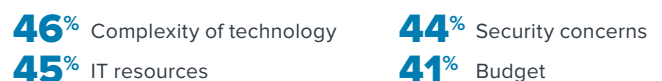
Often, proprietary legacy systems require a full rip-and-replace to achieve the integration needed for optimal IIoT. It's likely this is the reason respondents rated complexity of technology and availability of IT resources among the top reasons they aren't yet realizing a fully connected factory. Fortunately, new advancements in technology are making it possible to integrate these legacy systems and are simplifying the process.

While initial implementation may be difficult, manufacturers want to improve quality and therefore must adopt these processes. In fact, 34 percent of those surveyed expect to support a connected factory by 2022. IIoT deployment may occur in incremental stages, but to stay competitive companies are confronting these challenges.

BENEFITS OUTWEIGH COSTS

Companies are aware that IIoT is something they need to adopt. Interestingly, getting executive buy-in or estimating ROI for making such investments do not rate as respondents' top concerns. Of those surveyed, only 29 percent state that determining ROI is a barrier. The benefits that come from having a fully connected factory that communicates in real time with the supply chain far outweigh the costs and contribute greatly to maintaining a competitive edge. Once a plant floor adopts IIoT, the benefits are immediately evident both in terms of savings, increased productivity and quality improvements.

BARRIERS TO IIOT ADOPTION



QUALITY MANAGEMENT DRIVES CHANGE

Manufacturers are entering a new realm where quality has retaken its rightful place as a very real competitive differentiator. Producing high-quality products isn't only required for retaining and gaining customers, it also translates into incredible cost savings that ultimately impact the bottom line. This applies in particular to discrete manufacturing plants where one wrong item can affect the entire process.

Manufacturers across all industries cite supplier quality as a prominent concern, with a total of 58 percent of respondents stating supplier quality is an issue. Improving quality overall is a top concern for manufacturers and that trickles down to the materials and components they use to produce their products. In fact, executives across North America, Europe, Asia Pacific and Latin America cite improving quality assurance as their top priority over the next five years.

The benefits of consistently turning out quality products are overwhelming. Companies can expect to see a reduction in product recalls that can slow down production and tarnish a brand, an increase in sales and improved productivity.

A study by the American Society for Quality (ASQ) revealed that for every \$1 spent on a QMS, companies could expect to see an additional \$6 in revenue, a \$16 reduction in costs and a \$3 increase in profits.* Investing in improving quality in the

manufacturing process is a key way to decrease costs, reduce risk, maximize production and ultimately increase sales margins.

Achieving consistent quality output is now more attainable and affordable than ever before thanks to advancements in technology and automation. With auto ID technologies that enable track and trace, RFID tagging and gate automation, manufacturers have greater visibility into what is happening every step of the way so they can easily identify a point-of-failure or reconcile the bill of material.

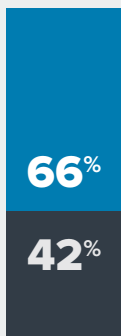
While quality is a top of mind concern, manufacturers don't foresee this as being a complication in the future with only 34 percent rating it as a potential issue in 2022.

This finding suggests that improvements made by both suppliers and manufacturers will ultimately improve the quality of finished goods.

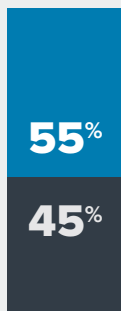
MANUFACTURERS EXPRESS GROWING CONFIDENCE

Manufacturers expect technology and automation will continue to transform the plant floor and deliver quality improvements across all stages of production.

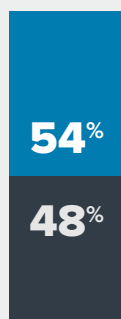
2022
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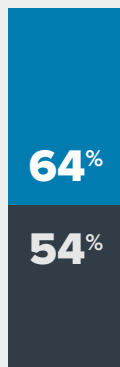
SUPPLIER QUALITY



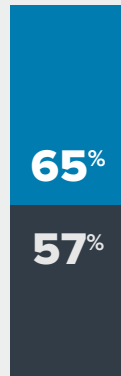
LABOR PERFORMANCE / PRODUCTIVITY



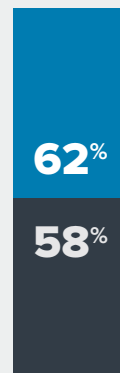
MACHINE PERFORMANCE



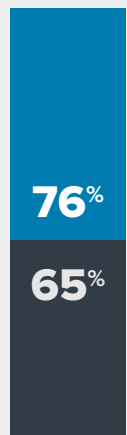
TOO MANY LINE STOPPAGES



SOP (STANDARD OPERATING PROCEDURE) NOT FOLLOWED



ACCOUNTABILITY AND TRACEABILITY



LENGTH OF TIME BEFORE ISSUES ARE IDENTIFIED/RESOLVED

*ISO Update



A NEW ERA OF VISIBILITY

Gates play an essential role not just to ensure production timings are achieved but also in ensuring quality through the production process. Today, more than half of manufacturers use five or fewer gates to track production, which signals that they are primarily checking products at the start and end points. However, this doesn't provide adequate visibility into the entire process. By increasing the number of gates with auto ID technology, manufacturers improve visibility and gain greater control over the quality of products making it easier to identify and remedy issues as they arise. It's more cost-effective to intercept and fix an issue mid-stream rather than after it's left the plant floor.

INCREASING TRACKING POINTS LEADS TO RISING QUALITY

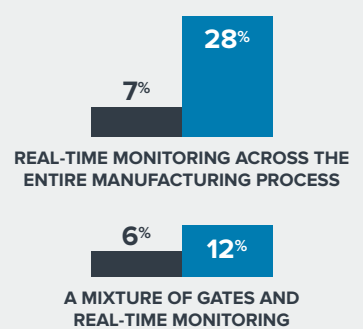
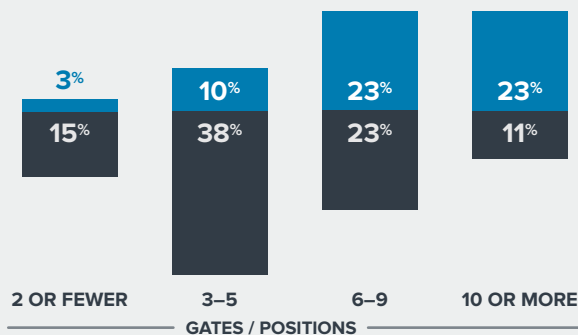
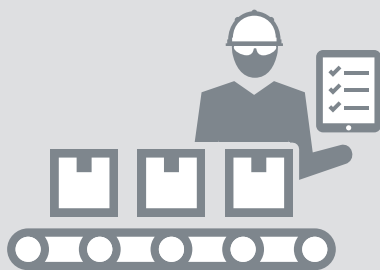
Gaining quality in the manufacturing process means having multiple checkpoints and real-time monitoring along the production line. In a connected plant floor, every physical asset has a digital profile. Manufacturers use these profiles to track real-time location, material allocation and condition of assets. The data can also be used to improve the overall manufacturing process, eliminate bottlenecks, communicate with suppliers and ensure quality. Although only 24 percent of those surveyed currently have technology-driven tracking capabilities in place, it's something manufacturers know they need. In five years, 63 percent of those surveyed plan to increase their tracking with more than 28 percent planning to adopt real-time monitoring.

According to the study, manufacturers are planning to install more gates across the entire manufacturing process. Increasing gates gives real-time monitoring capabilities that help improve quality and throughput. In fact, 23 percent of respondents report their intentions to increase the number of gates in the production process to 10 or more within the next five years. More check points will help ensure a higher quality of goods produced and reduce the costs associated with recovery.

These additional check points will provide much-needed transparency, an element that's critical to growth. Forty-six percent of those surveyed acknowledge increased visibility across their operations will support growth indicating that a connected plant floor with the ability to collect and analyze data is imperative. Providing employees real-time access to that data will improve productivity, decrease unplanned downtime, ensure process compliance, and enable traceability both in production and throughout the supply chain.

REAL-TIME MONITORING ACROSS THE MANUFACTURING PROCESS

2017 2022



DEMANDS OF INDUSTRY 4.0

Smart factories are the core of Industry 4.0 where real-time communication between the supply chain and the production line enable a high-level of automation and digitization. Making this possible are machines that can self-optimize and share data in real time to deliver better quality goods, unprecedented visibility and impressive cost efficiencies.

Increasingly, companies are focusing less on keeping materials on hand and depending more on suppliers to provide goods on-demand. Industry 4.0 brings with it a move toward Just in Time (JIT) shipments in which suppliers anticipate the needs of manufacturers and deliver materials when needed to meet production cycle requirements.

Currently, 26 percent of those surveyed require suppliers to provide JIT shipment notifications. This is anticipated to increase in the next five years with 35 percent of manufacturers expecting JIT notifications. This also means quality assurance must be top of mind for suppliers as well. If manufacturers aren't keeping extra inventory on hand and receive a bad batch from their supplier the entire production chain can slow down, thereby decreasing efficiencies.

However, suppliers aren't the only ones who will need to start adhering to JIT shipment requirements; manufacturers are being asked to do the same thing by their customers. Twenty-seven percent of those surveyed state their customers currently require JIT shipment notifications and they anticipate that number to go up to 36 percent by 2022.

This trend is particularly prevalent for the high tech and pharmaceutical industries that expect to have the greatest amount of change in this area.

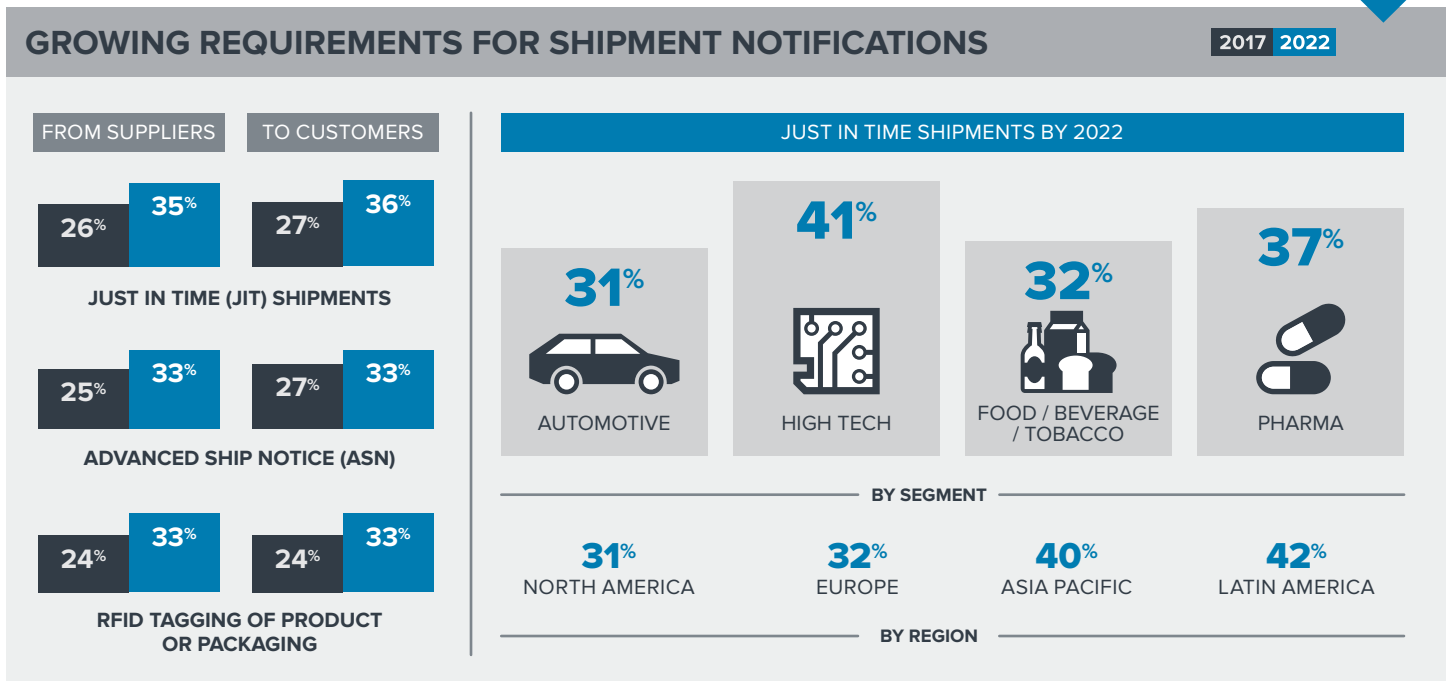
EXPANDING FUNCTIONALITY

To meet the needs of customers who require JIT notification of shipments, companies expect to deploy full-featured, best-of-breed Manufacturing Execution Systems (MESs) that track and document the transformation of raw materials into finished goods.

Currently, 40 percent of respondents report they are using a full-featured MES in their factories. By 2022, this number is expected to increase to 52 percent. Surprisingly, high tech is behind the trend with only 34 percent using best-of-breed MES today. Over the next five years, this industry will likely see the largest adoption with 50 percent of respondents expecting to deploy MES.

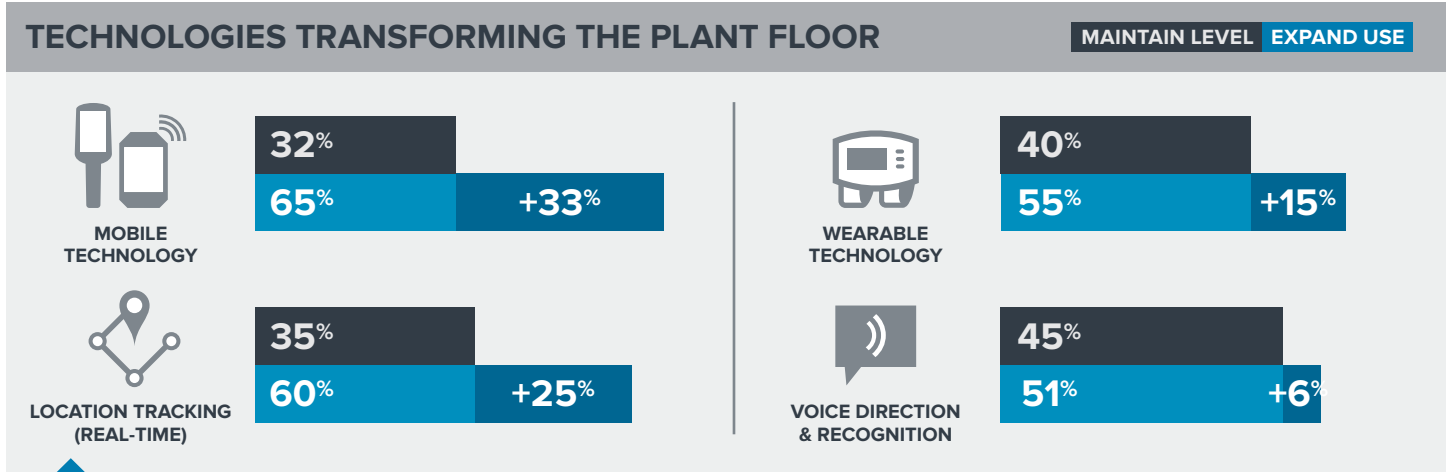
What will help companies make this leap? Most likely on-demand, cloud, and Software as a Service (SaaS) solutions will foster adoption. Fifty-two percent of respondents expect to use these services in 2022 compared to 38 percent who use it today. This also signals a move away from using ERP as an MES.

In five years, Just in Time (JIT) shipments will have the highest use in high-tech and pharma segments and regionally in Asia Pacific and Latin America.



LEVERAGING TECHNOLOGY TO REALIZE GROWTH POTENTIAL

As the manufacturing industry moves towards more automation, wearables and voice solutions will play a pivotal role. Wearables and voice-driven technologies go hand-in-hand and present exciting opportunities for manufacturers to automate processes and increase efficiencies.



Among those currently using relevant technologies, most are planning to expand their level of usage by 2022.

While still a relatively young technology, wearables offer a plethora of opportunities to improve safety and increase productivity on the plant floor. For example, some solutions can monitor a worker's physical condition and alert supervisors if issues arise that could be considered a health hazard. Employees equipped with video camera glasses will be able to record what's happening on the line. There are many more opportunities for wearables to transform the production line, which is likely why companies

plan to increase the use of wearable technology by 15 percent in the next five years.


As manufacturers seek to eliminate the need to store excessive inventory, voice technologies will play a key role in JIT manufacturing and automating processes. Fifty-one percent of companies are planning to expand the use of voice technology in the next five years. The most dramatic growth for voice technology will be in the largest companies (>\$1 Billion) with a reported use growing from 28 percent today, to 55 percent in 2022.

THE SHIFT FROM PEN AND PAPER

Today, 62 percent of those surveyed use pen and paper to track vital manufacturing steps and 50 percent are using spreadsheets or a computer on wheels. The use of pen and paper to track WIP is highly inefficient and makes the process susceptible to human error. While plant floor managers can use the data stored in spreadsheets to identify areas for improvement, it's a time-consuming, manual process. Providing plant floor employees with mobile handheld devices allows them to scan and collect WIP information in real-time, providing visibility to data that can help managers make faster decisions.

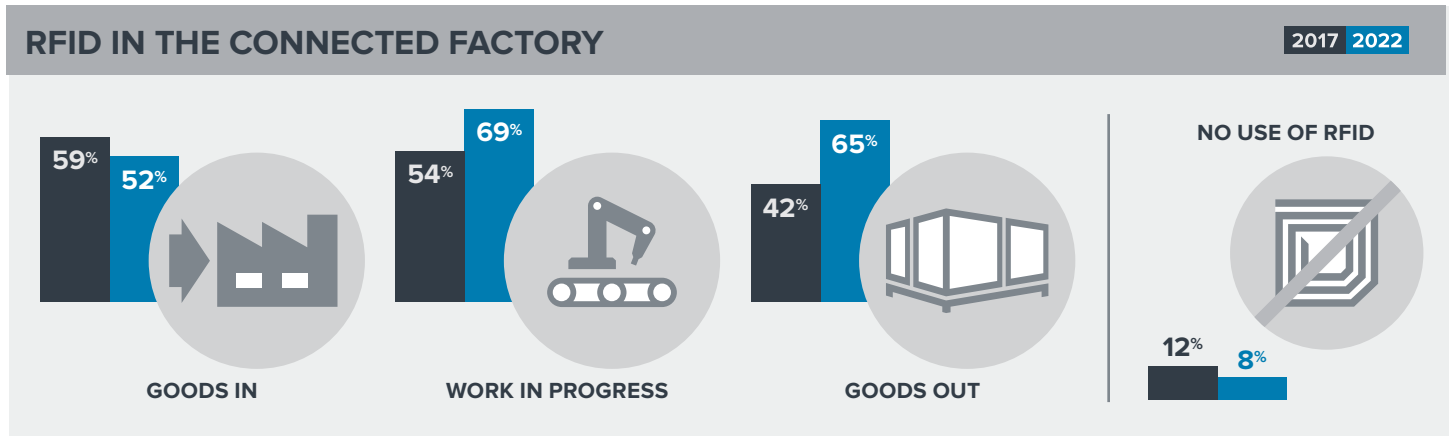
MANUAL PROCESSES DECREASING

PEN AND PAPER	62%	21%
COMPUTER ON WHEELS/ SPREADSHEET	50%	37%



RFID FINDS A HOME ON THE PLANT FLOOR

Along with wearables and voice solutions, manufacturers are adding RFID alongside existing barcode technologies to provide a more connected plant floor. IIoT is already beginning to transform manufacturing and companies are increasing their usage of RFID as a powerful tool to convert physical materials into digital assets that are easy to track in real-time on the plant floor.



RFID first gained adoption with slap-and-ship, when retailers began requiring manufacturers to tag all cases and pallets with RFID tags. For retailers, RFID tags helped them save on labor costs. No longer did forklift drivers have to get off the truck to scan a pallet; the information on the RFID tag had all the data they needed.

Today, 37 percent of respondent are using RFID and that number is only expected to grow over the next five years. By 2022, 48 percent of respondents across all industries plan to use RFID as part of the manufacturing process. Using RFID to optimize

production is seen as one of the top benefits by respondents in deploying IIoT technologies for a connected factory. Expect to also see increased use of RFID for WIP tracking and Goods Out.

It's no wonder that RFID is becoming more popular, since RFID tags are capable of handling more information than just what's on a pallet. To illustrate, an RFID tag can contain work instructions, bill of materials and tracking numbers. Workers can use this information to better move an item through production. RFID can also be used to improve order accuracy, which is crucial for suppliers, and offers even greater traceability.





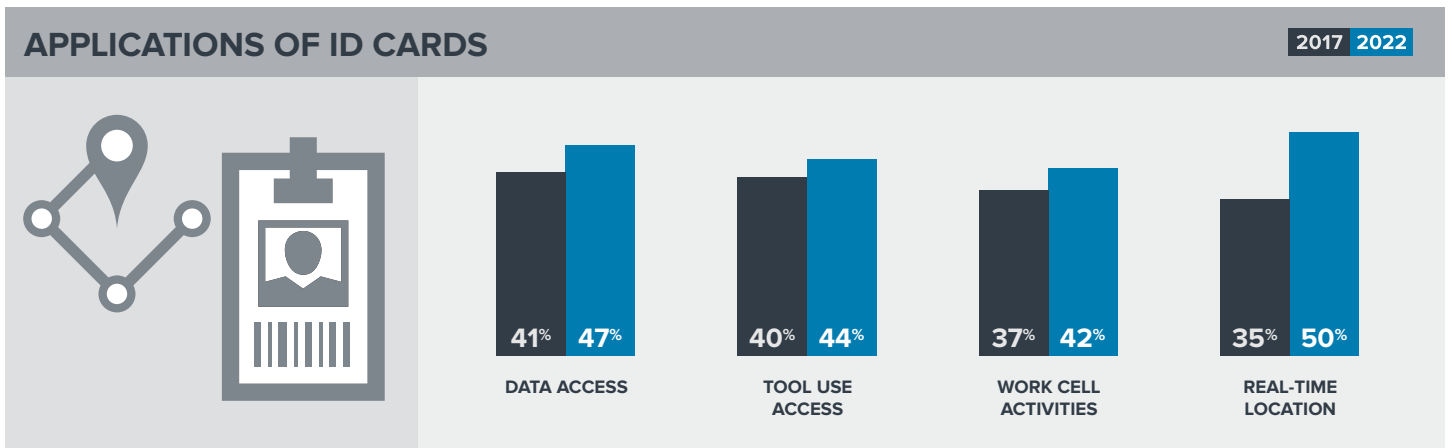
ASSET MANAGEMENT IS ESSENTIAL FOR SUCCESS

Manufacturers want real-time asset management and quality control of goods as they move through the production process. This is becoming increasingly important as the competitive landscape begins to encompass the importance of providing quality goods, tracking assets is taking center stage in the manufacturing industry. No longer can companies afford to track products solely at the Goods-In and Goods-Out phase of the process. According to survey respondents, only seven percent have real-time monitoring throughout the entire manufacturing process. However, 28 percent expect to add this capability within the next five years.

Real-Time Location Systems (RTLS) in the manufacturing environment enable a host of new benefits. Companies can use RTLS to collect critical data about assets including location, stage and condition. This provides actionable data that managers can use to make smarter decisions and improve production. The data collected by RTLS software can be sent directly from the factory floor to internal and external suppliers so that they can quickly respond to requests. This helps eliminate the need to store excess inventory. Over 50 percent of respondents plan to implement RTLS by 2022.

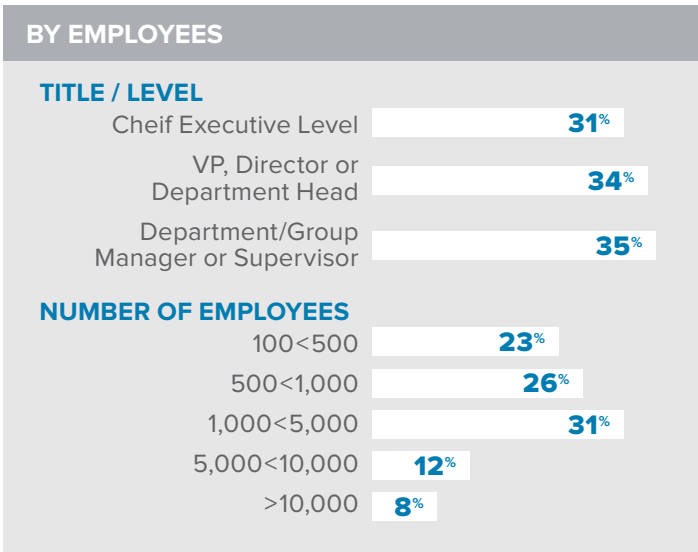
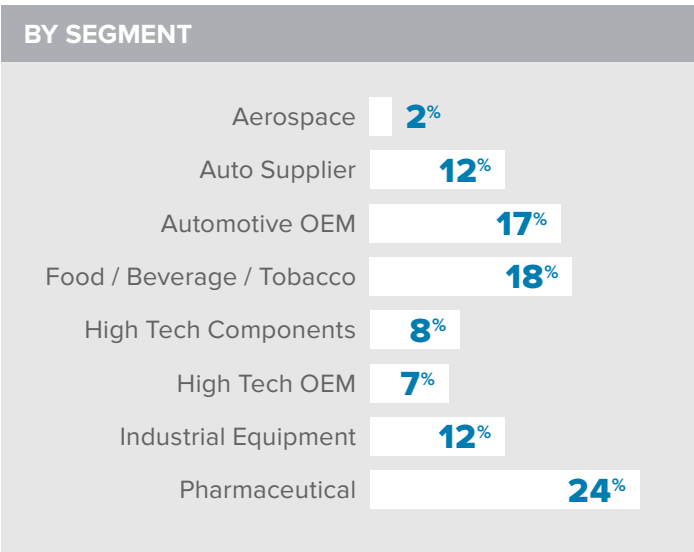
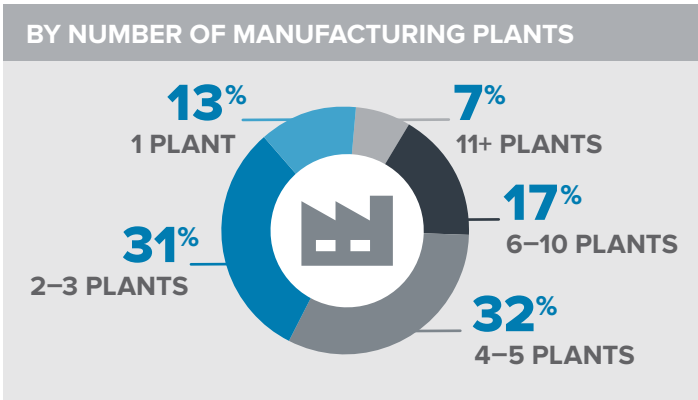
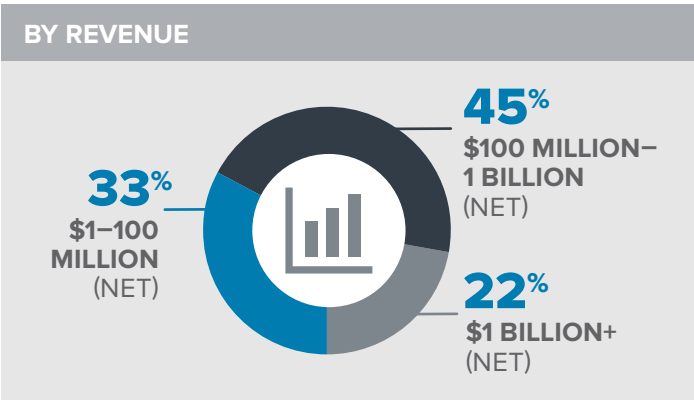
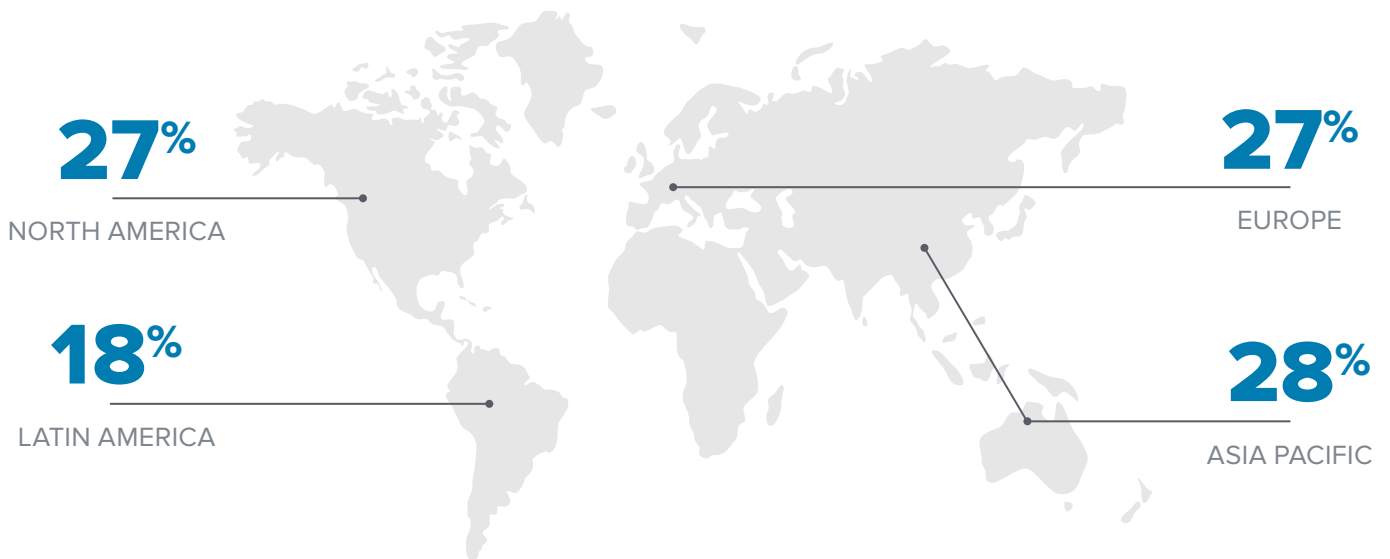
SMART ACCESS

On the factory floor, goods are not the only assets that require tracking. Another opportunity to create efficiencies is in deploying smart Identification (ID) cards to employees. Survey respondents would like to use ID cards to obtain real-time data on an employee's location. Currently, 35 percent of those surveyed are using ID cards to gather real-time location data on employees. In five years, 50 percent plan to implement locationing on employee ID cards.



ABOUT THE STUDY

RESPONDENTS BY GEOGRAPHY



SHIFTING QUALITY FOCUS IS CRITICAL TO STAYING COMPETITIVE

Industry 4.0 and IIoT may be transforming the manufacturing sector, but it is the need for quality assurance that's driving innovation and cultivating competition. Change is already underway and manufacturers and suppliers are integrating visibility solutions into the plant floor to increase quality, expedite production and reduce costs. Key efforts include instituting more gates along the production line, enabling automated communication between suppliers and manufacturers, and deploying advanced technologies to empower workers and decision making. All are strategic steps that companies are embracing to realize the truly smart factory of the future.



ABOUT ZEBRA TECHNOLOGIES

Zebra offers forward-thinking manufacturers unparalleled visibility into goods, assets, people and transactions that help maximize output, ensure quality assurance and traceability and increase operational flexibility with a smarter, more connected plant floor.

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