Testimony of

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Introduction

Thank you, Chairman Latta, Ranking Member Schakowsky, and members of the Subcommittee, for the opportunity to testify before you today. My name is Tom Bianculli and I am the Chief Technology Officer for Zebra Technologies Corporation. Zebra is a global leader in bringing Internet of Things (IoT) solutions to Business-to-Business (B2B) and Business-to-Government (B2G) markets.

With revenues of approximately $3.7 billion and almost 7,000 employees in more than 40 countries, Zebra is a trusted business partner to more than 95 percent of all Fortune 500 companies. However, Mr. Chairman, I recognize that many Americans may not know Zebra by name but I am sure they come into contact with our solutions every day. For example, the barcode labels that are prominently featured on airline bag tags, express delivery packages, and pharmaceutical prescription bottles are often generated by a Zebra barcode label printer and tracked and managed by a Zebra scanner. Factory, warehouse and delivery workers as well as countless healthcare workers across the globe employ our mobile computing devices daily in their work.

Overview

My testimony today reflects the contents of a soon-to-be-released White Paper entitled the "2017 Manufacturing Vision Study"[1] and provides Zebra's views on how the Internet of Things (IoT) – or, more specifically, the Industrial Internet of Things (IIoT) – will impact manufacturing and innovation.

[1] The Zebra 2017 Manufacturing Vision Study is the result of a global study Zebra commissioned last year to analyze the trends, opportunities, and challenges related to IIoT solutions in manufacturing. It includes the insights of 1,100 executives from automotive, high tech, food, beverage, tobacco, and pharmaceutical companies on the role and importance of adopting technology on the plant floor that increases overall company competitiveness.

As a starting point for my testimony and to assure a common definition, Zebra describes IIoT as those technologies which enable businesses to track critical assets and events within their operations and know exactly what they are, where they are and their condition so they can make smarter, faster decisions that improve the bottom line. IIoT leverages and recognizes the fact that people, assets and devices – especially mobile devices – are becoming increasingly connected and that this trend is advancing quickly. A few key facts help illustrate this point:

- By 2020, there will be 1.75 billion global mobile workers accounting for 42% of the global workforce.[2]

- By 2020, there will be 21 billion connected devices in a global Internet of Things.[3]

- By 2020, there will be 44 zettabytes of data with 10% of it coming from the Internet of Things.[4]

As a result of these trends, Zebra is working with companies around the world to provide solutions which yield real-time visibility into their processes, assets and people. The key elements which enable this work include:[5]

- Sense. The employment of unrivaled expertise in sensor and device connectivity enables companies to inter-connect devices to software and to mobile workers so that decision makers and workers alike have substantially more real-time visibility into operations.

- Analyze**.** Equally important, the provision of easy access to an unprecedented amount of data that IIoT enables allows companies to plan more effective short- and long-term

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2 Source: Strategy Analytics as cited in *Visibility That's Visionary*, Zebra Technologies Corporation (May 31, 2016, 11:15 AM), https://www.zebra.com/content/dam/zebra_new_ia/en-us/campaigns/brand-campaign/zebra-visibility-vision-report-en-us.pdf.

3 Source: Gartner Group as cited in *Visibility That's Visionary*, Zebra Technologies Corporation (May 31, 2016, 11:15 AM), https://www.zebra.com/content/dam/zebra_new_ia/en-us/campaigns/brand-campaign/zebra-visibility-vision-report-en-us.pdf.

4 Source: Digital Universe Study as cited in *Visibility That's Visionary*, Zebra Technologies Corporation (May 31, 2016, 11:15 AM), https://www.zebra.com/content/dam/zebra_new_ia/en-us/campaigns/brand-campaign/zebra-visibility-vision-report-en-us.pdf.

5 Source: Zebra Technologies Corporation, *Visibility That's Visionary*, (May 31, 2016, 11:15 AM), https://www.zebra.com/us/en/cpn/visibility.html.

strategies by delivering real-time insights into the critical data captured by the sensors in connected devices.

- Act**.** The explosive growth of mobile devices across the private, public and non-profit sectors enables management and workers at all levels to act on these visibility-driven insights in real-time, anytime and everywhere.

Both our experience and the findings of our 2017 Manufacturing Vision Study tell us that manufacturers and their supply chain partners are increasingly recognizing the transformational role of IIoT solutions in driving growth and improving performance in several areas including:

- Increasing total production and throughput.
- Improving the ability to adjust to fluctuating market demand.
- Increasing the number of product variants.
- Increasing visibility across a given business enterprise.
- Decreasing the cost of production.

The balance of my statement examines these issues in greater detail by discussing the elements and application of IIoT to manufacturing, including:

- The State of the Manufacturing Industry.
- The Benefits and Rising Importance of IIoT.
- The Challenges of Fully Deploying IIoT.
- IIoT Deployment Drivers:
    - Quality Management.
    - Creating Increasing Tracking Points in Manufacturing.
    - The Demands of Industry 4.0.
    - The Importance of Expanding Functionality.
    - The Value of Leveraging Technology to Realize Greater Growth.
- IIoT in American Manufacturing.
- Policy Recommendations.

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 ensuring high-quality products.

Moreover, and for the first time in decades, investment decisions are no longer being driven primarily by short-term Return on Investment (ROI) calculations but also, increasingly, by 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 these challenges the adverse impact of 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. As a result, manufacturers and their suppliers are making changes to their plant floor operations and moving toward a fully connected, smart factory as a way of achieving the goal of error-free production. Zebra views IIoT-based solutions as an essential component of this effort.

The Benefits of IIoT

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 provides unheard-of visibility that heightens operational performance. It is for this reason that technologies which connect assets, inventory and equipment are essential pieces of the IIoT puzzle.

Zebra believes that manufacturers are beginning to see the many benefits of having fully connected operations that include both internal plant operations and 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. Zebra's 2017 Manufacturing Vision Study indicates that the number of companies supporting a fully connected factory is expected to double by 2022 as over one-third of those surveyed anticipate having this capability.

The Rising Importance of IIoT

Manufacturers are adopting Industry 4.0 to create "smart factories" 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 faster and more decentralized decisions.[6]

With automation comes instant access to data which is essential to ensuring that the production process operates smoothly and efficiently. Importantly, data gives suppliers the ability to anticipate the needs of their customers. It also enables manufacturers to keep less inventory on hand and eliminate points-of-failure. In fact, 50 percent of the respondents to Zebra's 2017 Manufacturing Vision Study stated that improving their ability to adjust to fluctuating market demands is a top business growth strategy.

To this end, I am pleased to inform the Subcommittee that, from Zebra's perspective, manufacturers – and the U.S. economy – are already realizing the very real benefits of data connectivity through such things as:

[6] Source: Bernard Marr, *What Everyone Must Know About Industry 4.0*, Forbes Magazine, June 20, 2016. Web. 10 Apr. 2017, https://www.forbes.com/sites/bernardmarr/2016/06/20/what-everyone-must-know-about-industry-4-0/#1f25bf89795f.

- 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 interworking of their operations.

The Challenges to Fully Deploying IIoT

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 and this is likely a key reason why companies rank complexity of technology and availability of IT resources among the top reasons why businesses are not yet achieving a fully connected factory. Fortunately, new advancements in technology are both making it possible to integrate these legacy systems and simplifying the process for doing so.

Currently, 27 percent of those surveyed in the Zebra 2017 Manufacturing Vision Study indicate that they are collecting data from production, supply chain, and workers. It is worth noting, however, that the data appears to often remain in silos, rendering much of the intelligence unrealized.

While implementation may be challenging, Zebra believes manufacturers are committed to improving quality and, therefore, are focused on adopting and constantly improving these data collection processes. In fact, some 34 percent of those surveyed in the Zebra 2017 Manufacturing Vision Study expect to achieve a connected factory by 2022. IIoT deployment may occur in incremental stages, but there is little doubt that manufacturing companies will pursue the creation of fully connected factories over the next several years.

IIoT Deployment Drivers – Quality Management

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 an entire process.

Manufacturers across all industries cite supplier quality as a prominent concern, with a total of 58 percent of respondents to our 2017 Manufacturing Vision Study 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.

Thankfully, achieving consistent quality output is increasingly attainable and affordable thanks to advancements in IIoT 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.

IIoT Deployment Drivers – Creating Increasing Tracking Points in Manufacturing

Improving quality in the manufacturing process means having multiple checkpoints and real-time monitoring along the production line. In a fully 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 by eliminating bottlenecks, communicating with suppliers, and ensuring overall process and product quality. Although only 24 percent of those surveyed in the 2017 Zebra Manufacturing Vision Study currently have technology-driven tracking capabilities in place, it is 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.

Additionally, the 2017 Manufacturing Vision Study also notes that manufacturers are planning to install more check points or 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 both help ensure a higher quality of goods produced and reduce the costs associated with recovery. These additional check points will also provide much-needed transparency, an element that's critical to growth. Forty-six percent of those surveyed acknowledge increased visibility across their operations which, in turn, indicates that a connected plant floor with the ability to collect and analyze data is imperative. Providing employees real-time access to that check point data will improve productivity, decrease unplanned downtime, ensure process compliance, and enable traceability both in internal plant production and across the supply chain.

IIoT Deployment Drivers – The 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 IIoT helps 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 legitimate and affordable capability for mass adoption of Just in Time (JIT) shipments in which suppliers have the technology to anticipate the needs of manufacturers and deliver materials when needed to meet production cycle requirements. This trend is particularly prevalent for the high tech and

pharmaceutical industries, and these industries expect to have the greatest amount of change in this area in coming years.

IIoT Deployment Drivers – The Importance of 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 (MES) that track and document the transformation of raw materials into finished goods.

According to the Zebra study, 40 percent of respondents are currently 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, we believe it will be on-demand cloud capabilities and the growing trend toward Software as a Service (SaaS). Fifty-two percent of the respondents in the 2017 Zebra Manufacturing Vision Study expect to use these services in 2022 compared to 38 percent who use it today.

IIoT Deployment Drivers – The Value of Leveraging Technology to Realize Greater Growth

As the manufacturing industry moves toward more automation, IIoT-based wearable and voice solutions will play an increasingly pivotal role. Wearables and voice-driven technologies go hand-in-hand and present exciting opportunities for manufacturers to automate processes and increase efficiencies.

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 present a health or safety 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 most likely the reason why companies plan to increase the use of wearable technology by 15 percent in the next five years.

Similarly, 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 which participated in the Zebra 2017 Manufacturing Vision Study indicated that they 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 reported use growing from 28 percent today to 55 percent in 2022.

IIoT in American Manufacturing

In American manufacturing, companies are working hard to adopt IIoT solutions to create smart factories and superior supply chains. The Subcommittee's hearing this morning is well timed and most appropriate as firms are capitalizing on IIoT in both factory operations and across the supply chain to achieve real-time visibility into their goods, assets, processes and places.

Through the principles of Manufacturing 4.0, the smart factory calls for providing actionable visibility to the entire operation, from inside the plant to the operations of those vendors who can help manage the supply chain. Workers use a combination of RFID, wearable technology, automated systems, and other emerging technologies – many made by Zebra – to monitor the physical processes of the plant and enable companies to make faster, smarter and more decentralized decisions.

By way of example, Whirlpool Corporation wanted to optimize mobile device management at its distribution centers as a way of enhancing productivity. Whirlpool was having problems with misplaced devices, battery life, the inability to update devices in a systematic way, and a lack of data metrics around device performance. They needed a centralized management system to track device health, productivity, location, and ensure proper deployment.

To solve their problem, Whirlpool began using Zebra XT15 mobile computers, VH10 vehicle-mounted computers, and Zebra's Operational Visibility Service (OVS). The VH10 and XT15 are extremely rugged, reliable devices that suit the distribution center well. OVS helps Whirlpool and long-time Zebra partner, Industrial Service Technology (IST) right-size equipment and understand the needs of the pool as well as site-by-site needs. This combination allows Whirlpool and IST to sense when there could be a problem, analyze what it is, and act on a solution in real-time.

This is but one example of how automation provides instant access to data which is essential to ensuring that the production process operates smoothly. Manufacturers are 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 inner workings of their operations.

Policy Recommendations

For companies all across America to successfully utilize IIoT solutions, they must have unfettered access to quality high-speed broadband, both wireline and wireless. Without investment in ubiquitous broadband infrastructure, many rural communities, companies and consumers risk being left behind. Spectrum is the lifeblood of IoT, and that is no different for IIoT solutions.

We urge the Subcommittee and the full Committee to support infrastructure legislation that promotes the deployment of mobile broadband networks, as well as directs the NTIA and

FCC to allocate more commercial licensed and unlicensed spectrum in a technology neutral way. Additionally, we urge Congress to advance policies that increase broadband investment and deployment.

Zebra also supports coordination among government agencies to discourage overlapping government regulation of the Internet of Things which could impede innovation. We commend the Subcommittee for your efforts to ensure that American industry has the ability to continue to roll out new technologies that will improve the lives of both our workers and our citizens.

Conclusion

Industry 4.0 and IIoT may be transforming the manufacturing sector, but it is the need for quality assurance that is driving manufacturing process innovation. Change is already underway and manufacturers and suppliers are integrating visibility solutions into the plant floor operations 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.

In sum, Mr. Chairman, IIoT presents a transformative opportunity for enterprises of all types and sizes across the Unites States and around the world. The benefits of IIoT-based solutions are allowing companies to work smarter, enhance productivity, create jobs and improve the overall economy. At Zebra, we are committed to bringing IIoT solutions to companies to help them work better and smarter, giving them a performance edge.

Thank you for the opportunity to share our story. I am happy to answer any questions you or your colleagues may have.