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Sensors in Distribution: On the Cusp of New Performance Efficiencies

THE DIGITAL ECONOMY IS GOING STRONG with e-commerce accelerating at a better than 10 percent annual clip.[1] That shift in buyer behavior draws attention to consumer technologies like smart phones and mobile commerce, but when it comes to fulfilling all those orders for the goods that connected consumers are snapping up, distribution centers (DCs) are where the demands of the digital world run up against the realities of the physical world of order picking, packing, and getting goods out on time.

In short, to flourish in the digital economy, companies need to stay abreast of the latest technologies for data capture, condition monitoring, and inventory and asset positioning that allow physical order fulfillment processes to keep pace with customer expectations.

The world of DC operations, however, is a practical, cost-conscious environment. Concepts such as the Internet of Things (IoT) and IoT-connected sensors need to carry a bottom-line payoff, either through curbing costs on factors like energy, or improving throughput. While analyst forecasts about billions of Internet connected devices are impressive, the real question is what can be done with all the data being churned out by sensors and other "things," and how can new, Internet-connected forms of data capture mesh with existing forms of data collection to improve processes?

The research in this paper provides insight into how technologies such as sensors and IoT are viewed by supply chain and distribution professionals. Among the highlights: Sensors already are in use by more than a third of respondents, and approach half (46 percent) who are "very familiar" or "familiar" with the IoT. Being able to demonstrate return on investment (ROI) from projects is easily the top IoT adoption concern, cited by just over half of respondents.
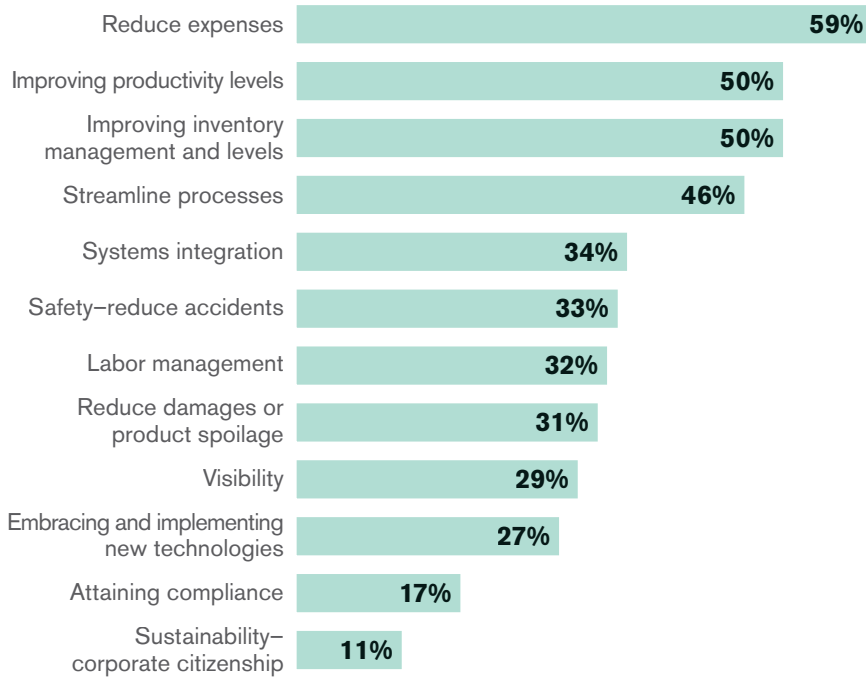
Sensors can be used in many ways within DCs, and in other supply chain processes. As this new research shows, sensors already are seeing use for controlling lighting and building management systems. Sensors within materials handling equipment such as sortation systems, lift trucks, or automated guided vehicles can be used for location tracking, generating data on utilization, or to help improve safety. Other supply chain uses for sensors include cold chain temperature and humidity monitoring, and in logistics, tracking the real-time positioning of shipments or vehicles.

To examine how sensors are being utilized in DCs today as well as in the future, 211 managers involved in decisions related to their DC operations were asked about the challenges they face in their facilities, the technologies being used to perform key inventory management functions, and their company's plans for adopting an IoT platform. As the survey shows, these professionals increasingly extol the potential of IoT or connected sensors to improve operations, but they know there must be a practical payoff to whatever technologies are put in place.

MODERN
MATERIALS HANDLING

Logistics
MANAGEMENT

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FIGURE 1

Main issues facilities need to improve

Issue	Percentage
Reduce expenses	59%
Improving productivity levels	50%
Improving inventory management and levels	50%
Streamline processes	46%
Systems integration	34%
Safety–reduce accidents	33%
Labor management	32%
Reduce damages or product spoilage	31%
Visibility	29%
Embracing and implementing new technologies	27%
Attaining compliance	17%
Sustainability–corporate citizenship	11%

Doing more with less continues to be a main challenge for DC managers

Facilities managers reaffirm that cutting costs, increasing productivity, improving inventory management and refining overall process efficiencies top their list of current operational goals. (See Figure 1.)
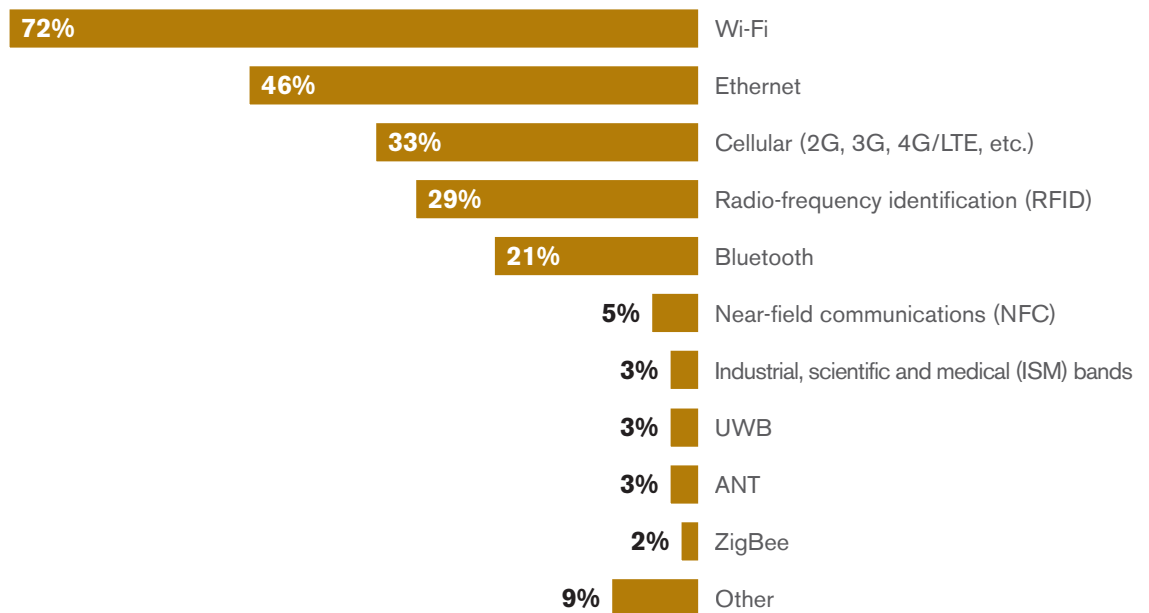
Adoption of data capture technologies can lead to improved productivity and process efficiencies

Wireless technology is the primary Internet protocol used in industrial and warehousing facilities as roughly three-fourths of those surveyed manage or plan to run Wi-Fi-based applications. Ethernet-based networks are also used most likely for transferring large amounts of data and for sending information requiring a higher security transmission. (See Figure 2.)

"Sensors have improved visibility and made us more productive."
Director of Logistics;
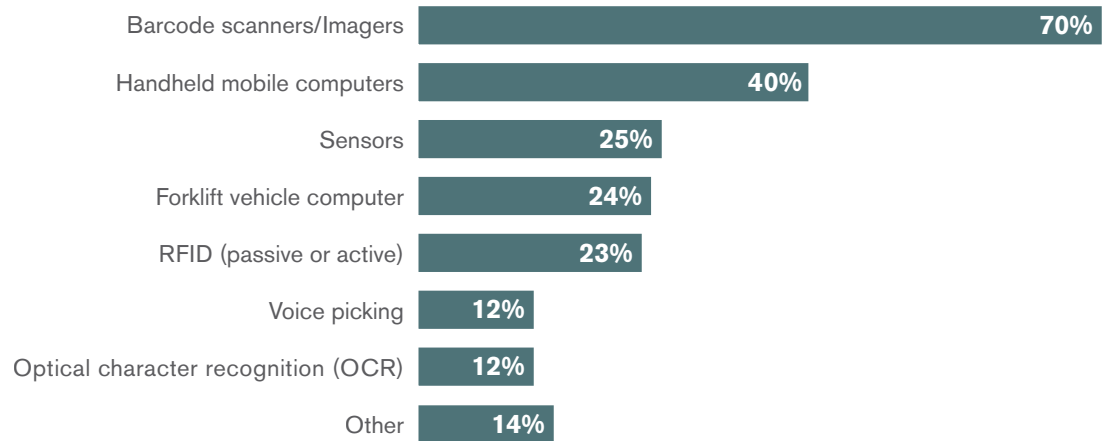Computers and
Electronics; $2.5B+

FIGURE 2

Communications platforms now in use/planned within the next 24 months

Platform	Percentage
Wi-Fi	72%
Ethernet	46%
Cellular (2G, 3G, 4G/LTE, etc.)	33%
Radio-frequency identification (RFID)	29%
Bluetooth	21%
Near-field communications (NFC)	5%
Industrial, scientific and medical (ISM) bands	3%
UWB	3%
ANT	3%
ZigBee	2%
Other	9%

FIGURE 3

Technologies using for data capture and management

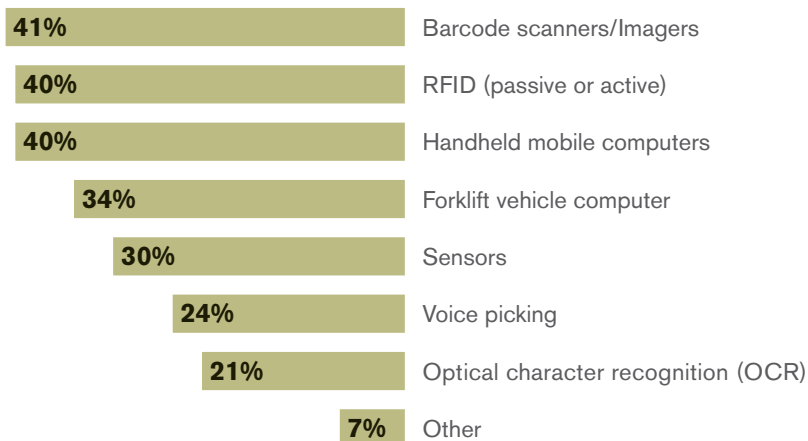| Technology	Percentage
Barcode scanners/Imagers	70%
Handheld mobile computers	40%
Sensors	25%
Forklift vehicle computer	24%
RFID (passive or active)	23%
Voice picking	12%
Optical character recognition (OCR)	12%
Other	14%

Organizations are predominantly using barcoding solutions and handheld systems for their data capture applications. In addition, roughly one out of four also now use sensors, forklift computers or RFID technologies. (See Figure 3.)

Yet, to improve efficiencies in their operations, DC managers feel that increased usage of barcode scanners and imaging technology,

RFID systems and handhelds would be highly valuable in generating more accurate data related to inventory control and fulfilment management. (See Figure 4.) The response to this "technologies needed" question indicates those surveyed see value in continuing to invest in more traditional data collection solutions alongside growing interest in newer technologies such as RFID, sensors and voice picking.

FIGURE 4

Data capture technologies needed to help improve warehouse/DC operations

Percentage	Technology
41%	Barcode scanners/Imagers
40%	RFID (passive or active)
40%	Handheld mobile computers
34%	Forklift vehicle computer
30%	Sensors
24%	Voice picking
21%	Optical character recognition (OCR)
7%	Other

FIGURE 5

Barriers faced in implementing warehouse/DC technologies

Barrier	Percent
Cost to implement	76%
Cost to maintain/operate	51%
Lack the proper systems to operate	25%
Just don't feel we have the need/ We are too small of an operation	21%
Training concerns	19%
A lack of knowledge	16%
Other	7%
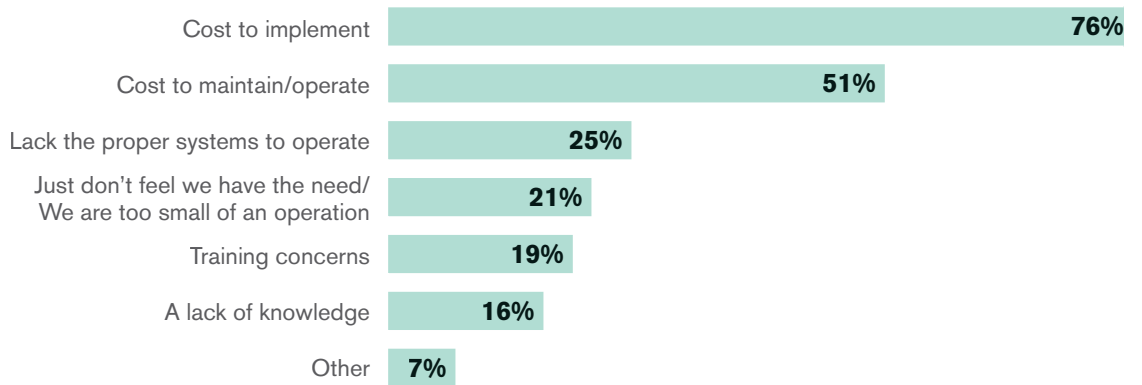
FIGURE 6

Sensor technology usage in warehouse/distribution center operations

Yes, we currently use sensors in our warehouse/DC operations **38%**

We're not currently using, but expect to be deploying within the next 24 months **24%**

No plans to use sensor technology at the present time **38%**

FIGURE 7

Types of sensors using/planning to use

Sensor type	In use	Planned for future use
Light sensors	46%	37%
Motion/velocity sensors	43%	35%
Temperature sensors	41%	28%
Humidity/Moisture sensors	28%	24%
Machine vision	15%	23%
Vibration sensors	10%	13%
Other	15%	16%

Legend:
- In use
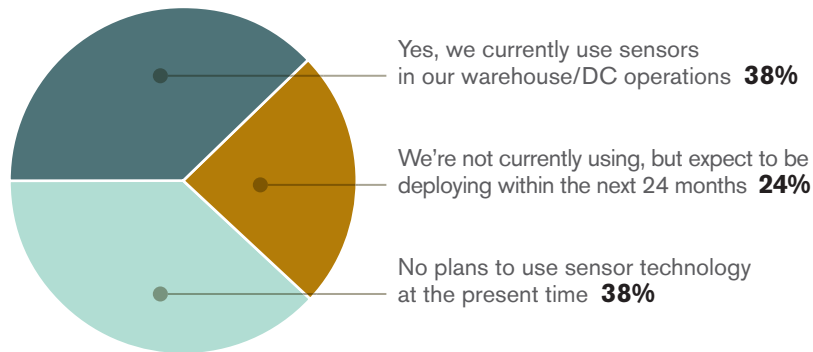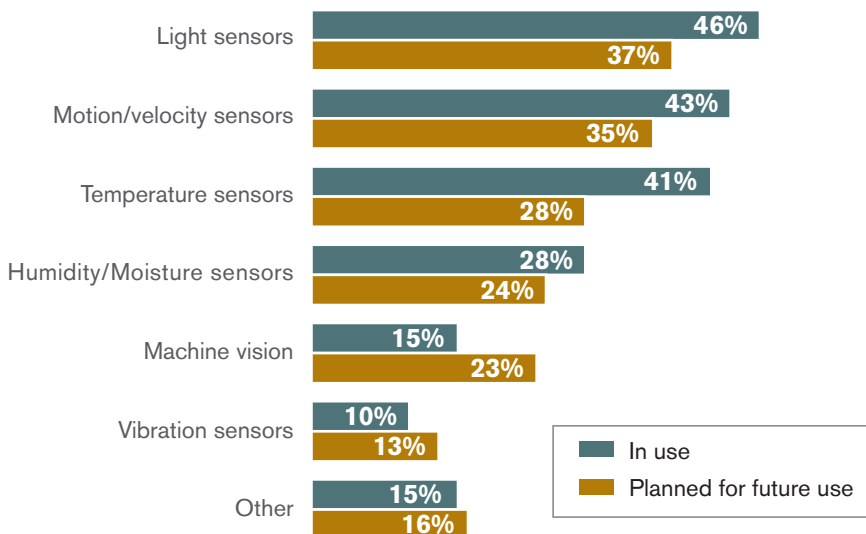- Planned for future use

However, while organizations are working to cut expenses, costs for implementing, operating and maintaining warehouse technologies loom as the largest hurdle. (See Figure 5.)

While usage of sensors is not yet mainstream, operations managers are thinking about them

Slightly more than one out of three of those surveyed (38 percent) currently use sensors in their DCs. In addition, one-fourth (24 percent) say that while they're not presently using sensors they expect to implement sensor-based applications during the next two years. Interestingly, more than one-third (38 percent) claim that they have no plans to adopt sensors at the present time. (See Figure 6.)

Light motion and temperature sensors are now most commonly in use. In addition to these types of sensors, over the next few years facilities will be adding machine vision sensors, which are often used for automating inspection processes and for use in robotic technology, as well as moisture sensors, which are mostly used for gauging soil moisture. (See Figure 7.)

FIGURE 8

Applications for which sensors are being used/will be used in warehouses/DC operations

Application	Now in use	In 24 months
Energy, lighting, heating and cooling, etc.	47%	28%
Wireless devices (smart phones, tablets, etc.)	30%	25%
Computers and electronics (PCs, laptops, printers, monitors, etc.)	26%	23%
Utilities (waste management, maintenance, emergency services, surveillance, etc.)	22%	25%
Equipment used in materials management (forklifts, AGVs, conveyors, sortation devices, etc.)	22%	22%
Data management	21%	26%
Communication systems (i.e. wireless, telecomm systems, enterprise networking solutions, etc.)	20%	18%
Automatic identification and data capture	19%	24%
Cold chain (monitor temperature and humidity of perishable transport)	19%	11%
Manufacturing and industrial (factory and building automation, motors and controls, test and measurement equipment, etc.)	18%	17%
Warehouse/DC transportation (traffic routing, telematics, smart parking, supply chain, etc.)	17%	23%
Business management systems	14%	18%
Retail and point-of-sale devices	7%	6%
Other	11%	9%

Sensors are now being employed in a variety of ways but mostly as a means of controlling energy, lighting, heating and cooling systems. During the next few years, DCs will experience a growing number of applications for which sensors will be used. It's expected that sensors will be used in conjunction with wireless devices such as smart phones and tablets as well as with other productivity devices and equipment. Along these lines, managers forecast that sensors will have business critical application for collecting and managing data, operating facilities, utilities, and for controlling or monitoring materials handling as well as transportation equipment. (See Figure 8.) For certain application uses, the 24-month outlook is stronger than the current adoption level. These relative growth application areas include data management, auto-ID and data capture, and warehouse and transportation routing and telematics. This can be seen as interest in tracking assets in motion and capturing supply chain data in a fully automated way.
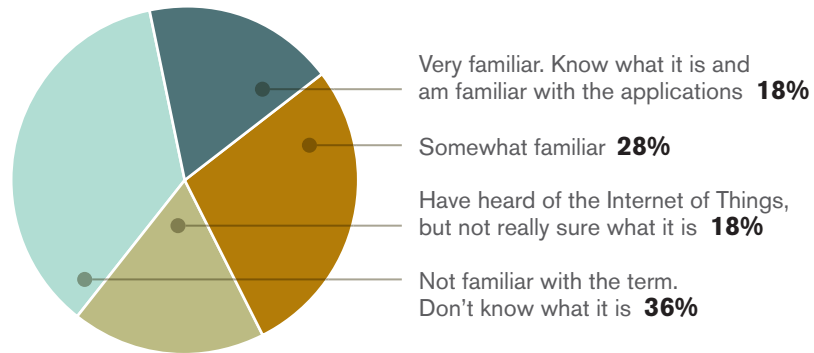
"IoT would enable us deeper analysis of data leading to enhanced segmentation of our product portfolio."
Manager, Global Supply Chain; Chemicals; $2.5B+

"IoT would increase efficiencies and better tracking of products."
Corporate Management; Electrical Equipment; $100M - $250M

"IoT would give us a global view of operations from beginning to end with automated data acquisition and entry."
Director; Food and Beverage; $100M - $250M

FIGURE 9

Familiarity with The Internet of Things (IoT)

Very familiar. Know what it is and am familiar with the applications **18%**

Somewhat familiar **28%**

Have heard of the Internet of Things, but not really sure what it is **18%**

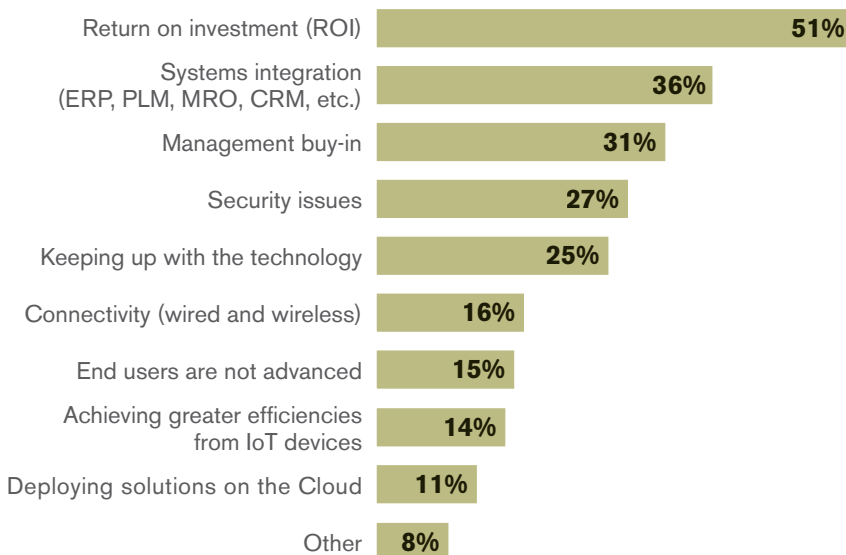Not familiar with the term. Don't know what it is **36%**

The Internet of Things is in the early stages of adoption

Awareness and an understanding of the IoT is in the formative stages. Less than one-fifth of those surveyed (18 percent) say they are very familiar with the IoT concept and its uses. While slightly more than one-fourth (28 percent) claim to be just somewhat familiar with the Internet of Things, more than half have either little (18 percent) or no knowledge (36 percent) of IoT. (See Figure 9.)

Roughly one-half of the managers surveyed (52 percent) believe an IoT platform will be relevant to their future distribution center operations. However, adoption won't come without its pain points. Managers must be able to show a return on any IoT investments and, for some, getting upper management to embrace the idea of re-engineering their facility is apt to be problematic. Integrating IoT solutions with current systems and platforms, keeping apprised of IoT technology advances and applications, and network security concerns are listed as additional primary reasons for moving cautiously to an IoT strategy. (See Figure 10.)

Summary

Given the cost-conscious, practical world of the warehouse, when managers responsible for DC operations say they are beginning to take up technologies such as sensors, it's time to take notice. The research indicates the first wave of sensor use will tend to involve better, more energy efficient management of building and lighting systems, but many also see the potential of sensors to improve productivity, improve inventory management, and streamline DC and logistics processes.

FIGURE 10

Top challenges or issues when evaluating IoT solutions for implementation

Return on investment (ROI)	51%
Systems integration (ERP, PLM, MRO, CRM, etc.)	36%
Management buy-in	31%
Security issues	27%
Keeping up with the technology	25%
Connectivity (wired and wireless)	16%
End users are not advanced	15%
Achieving greater efficiencies from IoT devices	14%
Deploying solutions on the Cloud	11%
Other	8%

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"This would enable remote operation, overall effectiveness, increased productivity, reduced error ratio, and streamlined information channels."
Director, Distribution Services; Wholesale; $2.5B+

Interestingly, respondents indicate growth plans over the next two years for sensor applications that involve automated data capture and data management, as well as automatically tracking the movement of assets and vehicles. Since sensors that tie into monitoring systems can capture data without having to burden workers with data collection tasks, sensors may have strong appeal to supply chain managers who face the daily dilemma of how to speed up fulfillment processes without expending more on labor.

With 38 percent of respondents reporting their operations already make use of sensors, and just under one-fourth saying they expect to be deploying sensors in the coming 24 months, one can expect to see sensors becoming more common in supply chain facilities and processes. Such interest by supply chain professionals in sensors is confirmed by other research and studies. For example, MHI's second-annual industry report, released in 2015, named sensors as one of the eight technologies that will reshape the supply chain landscape.[2]

Additionally, in announcing its "2015 Supply Chain Top 25," analyst firm Gartner specifically lists "sensors, gateways, tracking systems and business rules" as technologies that support the digital business models of the top 25 companies on their list.[3]

In sum, the survey indicates that companies involved in distribution and logistics are poised to make greater use of technologies such as sensors and the IoT, but will insist on clear ROI propositions that lower costs or help operations keep pace with today's order fulfilment pressures. Managers in distribution and logistics traditionally have been willing to apply new technologies when they can be shown to improve core processes and bring ROI and adoption of sensors and IoT are likely to fit that same pattern.

Sensors are not mainstream applications yet, but survey results show that DC managers are thinking about sensor technology as a solution. ●

Methodology

This research was conducted by Peerless Research Group on behalf of *Logistics Management* and *Modern Materials Handling* magazines for Honeywell International, Inc. This study was executed in October/November 2015, and was administered over the Internet among subscribers to *Logistics Management* and *Modern Materials Handling*. Respondents were qualified for being involved in decisions as they pertain to their company's warehouse and/or distribution center operations.

Respondents are predominantly top corporate executives, upper level warehouse and DC management, and directors of supply chain operations. Four out of ten report they work at a warehouse or DC, while about one out of three are located at a manufacturing facility or at their corporate headquarters. A breadth of industries are covered in the study and include manufacturers of food and beverage, automotive and parts, chemicals and pharmaceuticals, textiles, and computers and electronics. Wholesalers, retailers are also included in the study.

Footnotes:

Forrester Research eCommerce Forecast, 2014 To 2019 https://www.forrester.com/

1. Forrester Research eCommerce Forecast, 2014 To 2019 https://www.forrester.com/Forrester+Research+eCommerce+Forecast+2014+To+2019+US/fulltext/-/E-res116713

2. MHI 2015 Annual Industry Report, Deloitte press release, March 25, 2015. http://www2.deloitte.com/us/en/pages/about-deloitte/articles/press-releases/global-supply-mhi-industry-report.html

3. Gartner Announces Rankings of its 2015 Supply Chain Top 25, Gartner press release, May 14, 2015. http://www.gartner.com/newsroom/id/3053118

About Honeywell

Honeywell Sensing and Productivity Solutions is a global leader providing custom-engineered sensors, switches and controls, and productivity solutions built around our high performance data collection hardware including rugged mobile computers, voice-enabled software, barcode scanners, radio frequency identification (RFID) and workflow printing solutions. Our solutions serve customers in aerospace, automotive, field service, healthcare, industrial, manufacturing, medical, retail, supply chain, test and measurement, and transportation and logistics markets. We provide unparalleled precision and durability that improves efficiency, increases operational productivity and enhances customer service capabilities. For more information on Honeywell sensing products, visit http://sensing.honeywell.com and on Honeywell productivity solutions visit http://www.honeywellaidc.com.

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