

# TCS Global Trend Study - July 2015



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# Internet of Things: The Complete Reimaginative Force

Gadget trends come and go, with only a few starting real tech revolutions. Thus, it is natural to be skeptical about the latest gadgets-gone-gaga trend: the Internet of Things (IoT).

By this broad phrase, technology companies mean the digital hardware and software that is being embedded in items ranging from cameras and coffee makers to mattresses and multimillion-dollar aircraft engines. The technology also includes the communications networks (the Internet and wireless) that let such digitally endowed 'things' report their condition to businesses and consumers.

Technology researcher Gartner projects that there will be 4.9 billion 'connected things' (or 'smart-connected products,' as Harvard Business School Professor Michael Porter refers to them) this year. And we haven't seen anything yet, according to Gartner. It predicts the number will grow five times by the end of the decade, to 25 billion connected things, including a quarter billion vehicles.<sup>1</sup>

Will that be the case, or anything near to it? If two age-old industrial companies are bellwethers, the forecast might well be valid.

First, consider General Electric Co., the firm that sprang from Thomas Alva Edison's New Jersey laboratory in 1878. Since 2011, the \$149 billion industrial manufacturing company has committed more than \$1 billion to IoT initiatives, an investment that is expected to yield revenue of more than \$1 billion this year. What's interesting is that the proselytizing is coming from the highest level at GE – from CEO Jeffrey Immelt.

The IoT has come to mean everything to Caterpillar Inc. as well. That says a lot, given that the roots of the \$55 billion construction equipment manufacturer date back more than 100 years, when one founder, Benjamin Leroy Holt, began tinkering with a steam engine tractor in central California.<sup>2</sup> Fast forward to today, Caterpillar's CEO has similarly been smitten with the Internet of Things. "We have slightly over 3 million machines running somewhere in the world every day," Doug Oberhelman told a reporter earlier this year. "What we don't have today is all of those [machines] hooked into a system that can predict failures."<sup>3</sup>

GE and Caterpillar are not the only big, established companies embracing the Internet of Things. The interest – and investment – extends far beyond companies that make heavy, expensive equipment. That's what our latest global trend study has found. In fact, some 79% of more than 3,000 executives in North American, European, Asia-Pacific, and Latin American companies, whom we surveyed in March and April this year, said they have

According to Gartner, there will be close to 5 billion 'connected things' this year, with the number likely to increase fivefold by the end of this decade. With the Internet of Things gaining prominence, companies have a plethora of opportunities to tap into.

1 Gartner, "Gartner Says by 2020, a Quarter Billion Connected Vehicles Will Enable New In-Vehicle Services and Automated Driving Capabilities" (January 2015), <http://www.gartner.com/newsroom/id/2970017>

2 Caterpillar, "110 Years Pass Since the First Test of the Steam-Powered Track-Type Tractor", <http://www.caterpillar.com/en/news/caterpillarNews/history/110-years-pass-since-the-first-test-of-the-steam-powered-track-type-tractor.html>

3 Fortune, "The race to the Internet of things," (March 2015), <http://fortune.com/2015/03/05/the-race-to-the-internet-of-things/>

IoT initiatives in place today. From the responses of the 795 executives who answered all questions of our survey, and whose organizations have or plan to have an IoT program by the year 2020, we found that IoT initiatives are widespread beyond the industrial manufacturing sector. With respect to budgets, we asked for their plans for the next three years, since projections beyond this period may not be accurate.

All in all, we wanted to shed light on four core issues:

- Who's investing the most in IoT initiatives and what magnitude of investments do they plan to make in the next few years? Moreover, what exactly are they investing in?
- What IoT technologies are companies using, and what are they doing with them? In what aspects of their business are they using them (marketing, sales, service, supply chain, and so on), and how have they improved functional performance (if at all)?
- Has the IoT enabled some companies to fundamentally change their business models – the very products and services they offer, and thus how they make money? If so, how?
- What are the key lessons companies have learned in trying to make money from their IoT initiatives – either by generating new revenue or reducing costs? What differentiates the companies that have generated the greatest revenue from the IoT from the ones that have yielded the least?

This is the sixth in our series of global trend studies since 2011. The other five covered different but related topics at the intersection of business issues and digital technology issues. As with our previous studies, we combined quantitative and qualitative research, surveying hundreds of executives and interviewing a select number of others who gave us in-depth insights on business initiatives in their companies. For this research, those companies were Intel (which has a \$2 billion IoT business unit), Hewlett Packard, General Electric, and PTC (a product lifecycle management software company).

What's become clear to us is that the Internet of Things is no longer a closeted discussion held in the IT function or at technology vendor conferences. The topic has become the focus of passionate examination and spirited debate at the top-most level of a growing number of major companies around the world.

In this section, we present what we see as the most noteworthy findings across industries. In the rest of the report, you'll also find other findings on how IoT technologies are being used in four regions of the world and 13 industries, as well as the keys to generating business benefits from them.

## Previous TCS Global Trend Studies

Since 2011, we have conducted five major studies on the business impact of digital technologies:

The State of Cloud Application Adoption in Large Enterprises (2011)

The New Digital Mobile Consumer (2012)

The Emerging Big Returns on Big Data (2013)

Mastering Digital Feedback: How the best Consumer Companies Use Social Media (2013)

The Road to Reimagination: The State and High Stakes of Digital Initiatives (2014)

## Key Findings: The IoT is Starting to Fundamentally Change the Way Some Big Companies Operate

- 1. The IoT is a really big thing for many large global companies.** Some 79% already use IoT technologies to track their customers, products, the premises in which they do business with customers, or their supply chains. This year, companies with IoT initiatives that completed all our survey questions will invest \$86 million – or 0.4% of revenue – apiece to further their projects. They expect their IoT budgets to rise by 20% by 2018 to \$103 million.
- 2. Companies with high-priced product offerings will spend much more on the IoT this year than those with low-priced offerings.** Firms with the most expensive products will spend the most money on the IoT by a wide margin. In other words, spending on the IoT correlates strongly with the price of a company's products or services. Those whose offerings sell for more than \$10 million on average (for example, makers of aircraft engines and power turbines) will spend an average \$335 million each this year on IoT initiatives. In stark contrast, those with products priced at \$100 or less will spend about one-eighth that amount, an average \$39 million.
- 3. Mobile apps are the most frequently used IoT technology.** The most common approach to using IoT technologies is to track customers through mobile apps, which 50% companies do today. The second most common approach to using IoT technologies is tracking products as they move through production and distribution. Only about one quarter of companies track the products they sell to customers through embedded sensors. About the same percentage use IoT technologies to track what customers are doing on their premises – their stores, branches, and so on.
- 4. IoT adoption is greatest in North American and European companies; they are ahead of Asia-Pacific and Latin American companies on certain measures.** North American companies will spend 0.45% of revenue this year on IoT initiatives, while European companies will spend 0.40%. Asia-Pacific companies will invest 0.34% of revenue in the IoT, and Latin American firms will spend 0.23% of revenue. North American and European companies are more frequently selling smart, connected products than are Asia-Pacific and Latin American companies.
- 5. In some companies, the IoT is already having a big impact on revenue, product and service customization, and customer service.** Companies with IoT programs in place reported an average revenue increase of 16% in 2014, in the areas of business where IoT initiatives were deployed. In addition, about 9% of firms had an average revenue increase of more than 60%. The biggest product and process improvements reported by companies were more customized offerings and tailored marketing campaigns, faster product improvements, and more effective customer service (in part, by being able to identify product problems before customers knew about them).
- 6. In gaining benefits from the IoT, industrial manufacturers are far ahead of 12 other major global industries.** They reported the largest average revenue increase from their IoT initiatives last year (29%), and they forecast they'd have the largest revenue increase from the IoT by 2018 (27% over 2015). Industrial manufacturers were also in the lead for using sensors and other digital technologies to monitor the products they sold to customers (with 40% of the companies doing so). They were second in IoT spend, at an average \$121 million per company, close behind the travel industry's \$129 million.



- 7. To fully capitalize on IoT technologies, the most important issues to resolve are strategic and cultural. Technology challenges trail in importance, but they also loom large.** When asked to rank the importance of 21 success factors, executives rated two strategic issues: identifying and pursuing new business and/or revenue opportunities that the IoT makes possible, and determining what data to collect, as first and third, respectively. They rated two corporate culture challenges as second and fourth: getting managers and workers to change the way they think about customers, products, and processes, and having top executives who believe the IoT will have a profound impact and are willing to invest in it. Four technology-related issues also finished in the top 10: handling Big Data, deciding which IoT technologies to develop internally vs. externally, integrating IoT data with enterprise systems, and making sure IoT technologies are reliable and secure.
- 8. Companies with the greatest revenue increases from IoT initiatives differed in seven key ways from firms with the lowest gains.** First, the early IoT leaders are more likely to digitally reimagine their businesses and produce substantial value for customers – not just value for themselves. Second, they deliver that value through new business models, product and service offerings, product bundles, and data. Third, they appear more likely to see the breakthrough potential of the IoT: getting the ultimate truth on how their products and services are performing for customers, as well as actual usage patterns. Fourth, IoT leaders organize themselves to act rapidly based on this performance and customer usage data. Fifth, they are better at dealing with internal resistance to hearing the truth that IoT technologies reveal about product and service performance. Sixth, they make IoT reliable in the field, especially to reduce the risks of security breaches. Seventh, they make small test investments before making broader and bigger ones.

In the pages that follow, we explore these eight findings and what they mean across and within the four regions and 13 global industries that we studied.

# How Companies in Four Regions of the World are Using the Internet of Things



### **Highlights:**

- Nearly four out of five (79%) companies surveyed have Internet of Things (IoT) initiatives in place today.
- Almost half track (47%) customers through mobile apps, and 45% use IoT technologies to monitor production and distribution operations. However, only about one quarter track their products through embedded sensors or the customers who visit their premises.
- The average company increased revenue 16% last year in the area of its business in which it had an IoT initiative. Nine percent of respondents attributed a revenue rise of more than 30% to their IoT efforts.
- The higher the price of a company's products, the more heavily it will spend on IoT this year. Companies whose products' prices are more than \$10 million will spend an average of \$335 million, while those with product prices of \$100 or less will spend an average of only \$39 million.

## **Sensor by Sensor, the Internet of Things Spreads Rapidly**

For years, customers have been surfing companies' virtual offerings and clicking to order products and services. With the Internet of Things, companies can now reach out automatically to their customers – to understand their needs, discern how they really use products and services, and identify ways to deepen relationships and increase sales.

Systems that collect sensor signals from products, from customers' mobile devices and from the brick-and-mortar locations where companies do business with customers are in place or on the drawing board at most of the companies we studied in four regions of the world: North America, Europe, Asia-Pacific and Latin America.

In all, 3,764 executives took some part of the survey. Of this group, 79% said their companies had IoT initiatives in place today. Of the 21% that don't have them, nearly two-thirds (64%) plan to launch one by the year 2020, which means 92% of the 3,764 survey participants will have an IoT initiative by the end of the decade.

In other words, IoT initiatives in large companies are becoming as ubiquitous as the technologies themselves.





So what exactly are these companies doing (or planning to do) with IoT technologies? Because the market discussion on how companies should use IoT technologies can be confusing (especially because the technologies are complex), and because the technologies can be used in just about every nook and cranny of a business, we created four high-level categories of IoT business usage (Exhibit II-2) based on the aspects of a business that can be tracked:



- **Premises monitoring** – by putting sensors, digital cameras, and other devices in the places in which companies do business with their customers, be it a bank’s branches, a retailer’s stores, a lodging operator’s hotels, an airline’s planes and lounges, and so on



- **Product monitoring** – by embedding sensors, software, and other technologies into the offerings that a company brings to market, whether it’s a \$300 coffee machine, a \$2,000 refrigerator, a \$5 million haul truck that lugs tons of payload material, or a multimillion-dollar aircraft engine



- **Customer monitoring** – by tracking digital devices that customers carry (for example, mobile apps on their smartphones) or strap onto themselves (for example, wearable technologies such as digital wristbands)



- **Supply chain monitoring** – by putting sensors, digital cameras, and other digital devices in the production and distribution operations that make and deliver their products and services to customers



**Exhibit II-2: Four Core Business Areas for Applying IoT Technologies**

This section will explore how large companies are spending on IoT in these four areas, what technologies they're using, and the business process improvements they've achieved. We will also discuss the financial impact their IoT programs have had, and the biggest business-process and business-model impacts they see the IoT having by the end of the decade. Finally, we'll explain what executives see as the key factors in getting strong returns on their IoT investments.

### The Global Perspective

How are companies using digital technologies to track their products and/or services, premises, supply chains, and customers? That was the first question we asked our survey participants.

Across all four regions of the world, 47% companies leverage IoT technologies in the form of mobile apps to track customers (Exhibit II-3). Smartphones are driving customer connections to the Internet of Things. With close to 2 billion smartphone users globally<sup>4</sup> and with smartphones overtaking PCs and tablets as consumers' connected device of choice,<sup>5</sup> companies see opportunities they didn't have 20 years ago to track customers through the mobile devices they use.

4 eMarketer, press release, Dec. 11, 2014, "2 Billion Consumers Worldwide to Get Smart (phones) by 2016," <http://www.emarketer.com/Article/2-Billion-Consumers-Worldwide-Smartphones-by-2016/1011694>. There are 1.9 million smartphone users in 2015.

5 IDC press release, March 20, 2015, "As Tablets Slow and PCs Face Ongoing Challenges, Smartphones Grab an Ever-Larger Share of the Smart Connected Device Market Through 2019, According to IDC," <http://www.idc.com/getdoc.jsp?containerId=prUS25500515>.

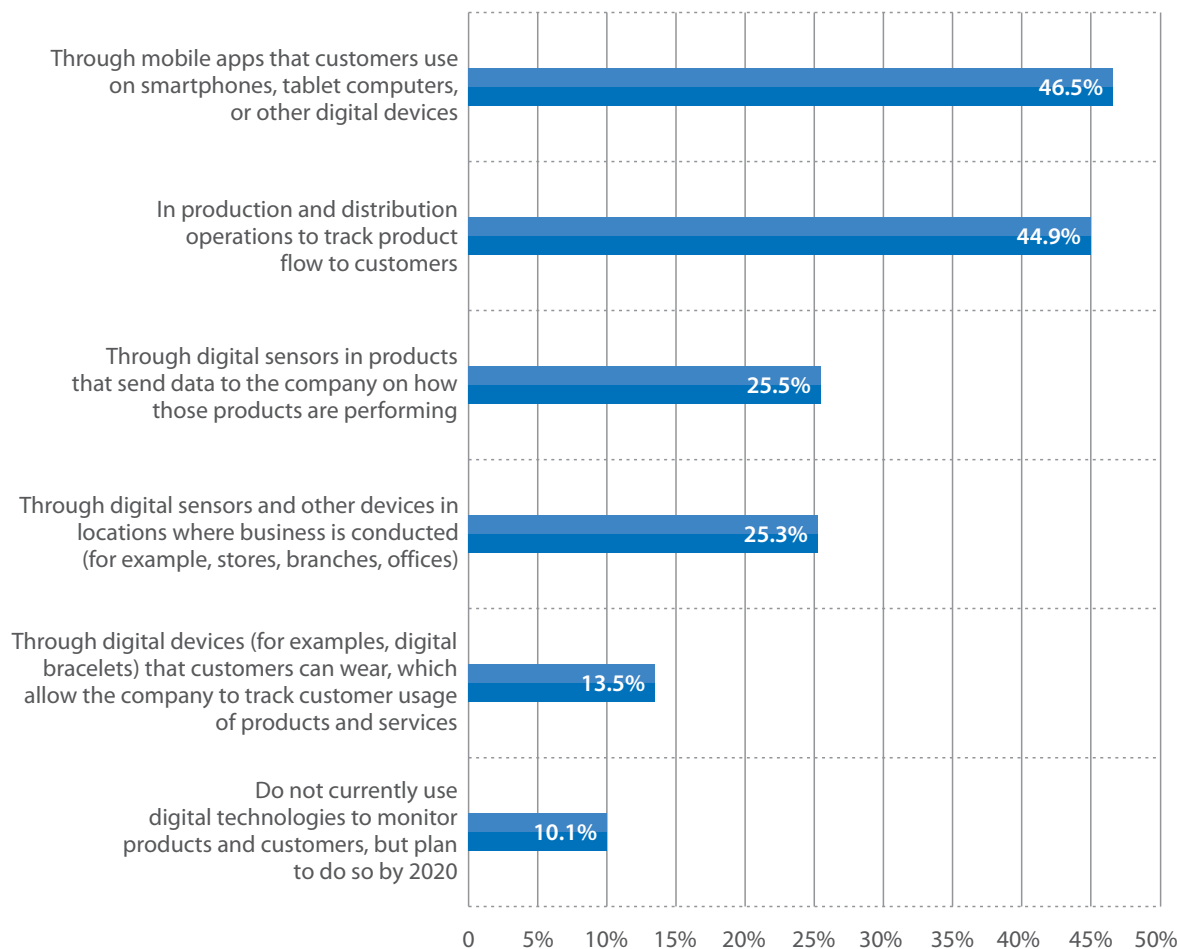
The most frequent way that companies use IoT technologies to track customers across all four regions of the world is through mobile apps, used by 47%



Sensors and other digital devices used in production lines and distribution operations were the second most frequent way IoT technologies were used (by 45% of all companies surveyed). This is not surprising, given that companies have been investing in factory automation and distribution technology such as RFID chips for a long time.

Far fewer companies – only about one-quarter – have installed digital technologies such as sensors in their products to send data to their company on how those products are performing in the field. A similarly low percentage have installed digital technologies such as sensors and digital cameras at the locations in which they do business with customers. Only about one in seven companies tracks customers through wearable digital devices (digital bracelets and other technologies).

**Q3 (Overall 3): Ways in which Companies Use IoT Technologies**



**Exhibit II-3: How Companies Use IoT Technologies**



The second most frequent way companies use IoT technologies is to monitor their supply chains. On this front, European companies are slightly ahead, with 48% of them using IoT in their production or distribution operations. In North America, 43% of companies do this today, and 42% do so in Asia-Pacific. Some 47% of the Latin American companies that we surveyed use IoT technologies in their supply chains.

This is old news for companies in the distribution business. For example, logistics firms like FedEx have provided package-tracking services for years. Now consumer packaged goods makers and other manufacturers are looking to the IoT for help tracking production processes and distribution operations as they monitor product flow to consumers. For example, Coca-Cola Enterprises in Western Europe, a manufacturing, bottling and distribution unit of the soft drink maker, has sensors on its vending machines that track supplies and identify machine problems.<sup>6</sup>

What about embedded technologies such as sensors and communications devices in products themselves? This year's study shows this practice to be on the uptake, even though only 26% of companies are doing it. In the 2014 TCS study, 'The Road to Reimagination',<sup>7</sup> we surveyed more than 800 companies in the same four regions of the world and the same 13 industries. We found 21% had digital sensors in their products and nearly the same number as this year – 50% – were monitoring customers' mobile apps.

Our latest study found some regional differences in companies' IoT programs. For example, North American firms reported greater than average use of mobile apps to monitor customers. However, these same firms were less likely to use wearable devices to monitor customers. (Companies in the Asia-Pacific region were the most likely to do so.) Companies in Asia-Pacific and Latin American regions are less likely to place sensors in products. Companies in Asia-Pacific are also more likely than those in other regions to install sensors and other digital devices in physical locations where they do business with customers.

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6 Michael Higgins, "How Coke is Leveraging the Internet of Things," The Wall Street Journal, June 25, 2014. <http://blogs.wsj.com/cio/2014/06/25/how-coke-is-leveraging-the-internet-of-things/>

7 TCS Global Trend Study – July 2014, "The Road to Reimagination: The State and High Stakes of Digital Initiatives." <http://sites.tcs.com/stateofdigital/>



With Amazon.com's Amazon Dash Button,<sup>8</sup> consumers at home use a Wi-Fi-connected device to reorder goods such as coffee, paper towels, and detergent. The products are delivered two days later.<sup>9</sup> The customer is the one monitoring supplies and reordering these via a mobile app. Amazon and its partners can see data on shopping trends. The program is a precursor to automated refills of household goods, when sensors can be attached to those products or the environment in which they reside (for example, inside a refrigerator or pantry closet).

With all the recent attention on wearable technologies (think of Google Glass and the recently unveiled Apple Watch), one might expect a large number of companies using these devices to connect to the IoT. However, it is still early days for these applications. Only 14.8% of firms in last year's survey monitored customers through wearable digital devices or other devices attached to products. The number this year – 13.5% across the world – is lower. That suggests that companies' interest in wearable technologies might be ebbing for now.

For customer monitoring initiatives, companies appear to be experimenting carefully with wearable technologies. Companies with products costing between \$10,000 and \$100,000 reported the highest monitoring of wearable technologies (19.7%).

Companies appear to be far more comfortable using IoT technologies to track their own supply chains. Those tracking products worth more than \$10 million on average reported the highest usage of digital technologies in supply chain monitoring (55.3%), while those with less costly products (priced on average between \$500 to \$1,000) cited the lowest usage (35.2%).

Premises monitoring, which 26.3% of respondents have implemented or plan to implement, found the highest adoption (31%) in companies offering products and services in the \$1,000–\$10,000 range. (Not so coincidentally, that is the price range that it would cost a family of four to spend seven days at Disney World, or \$3,423, to quote the company's package price as of May 2015. The theme park has received lots of press<sup>10</sup> for an IoT initiative with a reported \$1 billion price tag that includes a lot of premises monitoring technology.)<sup>11</sup> The lowest adoption rate of premises monitoring was for companies producing the least costly products (less than \$100).

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8 Amazon Dash Button page, <https://www.amazon.com/oc/dash-button>

9 Mike Isaac, "Amazon Dash Aims to Be a Push-Button Substitute for the Supply Run," New York Times, March 31, 2015, <http://bits.blogs.nytimes.com/2015/03/31/amazon-dash-aims-to-be-a-push-button-substitute-for-the-supply-run/>. Accessed May 1, 2015.

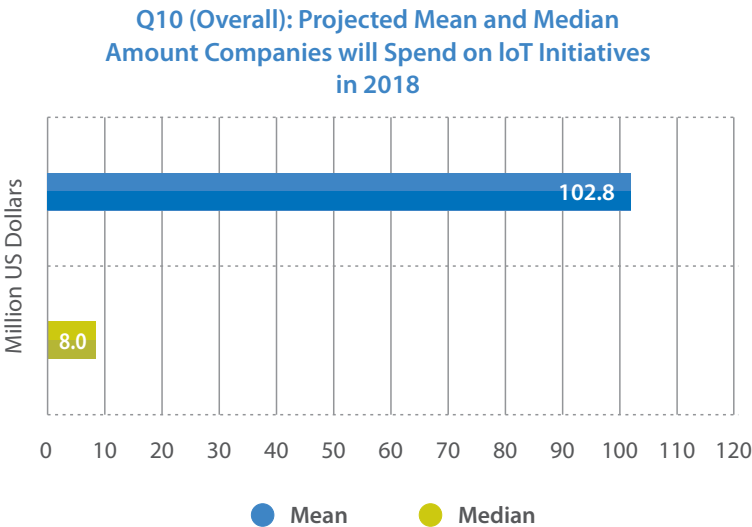
10 Brooks Barnes, "A Billion-Dollar Bracelet Is the Key to a Disney Park," The New York Times, April 1, 2014. <http://www.nytimes.com/2014/04/02/business/billion-dollar-bracelet-is-key-to-magical-kingdom.html>

11 From a DisneyWorld webpage, <https://disneyworld.disney.go.com/plan/my-disney-experience/vacation-packages/>. Accessed May 1, 2015.





The next few years will see greater spending, with the largest IoT commitments coming from a range of industries. By 2018, companies in this study project spending an average of \$102.8 million on IoT initiatives (Exhibit II-7).



**Exhibit II-7: Projected 2018 IoT Spend**

That represents a strong 20% rise in three years, but some leading firms are investing much more than the average. Twenty-six respondents (3.3% of the total) said their companies would spend \$1 billion or more each on IoT initiatives this year. The billion-dollar group includes 14 firms based in the United States. And they come from seven industries: banking and financial services; automotive; travel, hospitality, and transportation; high tech; insurance; telecommunications; retail; and healthcare and life sciences.

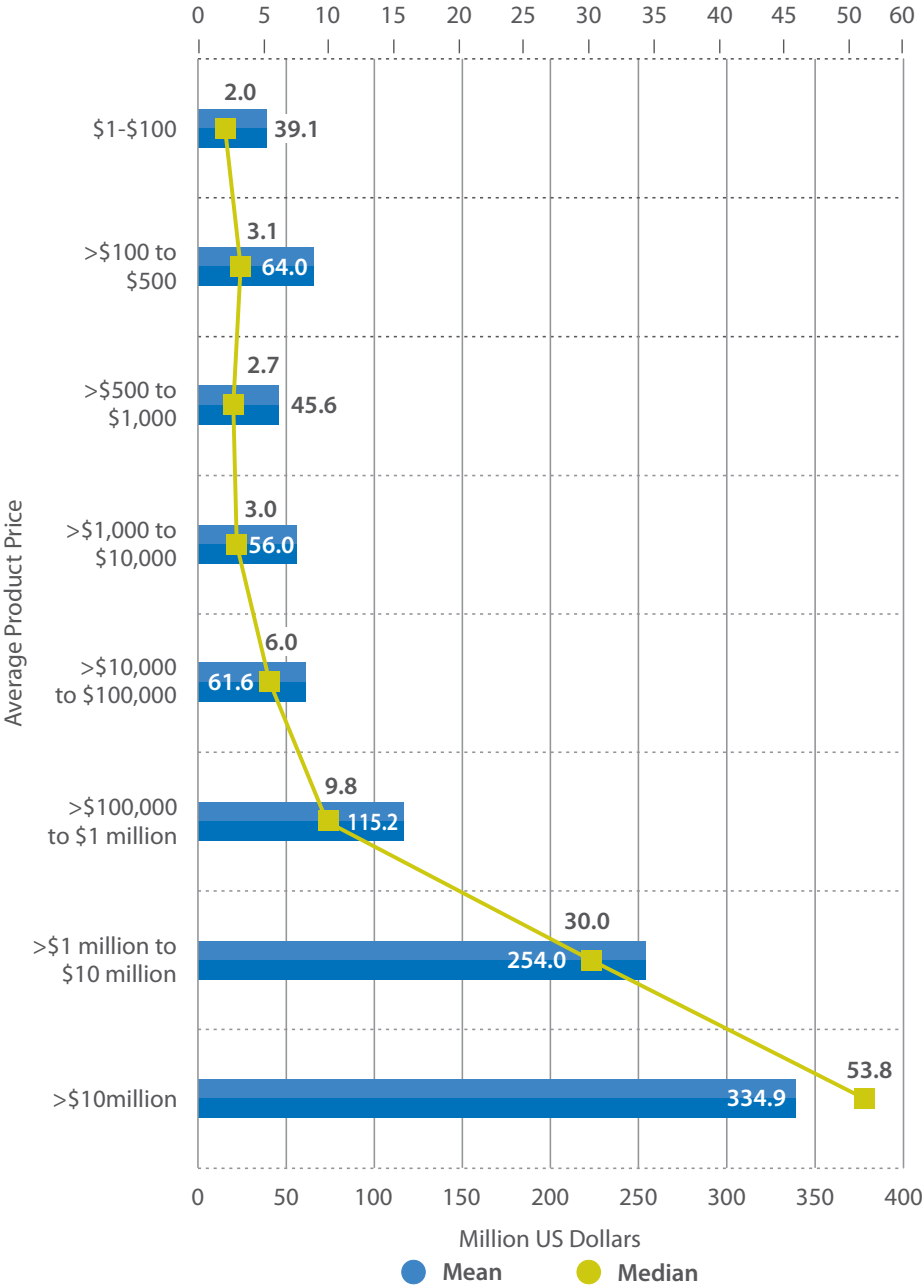
As a rule, our study found that the higher the company revenue, the more it is spending on IoT initiatives in 2015 (Exhibit II-8). For companies with revenues of more than \$50 billion, average IoT spend per company will be \$268.5 million – more than twice what companies with revenues between \$30 billion and \$50 billion will spend this year (\$121.2 million), and more than five times what companies with revenues between \$1 billion and \$5 billion plan to invest (\$49.4 million).

In 2018, respondents in each of these revenue groups said their spending would rise further. Firms with more than \$50 billion in revenues plan to spend on average \$306 million on IoT programs; planned spending is \$110.6 million for firms between \$10 billion and \$30 billion, and \$60.4 million for firms between \$1 billion and \$5 billion.



The price of products correlates similarly. The higher a company's average product price, the more it is investing and plans to invest in IoT initiatives. In 2015, companies with products priced at more than \$10 million (such as aircraft engines, airplanes, power generation turbines, trains, ships and other large capital-intensive products) plan to spend an average of \$334.9 million on IoT initiatives. Companies whose products' average price is less than \$100 (such as most grocery store items) plan to spend an eighth of that: \$39.1 million (Exhibit II-9).

**Q9 (Price Ranges): Mean and Median Amount Companies will Spend on IoT in 2015 (by Price of Products)**

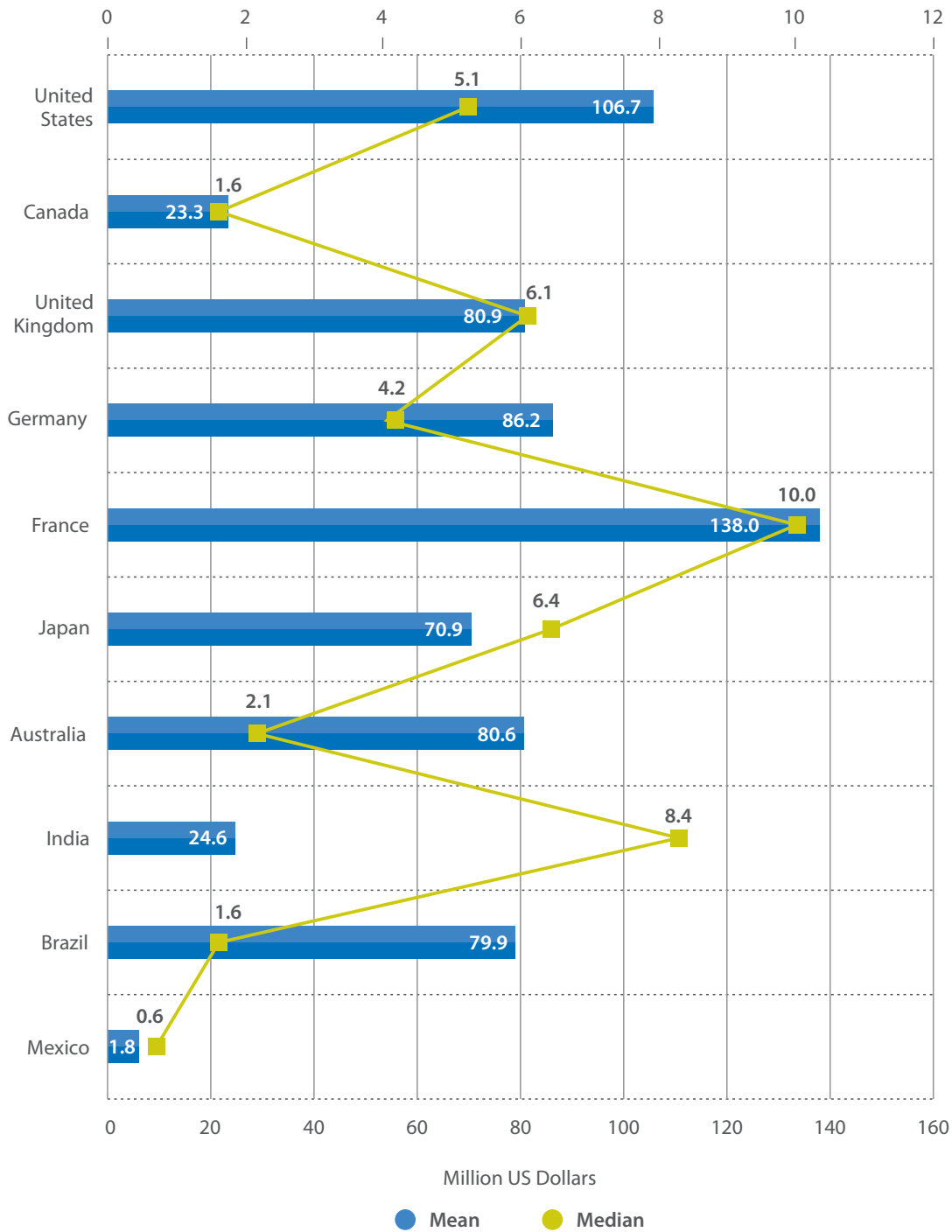


**Exhibit II-9: 2015 IoT Spend by Average Price of a Company's Products**





**Q9 (Countries): Mean and Median Amount Companies  
will Spend on IoT Initiatives in 2015**



**Exhibit II-11: 2015 Per Company IoT Spend by Country**



North American firms will spend 0.45% of their revenue this year, on average, on IoT initiatives, a higher commitment than other regions. More about each region's 2015 IoT investments:

- European firms on average are spending \$93.9 million (or 0.40% of average revenue). French firms lead the group (\$138 million on average), ahead of Germany (\$86.2 million) and the UK (\$80.9 million).
- Asia-Pacific companies on average are spending \$63.1 million (or 0.34% of average revenue). Australian firms top the group (\$80.6 million on average), followed by Japan (\$70.9 million) and India (\$24.6 million).
- Latin American enterprises are investing an average \$54.7 million (or 0.23% of average revenue). Brazilian companies lead this charge with a \$79 million average investment. Mexican companies have just begun their efforts, investing \$1.8 million on average.

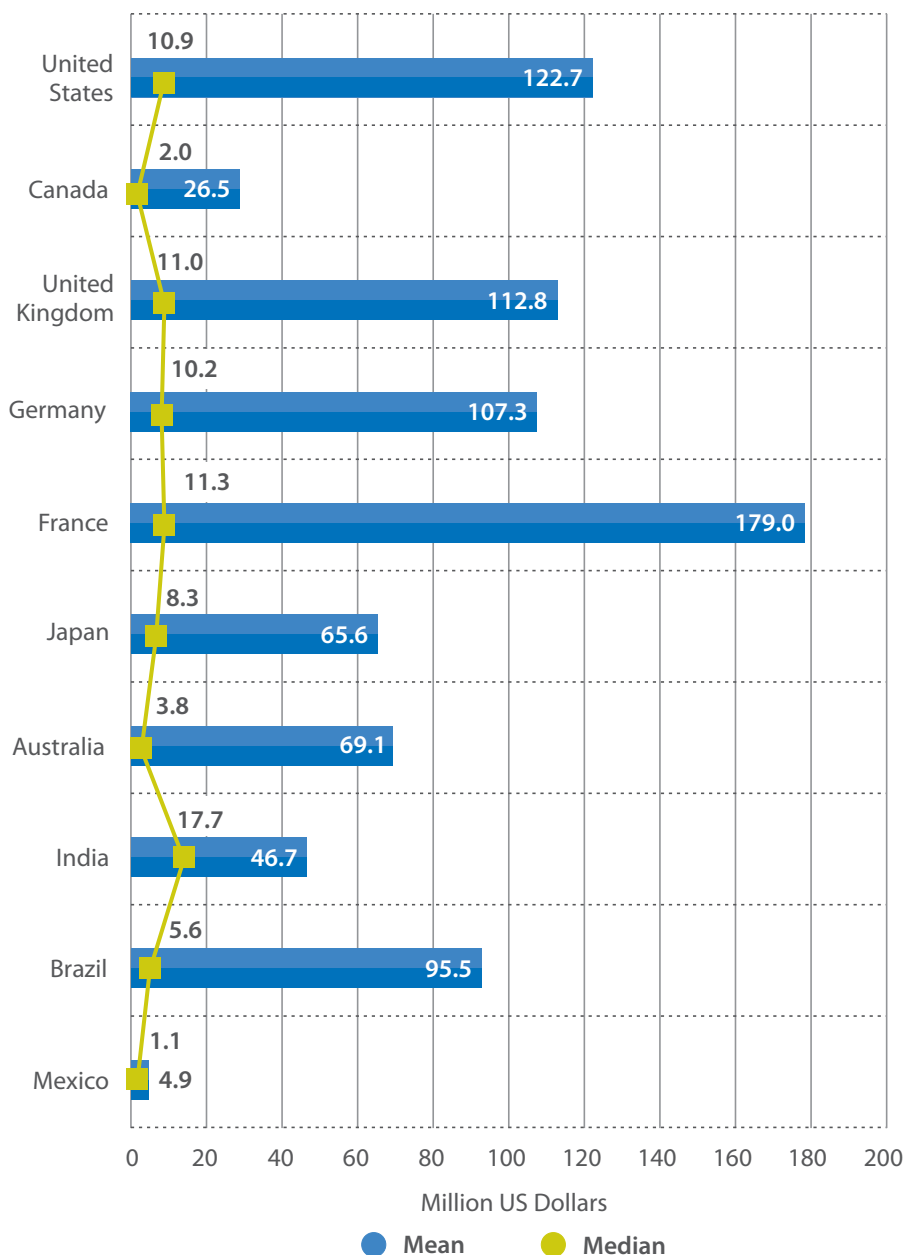
Across the world, respondents said that they will spend 20% more on average in 2018 (\$102.8 million) compared with 2015 on IoT projects (Exhibit II-12). European companies indicate more robust commitments to increased spending than those in other regions of the world, with plans to ramp up investments by 32.4% to \$124.4 million. British firms lead the way, with respondents reporting they plan to spend 38% more (\$112.8 million) in 2018, followed by companies in France (\$179 million, a 30% increase from 2015) and Germany (\$107.3 million, a 25% rise).

Latin American firms plan to spend 22% more in 2018 (\$67 million) than this year. Mexican companies, starting from a relatively small base, expect to increase spending 2.7 times, to \$4.9 million. Brazilian firms plan to spend \$95.6 million (a 21% increase) on their IoT programs.

In North America, companies plan to increase their 2015 spend by 14.8%, to \$108.9 million in 2018. The percentage increase is consistent across U.S. firms (\$122.7 million) and Canadian companies (\$26.5 million).

In the Asia-Pacific region, average spend on IoT initiatives will remain flat between now and 2018, at \$62.2 million. Within the region, Indian companies plan to almost double their investments (to \$46.7 million on average), while firms in Australia (\$69.1 million) and Japan (\$65.6 million) expect to slow their average spend rates.

#### Q10 (Countries): Mean and Median Amount Companies will Spend on IoT Initiatives in 2018



**Exhibit II-12: Projected 2018 IoT Spend Per Company by Country**



Customer monitoring (through the use of mobile devices and apps, for example) represents 26.6% of IoT investments in 2015, followed by supply chain monitoring (23.2%) and premises monitoring (19%).

To get a sense of these initiatives in action, consider these examples:

*Product monitoring:* Banks that provide car loans are using GPS devices installed in cars to identify locations and repossess cars if customers miss a payment. Some lenders include technology that can prevent the car from starting. These moves reduce the cost of repossession and lower lending risks.<sup>13</sup>

*Customer monitoring:* Coca-Cola Enterprises has tested Apple's iBeacon low-cost transmitter technology to send a marketing message to a consumer's iPhone when the user nears a relevant location inside a store.<sup>14</sup> The test: whether such promotions can help the company's products stand out in a crowded aisle.

*Premises monitoring:* McDonald's analyzes footage from video cameras along with point-of-sale data and audio recordings to analyze the performance of drive-through windows at some franchises.<sup>15</sup> The goal is to root out errors while accelerating service.

The data in Exhibit II-13 shows that more than three-quarters of IoT spend is going toward tracking customers – either via customer mobile apps or wearable devices, via products in use, or via sensors in places where companies do business (such as retail stores, bank branches and hotels). Companies in our study devote only one-quarter of their investments to monitoring their production facilities and factories, distribution assets and warehouses and pallets with RFID chips on trains, boats, trucks and other means of distribution.

This emphasis on product monitoring, followed by monitoring customers and premises holds up across all regions of the world, except in Latin America, where companies are spending more on customer monitoring than on product monitoring (Exhibit II-14).

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13 Jonathan Welsh, "Late on a Car Loan? Meet the Disabler," *The Wall Street Journal*, Mar. 25, 2009. <http://www.wsj.com/articles/SB123794137545832713>

14 Jessica Davies, "Coca-Cola explores iBeacons as marketing tool for World Cup sponsorship," *The Drum*, Jan. 13, 2014. <http://www.thedrum.com/news/2014/01/13/coca-cola-explores-ibeacons-marketing-tool-world-cup-sponsorship>

15 Ellis Booker, "McDonald's Moves to Franchise-Level Analytics to Elevate Performance," *Data Informed*, August 29, 2013, <http://data-informed.com/mcdonalds-moves-franchise-level-analytics-elevate-performance/>

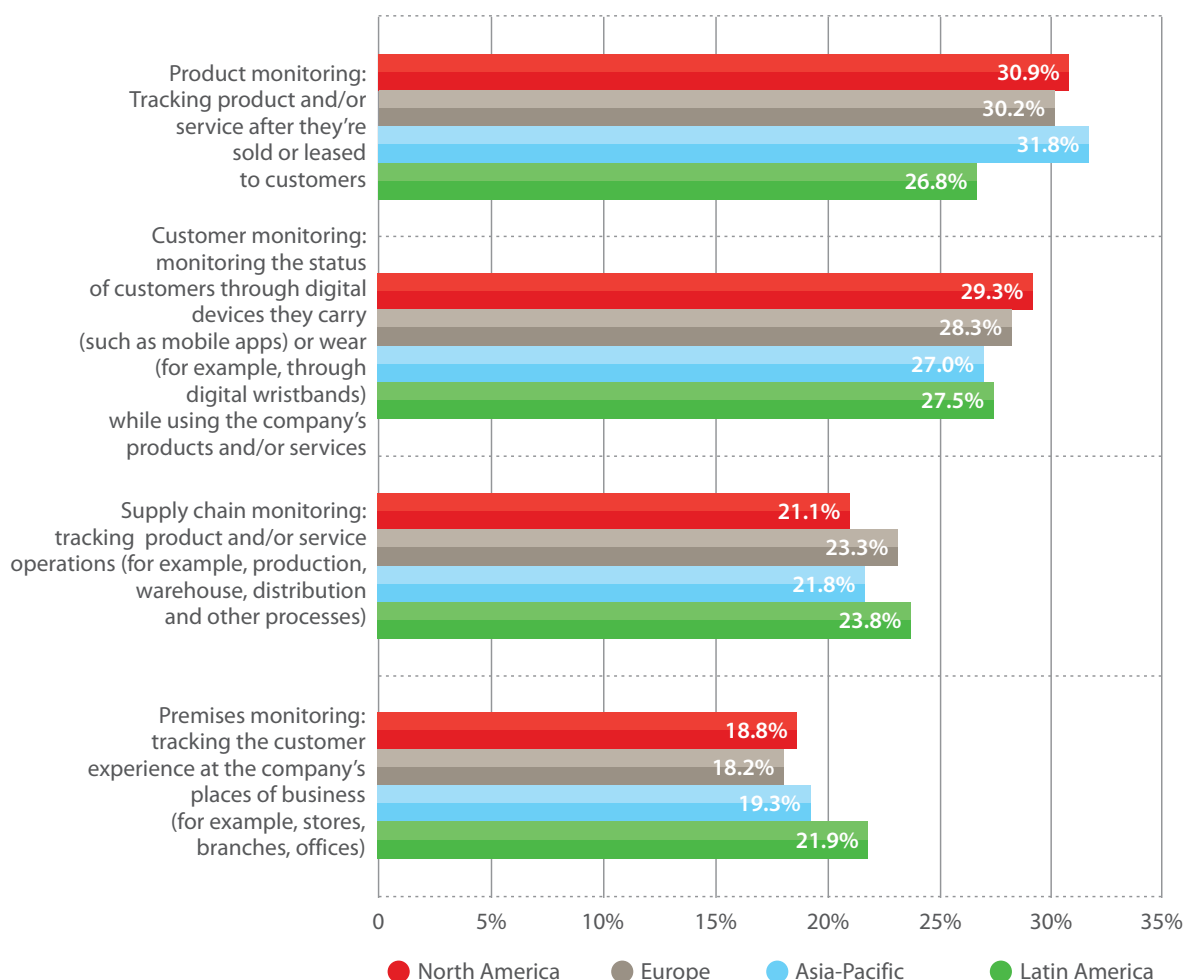




When asked about plans for IoT initiatives in 2020, companies by and large stayed on similar paths. Product monitoring remains the top priority, with customer monitoring rising slightly to become a close second (29.2% projected in 2020, up from 26.6% today).

Regionally, the companies we studied plan to retain similar investment proportions for their IoT initiatives in 2020 compared with today. Companies in North America and Asia-Pacific will place strong emphasis on product monitoring initiatives in 2020, as they do in 2015 (Exhibit II-15). North American firms also plan to devote relatively fewer resources than the other regions to premises monitoring (but only slightly less than European companies).

**Q11A (Regions): 2018 Projected Budget for IoT Initiatives by Core IoT Business Area**



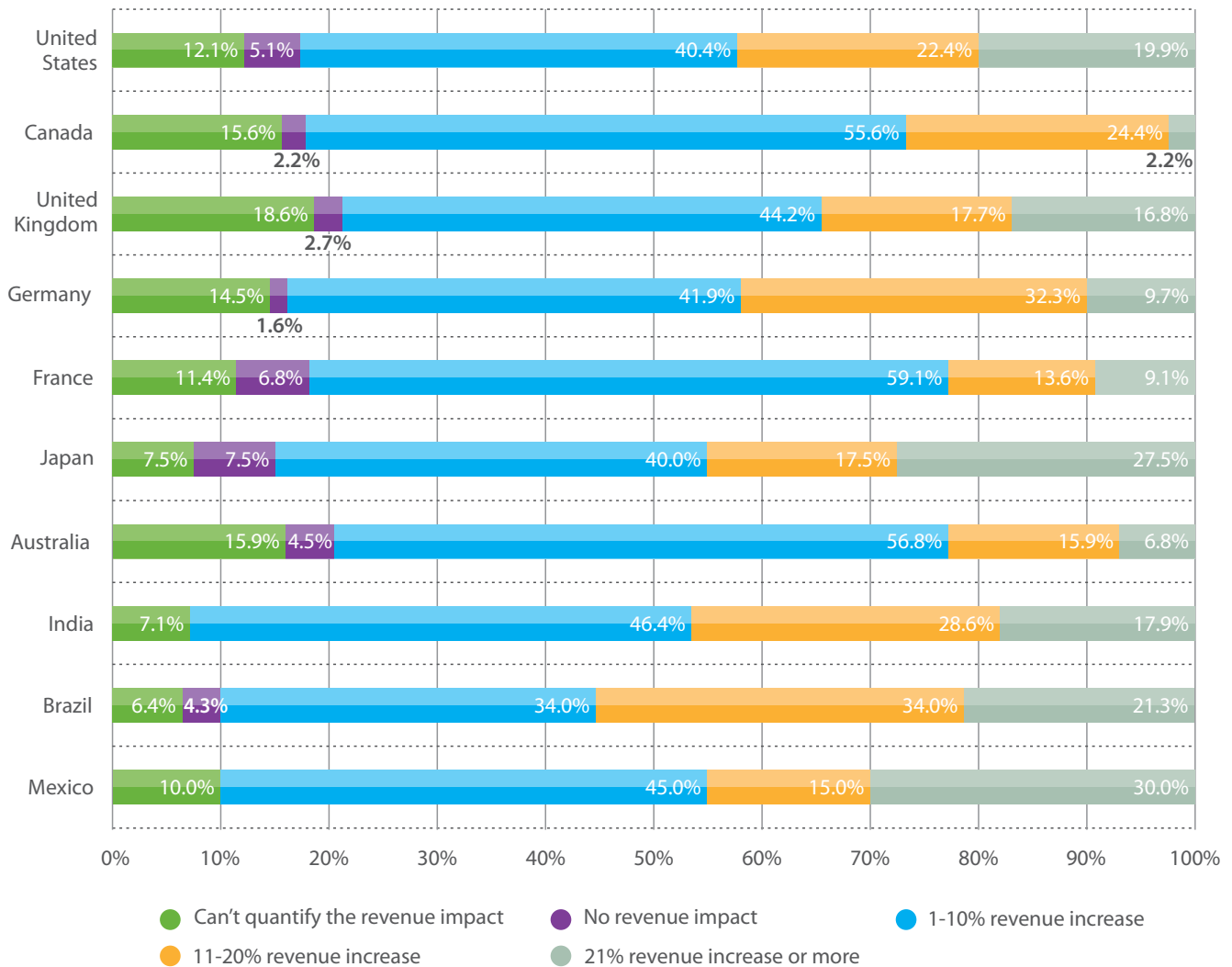
**Exhibit II-15: IoT Spend by Region on Four Core IoT Business Areas**



Asked to project the impact of their IoT initiatives on revenue between 2015 and 2018, respondents anticipate a 16.3% increase (Exhibit II-16). The outlook is slightly higher in North America (companies expect to see 18.1% in revenue gains, on average), Asia-Pacific (17.9%) and Latin America (17.8%). European firms say they expect less than the average, but companies there still expect a double-digit revenue increase (12.6%).

The business benefits associated with expected revenue increases vary by region—but the top benefits center around a better understanding of customers and improved customer service. Asked to identify the greatest impact of their IoT initiatives in 2020, North American and Latin American companies cited “greater insights for our salespeople on key aspects of our products, such as how our customers use our products or services.” European firm respondents identified “more tailored products and services” designed to better meet customer needs. Those based in Asia-Pacific said the ability to reduce sales costs through automated reordering would have the greatest impact.

**Q12B (Countries): Average Per-Company Revenue Impact of IoT Initiatives (2014 vs. 2013)**

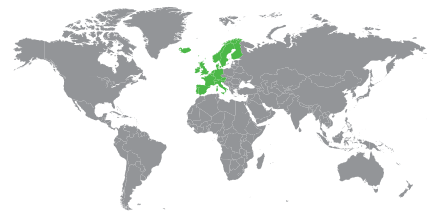


**Exhibit II-16: Revenue Impact of IoT Initiatives in the Business Area in which these were deployed**

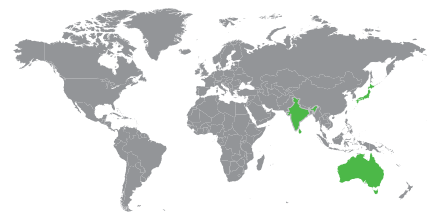




Europe: 5 Biggest Impacts of IoT Initiatives to Date	
1 (tied)	<ul style="list-style-type: none"> <li>More proactive service: identifying product problems before customers are even aware of them</li> <li>More tailored products and/or services</li> <li>Better service because of more informed service reps (they can view data on how customers are using the products)</li> </ul>
2	<ul style="list-style-type: none"> <li>More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)</li> </ul>
3	<ul style="list-style-type: none"> <li>More tailored marketing and/or marketing campaigns</li> </ul>
4 (tied)	<ul style="list-style-type: none"> <li>Insights on new product testing for R&amp;D</li> <li>Lower field service costs through remote diagnosis of product problems (and, therefore, lower number of technician dispatches into the field)</li> </ul>
5	<ul style="list-style-type: none"> <li>Improvement in existing products through a much better understanding of what features and/or functions customers are using or not using</li> </ul>



Asia-Pacific: 5 Biggest Impacts of IoT Initiatives to Date	
1	<ul style="list-style-type: none"> <li>Better service because of more informed service reps (they can view data on how customers are using the products)</li> </ul>
2 (tied)	<ul style="list-style-type: none"> <li>More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)</li> <li>More profitable product pricing</li> </ul>
3	<ul style="list-style-type: none"> <li>More tailored products and/or services</li> </ul>
4	<ul style="list-style-type: none"> <li>More proactive service: identifying product problems before customers are even aware of them</li> </ul>
5	<ul style="list-style-type: none"> <li>Greater insights for salespeople on key aspects of company products (for example, product features that customers use the most)</li> </ul>



Latin America: 5 Biggest Impacts of IoT Initiatives to Date	
1	<ul style="list-style-type: none"> <li>Making updates to products through software</li> </ul>
2	<ul style="list-style-type: none"> <li>Better service because of more informed service reps (they can view data on how customers are using the products)</li> </ul>
3	<ul style="list-style-type: none"> <li>More proactive service: identifying product problems before customers are even aware of them</li> </ul>
4 (tied)	<ul style="list-style-type: none"> <li>More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)</li> <li>More tailored products and/or services</li> </ul>
5	<ul style="list-style-type: none"> <li>Lower field-service costs through remote diagnosis of product problems (and, therefore, lower number of technician dispatches into the field)</li> </ul>



**Exhibit II-17: Biggest Impacts of IoT Initiatives to Date**

Asked to consider the future impacts of their IoT initiatives, executives hope the technologies and data they generate can provide growth opportunities by 2020. Globally, more precise customer segmentation information (for example, from insights on how customers use a company's products and services) was the biggest projected impact of IoT initiatives. Respondents cited programs that give salespeople greater insights on what aspects of products customers use the most, and those that identify more tailored products and services the company can offer.

Also included in the top five are two impacts related to customer service. One – reducing the cost of sales through automated reordering for customers – calls to mind products that turn into subscription services, such as HP's Instant Ink program<sup>17</sup> that senses when a customer's printer needs ink and triggers a delivery. Respondents also identified better customer service as an initiative with impact, because service representatives can view data on how customers are using products and respond.

## Regional Differences in Companies' Outlook

Examining the top three choices for each region in our study shows that companies around the world share a view that their IoT programs will strengthen their marketing and customerservice functions by 2020 (Exhibit II-18).

Companies in North America and Latin America cited the same top pair of initiatives that would have the greatest impact by 2020. First on these respondents' list: initiatives that give salespeople insights on key aspects of products that customers use most. Programs that provide more precise customer segmentation capabilities was the program named second in both regions.

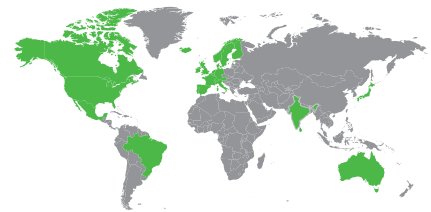
Asia-Pacific companies projected automated reordering (as in the ink refill example) to generate the greatest impact for their firms by 2020. Companies in this region also believe the ability to offer more tailored products and services would be important. Notably, companies in this region gave a top-three ranking to "making products facing obsolescence more attractive to customers" to help customers know when their products need maintenance (and to extend the product's life).

European firms projected that by 2020, IoT initiatives' greatest impact would be on customized products and more precise customer segmentation. They said that reducing the cost of sales through automated reordering would have the third-highest impact (a view shared by respondents in North America).

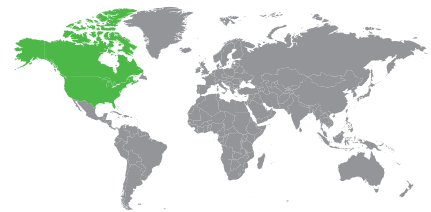
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<sup>17</sup> HP Instant Ink press kit, March 11, 2014, <http://www8.hp.com/us/en/hp-news/press-kit.html?id=1489337>

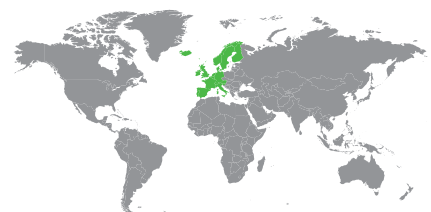
Globally: 5 Biggest Impacts of IoT Initiatives by 2020	
1	▪ More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)
2	▪ Greater insights for salespeople on key aspects of company products (for example, product features) that customers use the most
3	▪ More tailored products and/or services
4	▪ Reduction in cost of sales through automated reordering for customers
5	▪ Better service because of more informed service reps (they can view data on how customers are using the products)

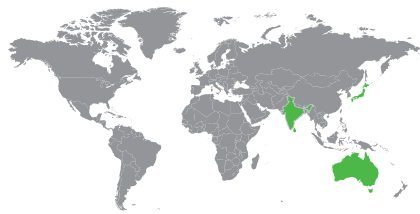


North America: 5 Biggest Impacts of IoT Initiatives by 2020	
1	▪ Greater insights for salespeople on key aspects of company products (for example, product features) that customers use the most
2	▪ More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)
3	▪ Reduction in cost of sales through automated reordering for customers
4	▪ More tailored products and/or services
5	▪ Better service because of more informed service reps (they can view data on how customers are using the products)



Europe: 5 Biggest Impacts of IoT Initiatives by 2020	
1	▪ More tailored products and/or services
2	▪ More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)
3	▪ Reduction in cost of sales through automated reordering for customers
4	▪ Greater insights for salespeople on key aspects of company products (for example, product features) that customers use the most
5	▪ Better service because of more informed service reps (they can view data on how customers are using the products)





## Asia-Pacific: 5 Biggest Impacts of IoT Initiatives by 2020

1	▪ Reduction in cost of sales through automated reordering for customer
2	▪ More tailored products and/or services
3	▪ Improved user experience by making near-obsolescence products more attractive to customers (for example, by monitoring such a product and preempting its breakdown before the customer realizes)
4	▪ More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)
5	▪ Greater insights for salespeople on key aspects of company products (for example, product features that customers use the most)



## Latin America: 5 Biggest Impacts of IoT Initiatives by 2020

1	<ul style="list-style-type: none"> <li>▪ Greater insights for salespeople on key aspects of company products (for example, product features that customers use the most)</li> </ul>
2	<ul style="list-style-type: none"> <li>▪ More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)</li> </ul>
3	<ul style="list-style-type: none"> <li>▪ More tailored products and/or services</li> </ul>
4	<ul style="list-style-type: none"> <li>▪ Reduction in cost of sales through automated reordering for customers</li> </ul>
5 (tied)	<ul style="list-style-type: none"> <li>▪ Improved user experience by making near-obsolescence products more attractive to customers (for example, by monitoring such a product and preempting its breakdown before the customer realizes)</li> <li>▪ Better service because of more informed service reps (they can view data on how customers are using products)</li> </ul>

### Exhibit II-18 Projected Impacts of IoT Initiatives by 2020



## How the Internet of Things Changes Business Models

The Internet of Things is already creating new business models (think of a consumer's remote ordering of detergent with the Amazon Dash Button, and aircraft engines that send alerts when maintenance is due). Our study asked executives to indicate which of four possible changes in their companies' business models had been made *to date* as a result of their IoT initiatives, and which *they expect will occur by the year 2020*:

1. Much greater leasing of products (not just selling them outright – that is, shifting to 'product-as-a-service' model)
2. Increasing service business (support and repair) because product usage by customers can now be monitored
3. Making money from customer product usage data (for example, selling it to third parties)
4. Bypassing entities in the distribution channel and resupplying end customers directly



Although these percentages appear small, note that the vast majority of companies – 84% – have already made business model changes to date because of the Internet of Things. Only 16% said they have made no such changes to date.

From a regional perspective, Asia-Pacific companies are leading the way in using the IoT to increase their service businesses, with 55% reporting having made this business model change (vs. 36% in North America) (Exhibit II-20). Asia-Pacific companies also are more likely to be using the IoT to automatically resupply end customers (26% said they have made this change) compared with 20% of North American and 22% of European companies.

A higher percentage (31%) of European companies – oddly enough, despite stringent European data privacy laws – make money from customer usage data. Only 25% of North American companies do so.

Latin American companies are changing their business models to increase leasing of products more than the other three regions. Today, 24% do so, compared with only 11% of European and 14% of North American companies.



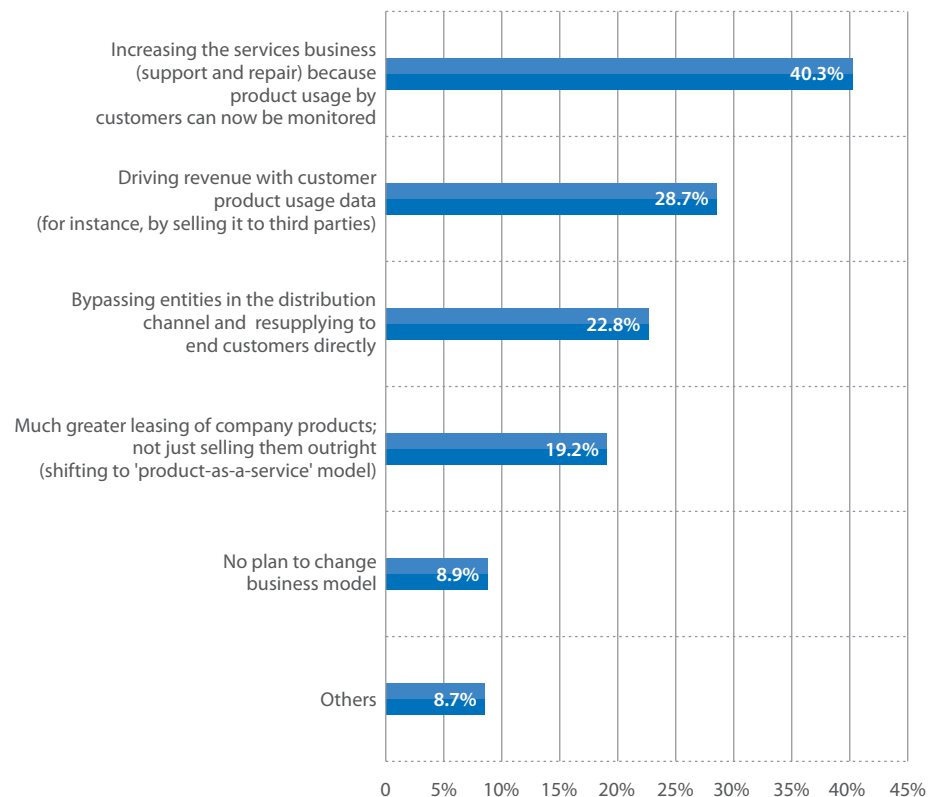


## Anticipated Business Model Changes

We asked respondents to predict what business model changes their companies would make by the year 2020 because of the Internet of Things (Exhibit II-21). Noteworthy predicted changes, overall and by region, include:

- More respondents said they expect their companies to lease their products even more (19% by 2020 vs. 15% today)
- Similar percentages of respondents throughout the four regions of the world see business model changes for increasing their service business (close to 40% across the board) and monetizing customer data (around 30%, though 36% of Latin American firms anticipate doing this) (Exhibit II-22)
- Only 29% of companies expect to be selling customer product usage data by 2020. (Perhaps they are concerned about data privacy issues and alienating consumers).
- Companies appear to be hesitant to change their relationships with middlemen such as retailers and wholesalers. Respondents who said they expect to bypass middlemen through automated product resupply increased only slightly from today (21%) to predicted levels by 2020 (23%)
- The number of executives who said they would not make any business model changes because of the Internet of Things drops significantly by 2020, to 9% of respondents vs. 16% today

**Q16 (Overall): Projected Business Model Changes because of the IoT by 2020**



**Exhibit II-21: Projected Business Model Changes by the End of the Decade**



## Key Success Factors with the Internet of Things

As part of our study, we asked respondents to rate keys to IoT project success, using 21 factors in eight categories: strategy, business process, customer, organizational, skills, distribution channels, information technology, and culture. Respondents were asked to rate the factors on a 1–5 scale (1 signifies no importance, 3 is moderately important and 5 is a factor of very high importance) (Exhibit II-23).

Executives identified strategic and company culture factors as the most important IoT success factors. Strategic factors cited as important:

- Identifying and pursuing new business and revenue opportunities made possible by the Internet of Things. The technology is complex and so are the opportunities. Sorting them out is crucial.
- Figuring out exactly what data to capture. How do you avoid drinking from a fire-hose of both important and marginally important data?

Cultural factors include:

- Changing mindsets at all company levels – from top to bottom – about how customers can be served. What products can an IoT initiative (for example, designing products for remote software fixes) help repair? What products should be developed to take advantage of this mechanism?
- Getting top management to believe and invest aggressively in the IoT.
- Accelerating the pace at which decisions are made in a company, given that unprecedented amounts of data about products in the field will come flooding in. Examples include making product recall decisions earlier, alerting customers more quickly to product problems, and developing new service offerings.

Respondents also cited the ability to conquer technology challenges involved in implementing IoT efforts, such as:

- Being able to gather, process, and analyze huge amounts of digital data. For example, according to software firm SAS Institute Inc., an auto insurance company that insures 100,000 cars through usage-based insurance has to gather more than 1 terabyte of data every year.<sup>18</sup>
- Determining which IoT technologies to develop internally vs. externally. Technology experts describe a lack of standards in the field, including foundation-setting issues such as common definitions for IoT technologies, architecture and reference models, application standards, device interoperability, and security and privacy issues.<sup>19</sup>
- Integrating IoT data with enterprise systems. Companies must plan for the collection and processing of large amounts of data and for network transmission challenges. This takes proper planning and engineering of IT infrastructure, including accounting for how many sensors may be in a certain location and regulating network access to ensure adequate performance.
- Getting IoT technologies to work in the field, reliably and securely.

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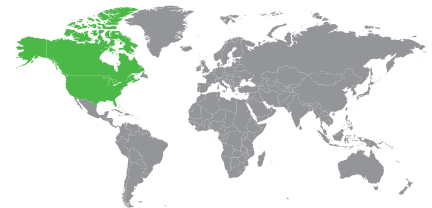
18 As mentioned in a March 2015 study by the National Association of Insurance Commissioners and the Center for Insurance Policy and Research, “Usage-Based Insurance and Vehicle Telematics: Insurance Market and Regulatory Implications,” p. 8. [http://www.naic.org/documents/cipr\\_study\\_150324\\_usage\\_based\\_insurance\\_and\\_vehicle\\_telematics\\_study\\_series.pdf](http://www.naic.org/documents/cipr_study_150324_usage_based_insurance_and_vehicle_telematics_study_series.pdf)

19 The Institute of Electrical and Electronics Engineers, Inc., “IEEE Standards Association Internet of Things Ecosystem Study,” January 2015.



This is not surprising, as media reports have trumpeted a shortage of dataanalysis experts since the advent of the 'Big Data' trend – and experts see the IoT producing orders of magnitude of more data than, say, social-media streams. Universities in the U.S., India, and other countries have established programs to answer this call.

Q17 (North America): 5 Most Important Success Factors for IoT Initiatives		
Rank	Success Factor and Rating	Category
1	Identifying and pursuing new business and revenue opportunities (3.65)	Strategic
2	Determining what data to capture from the IoT (3.55)	Strategic
3	Getting managers and staff to change the way they think about customers, products, and processes for serving those customers (3.52)	Company Culture
4	Being able to gather, process, and analyze huge amounts of digital data and/or Big Data (3.50)	Technology
5	Having skilled business analysts who understand what IoT data is revealing about products in the field, the factory, the supply chain, and so on (3.49)	Skills



**Exhibit II-24: Success Factors for North American Companies**

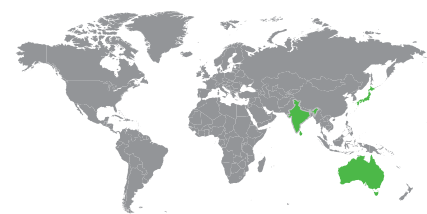




While respondents in other regions highlighted strategy and culture as top issues, executives in the Asia-Pacific region worry most about who is going to make their IoT initiatives work properly and profitably. The No. 1 success factor they cite is having skilled technologists who can develop or integrate IoT technologies into specific products and processes.

Just as important in their view: having skilled business analysts who can interpret IoT data for business decision-makers. Asia-Pacific respondents are also the only ones who put “determining what technologies to develop internally or externally” in their top five factors(Exhibit II-26).

Q17 (Asia-Pacific): 5 Most Important Success Factors for IoT Initiatives		
Rank	Success Factor and Rating	Category
1	Having skilled technologists who know how to develop or integrate IoT technologies into products and processes (3.58)	Skills
2	Having skilled business analysts who understand what IoT data is revealing about products in the field, the factory, the supply chain, and so on (3.57)	Skills
3	Getting managers and staff to change the way they think about customers, products, and processes for serving those customers (3.56)	Company Culture
4	Having top management that believes the IoT could have a major impact on business and is willing to invest in it today (3.53)	Company Culture
5	Determining what technologies to develop internally or externally (3.52)	Technology



**Exhibit II-26: Success Factors for Asia-Pacific Companies**

A world map with a grayscale background. The continents are outlined in a light gray. The country of Brazil in South America is highlighted in a solid green color, indicating the location of the study area.

# Section III

## Adoption of the Internet of Things in 13 Global Industries









## Spend by Core Business Area

We saw other noteworthy differences (see Exhibit III-2) in the proportion of 2015 IoT investments by industry in the four core business areas:



- **Supply chain monitoring:** CPG (30.1%), energy (28.0%) and automotive companies (27.9%) are allocating the most here.



- **Premises monitoring:** Travel-related companies have the largest portion of IoT spend here, at 22.3%, with financial institutions (21.7%), retail (21.4%) and health care (21.1%) close behind.



- **Product monitoring:** Industrial manufacturers (40.4%) are way out in front on this metric, with media and entertainment companies next (at 34.8% of IoT budget)



- **Customer monitoring:** Insurance companies will spend a larger percentage of their IoT budgets here than any other industry (34.7%).

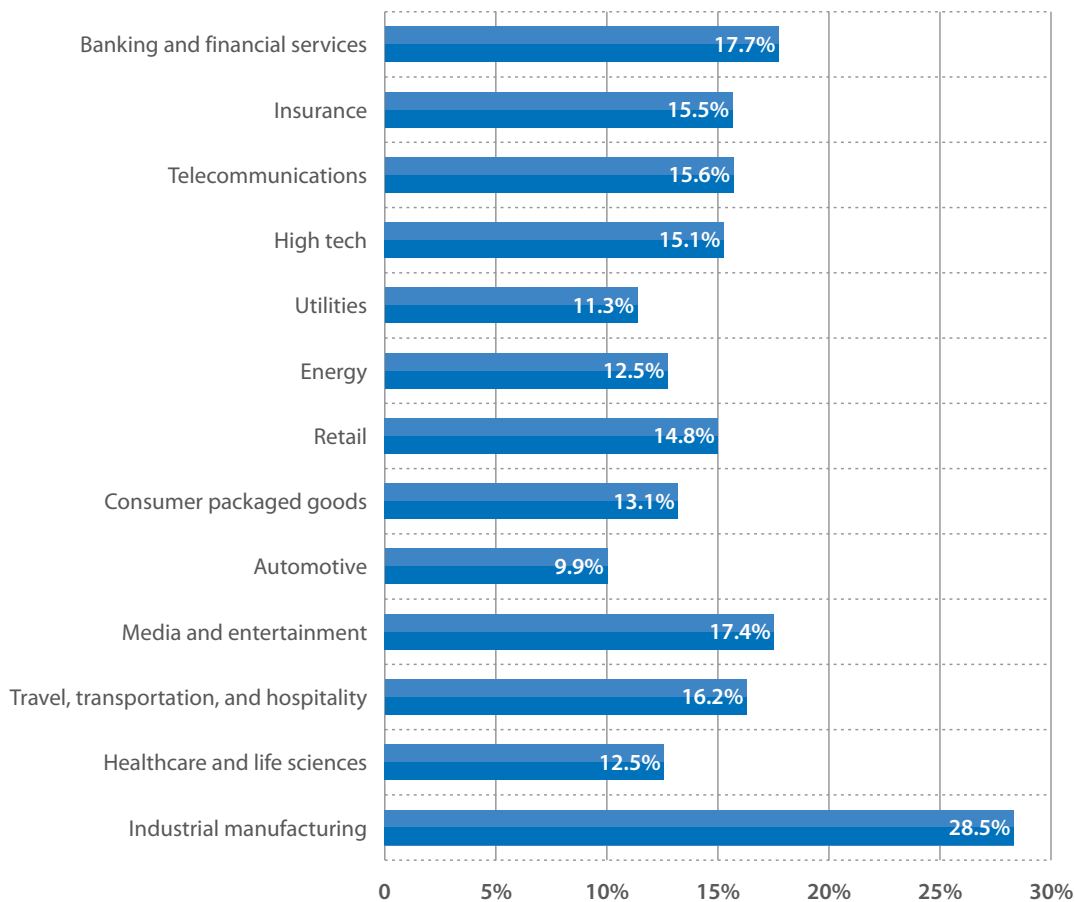




## In Generating Revenue from the IoT, Industrial Manufacturers Have the Most to Brag

In terms of how much their IoT initiatives increased revenue in 2014 (over 2013) in the part of the business where the initiative focused (whether a product line, business unit and/or division or other organizational unit), one industry stood above all others: industrial manufacturing. Companies in this sector reported an average 28.5% revenue increase from IoT. Second was financial services (17.7%) and third was media and entertainment (17.4%). The auto industry had the lowest revenue gain: a still-impressive 9.9% increase. (See Exhibit III-3.)

**Q12B (Industries): Revenue Impact of IoT Initiatives (2014 vs. 2013)**



**Exhibit III-3: Industrial Manufacturers Had the Greatest Revenue Boost from IoT**



Now let's look at each of the 13 industries whose companies provided data on their IoT initiatives, today and over the next five years.



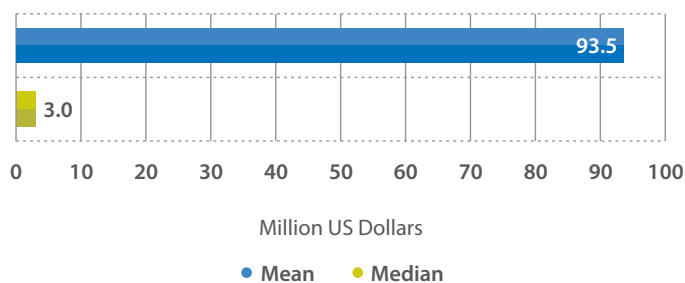
### Automotive: Rapidly Motoring Down the IoT Highway

Peek inside a Tesla automobile and one of the first things you notice is the huge display on the dashboard: It's like having a full-size iPad display in your car. That's just the start of how electric carmaker Tesla is disrupting the automotive industry. It's rolling out ideas like using software downloads to upgrade the features of its automobiles, including the ability for its cars to drive themselves. In fact, Tesla has been updating vehicles through software downloads since 2012.<sup>20</sup>

That move, possible only in a world where products such as wearable devices or cars can download updates wherever those products are located (albeit within range of wireless connections), is beginning to change the industry's longtime rules on car model years. Tesla has learned from the agility of software companies. "We really designed the Model S to be a very sophisticated computer on wheels," Tesla's CEO, Elon Musk, told the press in March.<sup>21</sup>

The automotive industry, challenged both by new entrants like Tesla and safety-related product recalls that have had huge business impact, needs all the data it can get to improve both its business model and its products. Collecting IoT data is not optional for these companies; the winners will be the companies that best capture, analyze and act on the data.

**Q9 (Automotive):**  
**2015 Spend on IoT Initiatives (Per Survey Respondent)**



#### *Exhibit III-5: What Auto Companies Will Spend on IoT This Year*

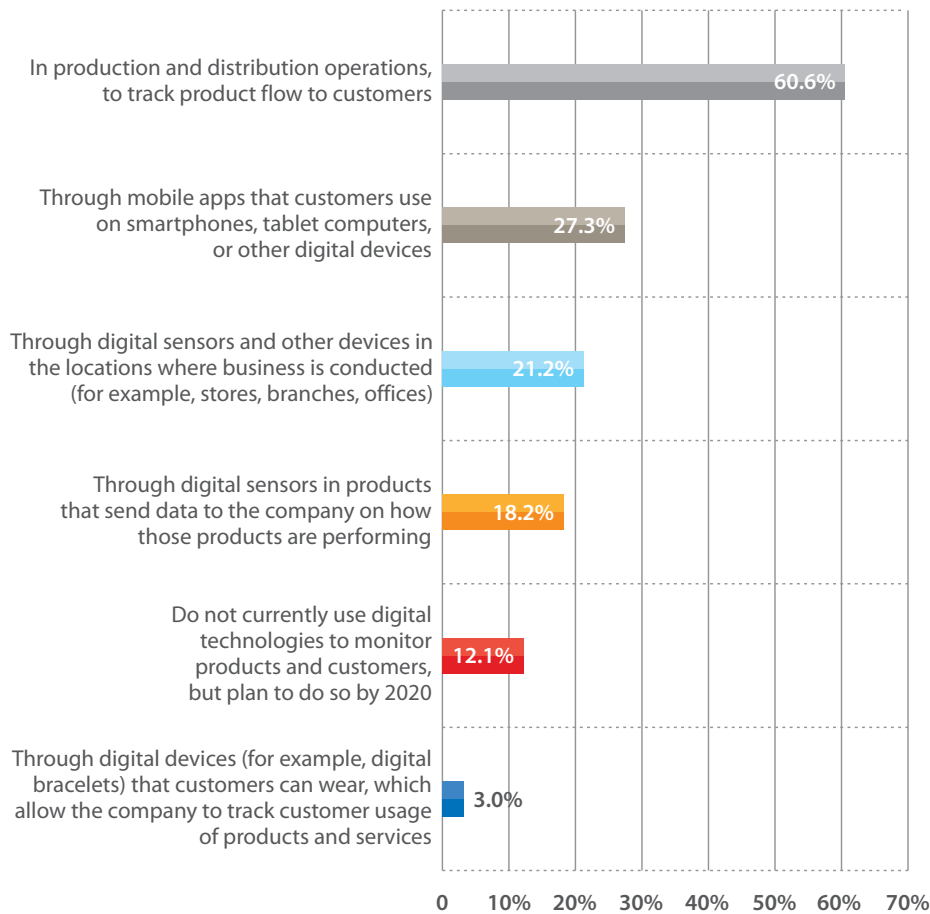
20 Jerry Hirsch, "Elon Musk: Model S is not a car but a 'sophisticated computer on wheel,'" The Los Angeles Times, Mar. 19, 2015, <http://www.latimes.com/business/autos/la-fi-hy-musk-computer-on-wheels-20150319-story.html>

21 Ibid



So exactly what are auto companies doing with their IoT technologies? Some 18.2% are already using digital sensors in products to gather data; 27.3% monitor customers via mobile apps, 21.2% monitor locations such as dealerships – and a whopping 60.6% monitor their supply chain. That last figure stands out among the 13 industry segments we examined. Supply chain efficiency has been a core issue in this industry for years. (See Exhibit III-8.)

### Q3 (Automotive): Ways in which Companies use IoT Technologies



**Exhibit III-8: How Auto Companies Use IoT to Monitor Products and/or Services**

Like media companies, automotive companies feel deluged by new types and streams of data. Researcher IHS Automotive, projects the number of 'connected cars' will explode from 23 million in 2014 to more than 150 million by 2020. These cars will generate truckloads of digital data, 11 petabytes globally by 2020.<sup>22</sup> As the head of General Motors' Chevrolet brand, Alan Batey, told a reporter in 2014, "People spend a lot of time in their car, so connecting their car to their life and making it seamless has got a lot of upside."<sup>23</sup>

Or as Daimler AG Chairman Dieter Zetsche put it: "The car is growing beyond its role as a mere means of transport and will ultimately become a mobile living space."<sup>24</sup>

According to the Center of Automotive Research, a typical car today has 60 microprocessors and 10 million lines of computer code just to manage electricity. Those 60 microprocessors are four times the number of 2005.<sup>25</sup> Adding sensors and other digital devices will mean that 20% of cars in 2018 will be able to diagnose and communicate their location, things around them, and their mechanical condition, according to Gartner.<sup>26</sup>

We see the automotive industry generating three major revenue streams from the IoT in the years ahead: infotainment, vehicle performance monitoring, and driver safety assistance. Increasingly, many of these features will be available (for a fee) through software downloads. Auto companies will be able to upgrade their customers' cars throughout the period in which they own or lease them. That may lead to dramatic changes to the product development process and give auto companies ways to profit from their installed base of customers before they tempt them with the next model change.

Amid all this change, automotive companies have not reaped huge revenue wins yet. Auto companies logged a 9.9% average revenue increase from their IoT initiatives in 2014 over 2013, and project another relatively modest increase of 12.3% between 2015 and 2018.

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22 Bryan Jonston, "152 Million Connected Cars in 2020 with \$14.5 Billion in Revs and VERY Big Data," Auto Connected Car News, April 8, 2014. <http://www.autoconnectedcar.com/2014/04/152-million-connected-cars-in-2020-with-14-5-billion-in-revs-very-big-data/>

23 Keith Naughton, "The race to market the connected car," Bloomberg, Jan. 10, 2014. <http://www.autonews.com/article/20140110/OEM06/301109910/the-race-to-market-the-connected-car>

24 From Daimler web page. <https://www.mercedes-benz.com/en/mercedes-benz/innovation/research-vehicle-f-015-luxury-in-motion/>

25 Center for Automotive Research, 2014 report, which can be found here: <http://www.autoalliance.org/auto-innovation/2014-car-report>

26 Ibid

## Business Improvements and Keys to Success: The Present and the Future

Of course, automakers are in the early years of the IoT journey. Today, the top business process improvement related to IoT that auto companies cite is more precise customer segmentation. Second, they point to more proactive service and identifying problems before customers do. Car companies must convince you you're a Tesla driver or a Mercedes driver before they ever have a chance to prove they're keeping your car healthy. (See Exhibit III-9.)

These companies also note the ability to funnel new insights from product testing to R&D. They need to, otherwise revolutionary ideas from the likes of Google, which sings the praises of self-driving cars, may leave them behind. As examples of improving existing products, GM has added 4G connectivity in cars. Ford is investigating how to connect consumer health devices such as heart rate monitors or glucose meters to its Ford Sync in-car software.<sup>27</sup> Looking ahead, automakers hope the top business process improvements that IoT efforts will produce by 2020 will be more tailored products and new insights for salespeople.

Q12 and Q13 (Automotive): Biggest Impacts of IoT Initiatives			
5 Top to Date		5 Top by 2020	
1	More tailored and/or precise customer segmentation (for example based on how customers use products and/or services)	1 (tied)	More tailored products and/or services Greater insights for salespeople on key aspects of company products (for example product features that customers use the most)
2	More proactive service: identifying product problems before customers are even aware of them	2	More tailored and/or precise customer segmentation (for example, based on how customers use our products and/or services)
3	Improvement in existing products through a much better understanding of what features or functions customers are using or not using	3	Lower production costs by reducing the need for human inspection of products and processes
4	Insights on new product testing for R&D	4	Better service because of more informed service reps (they can view data on how customers are using the product/service)
5	Better service because of more informed service reps (they can view data on how customers are using the product/service)	5	More proactive service: identifying product problems before customers are even aware of them

**Exhibit III-9: Product and Process Improvements from the IoT**

27 Rachel King, "Ford Grapples With Wearables And the Future of IoT," Wall Street Journal CIO Journal, March 31, 2015. <http://blogs.wsj.com/cio/2015/03/31/ford-grapples-with-wearables-and-the-future-of-iot/>



What are the key success factors for IoT projects in automotive companies? The most important factor these companies rated is identifying and pursuing new business and revenue opportunities. (See Exhibit III-10.)

The companies also note the importance of integrating IoT data into existing enterprise systems, such as ERP, CRM, and supply chain software. (These companies have some of the most expensive highest-profile enterprise IT software implementations, so this is not surprising.) It's also worth noting that automakers point to their ability to determine what technologies to develop internally or externally. As car companies become more and more like software companies, that is a key question.

Q17 (Automotive): 5 Top Success Factors for IoT Initiatives		
Rank	Success Factor	Type of Factor
1	Identifying and pursuing new business and revenue opportunities	Strategic
2	Integrating our IoT data (from sensors and other digital device) into enterprise systems (for example enterprise resource planning, customer relationship management, supply chain management, and HR, among others)	Technology
3 (tied)	Determining what technologies to develop internally or externally	Technology
	Determining what data to capture from the IoT	Strategic
4	Making large changes in the marketing, sales, and service processes	Business Processes
5	Having skilled business analysts who understand what the IoT data is telling us about company products in the field, the factory, and the supply chain, and so on	Skills

***Exhibit III-10: Determining How to Make Money from IoT is a Top Success Factor***

Tesla has already demonstrated its willingness to run more like a software company than a traditional automaker. Among U.S. automakers, Ford, GM, and Chrysler certainly understand this need and are sprinting fast toward it as well. "Now the car is becoming the ultimate technology product, and we are becoming more of an information company," Ford CEO Mark Fields told a reporter this March.<sup>28</sup>

Automakers around the world want to be not only information companies but also IoT pioneers. As expected, in an industry where design is revered, IoT data is helping shape design's future.

28 Rachel King, "Ford Grapples With Wearables And the Future of IoT," Wall Street Journal CIO Journal, March 31, 2015. <http://blogs.wsj.com/cio/2015/03/31/ford-grapples-with-wearables-and-the-future-of-iot/>

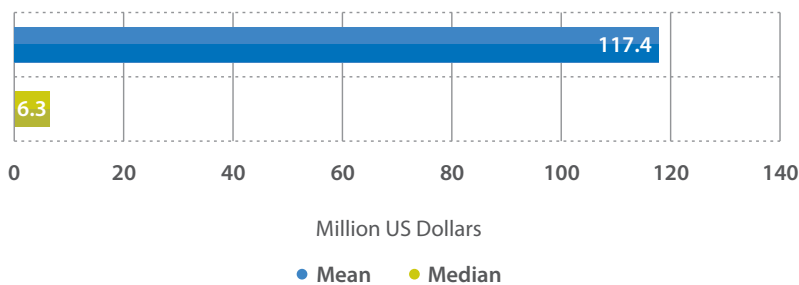


## Banking and Financial Services: Pleasing Customers, Fighting Fraud

Banks, especially large ones, invest in IoT technologies heavily and reap some of the greatest financial rewards. Only the travel, hospitality, and transportation, and industrial manufacturing sectors are making bigger IoT investments in 2015. Banking ties with telecom for the largest expected annual investment in 2018. (See Exhibits III-11 and 12.)

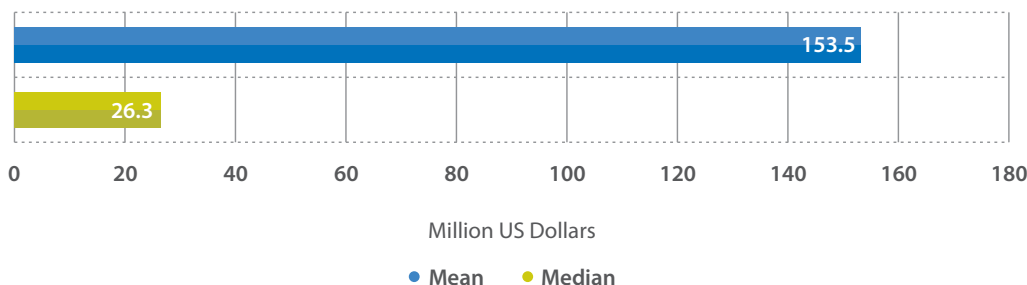
Financial institutions report average IoT budgets of \$117.4 million in 2015, which is 0.4% of the revenue (the median spend is \$6.3 million, or 1% of median company revenue). By 2018, they plan to spend \$153.5 million (median of \$26.3 million).

**Q9 (Banking and Financial Services): 2015 Spend on IoT Initiatives (Per Survey Respondent)**



**Exhibit III-11: What Banks Will Spend on IoT This Year**

**Q10 (Banking and Financial Services): 2018 Projected Budget for IoT Initiatives (Per Survey Respondent)**



**Exhibit III-12: What Banks Will Spend on IoT in 2018**

For financial institutions, the IoT investments appear to be paying off. Between 2013 and 2014, they reported an average 18% revenue increase from IoT efforts. These companies expect a 19% average revenue increase between 2015 and 2018. Of the 13 industry sectors we studied, only industrial manufacturing is experiencing greater revenue gains from IoT projects.



## What They're Spending Their IoT Budgets On

Monitoring customers is by far banks' most popular application of IoT technologies. To engage with customers and understand what they are doing, a notable 65% of banking respondents say their organizations use mobile apps and 16% track wearables. (See Exhibit III-14.)

To a large degree, the financial sector's pronounced emphasis on customer monitoring comes in response to growing online fraud and the ever-present threat of hacked computer systems, especially those of retailers. Citigroup publicly explained that it is exploring wearable technologies that use biometrics such as fingerprints to make online payments more secure.<sup>30</sup> This year, Visa unveiled a mobile service that uses phone geo-location data to verify a customer's identity. Visa hopes the service will reduce fraud and decrease the number of declined transactions that often occur because a customer's identity can't be accurately established.<sup>31</sup>

Financial institutions are also using the IoT to improve the banking experience. Last year, Citigroup issued its Citi Mobile Challenge, urging software developers to create innovative solutions for the bank's mobile device platform, wearables, and other technologies.<sup>32</sup> This year, Citigroup announced an app for Apple Watches that tells wearers how close they are to their credit limits.<sup>33</sup>

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30 Mary Wisniewski, "Citi Calls Coders to Develop Apps for 'Internet of Things,'" American Banker, Sept. 25, 2014. [http://www.americanbanker.com/issues/179\\_186/citi-calls-coders-to-develop-apps-for-internet-of-things-1070231-1.html](http://www.americanbanker.com/issues/179_186/citi-calls-coders-to-develop-apps-for-internet-of-things-1070231-1.html)

31 Visa press release, Feb. 12, 2015. <http://pressreleases.visa.com/phoenix.zhtml?c=215693&p=irol-newsarticlePR&ID=2016148>

32 Citigroup web page, <http://www.citimobilechallenge.com>

33 Mary Wisniewski, "Why Citi Was the First Bank on the Apple Watch," American Banker, Mar. 13, 2015. <http://www.americanbanker.com/news/bank-technology/why-citi-was-the-first-bank-on-the-apple-watch-1073246-1.html>



## Business Improvements and Keys to Success: The Present and the Future

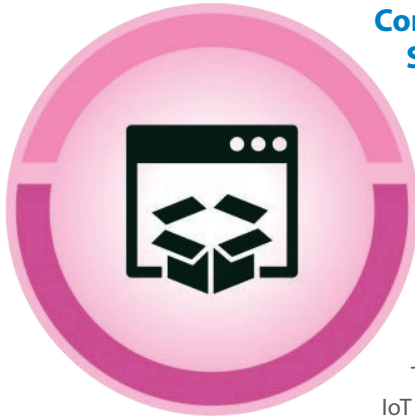
Financial institutions have focused their IoT efforts on products. The top business process improvement to date is tailoring products and services. For example, Chase and Wells Fargo are researching services for customers who visit branch offices often, to let them check in faster with fewer questions. Wells Fargo is considering Bluetooth beacons in offices to let customers get recognized after walking inside. Similarly, Wells Fargo is working on connected car technologies for the 30% of its customers who favor drive-through banking, and want to pay for products at places like restaurants and gas stations while in their cars.<sup>34</sup> By 2020, the emphasis is expected to shift to improved selling and providing better insights for sales staff. (See Exhibit III-15.)

Q12 and Q13: (Banking and Financial Services): Biggest Impacts of IoT Initiatives			
5 Top to Date		Top 5 by 2020	
1	More tailored products and/or services	1	Greater insights for salespeople on key aspects of company products (For example, product features that customers use the most)
2	More tailored marketing and/or marketing campaigns	2	More tailored and/or precise customer segmentation (For example, based on how customers use products and/or services )
3	More proactive service: identifying product problems before customers are even aware of them	3	More tailored products and/or services
4	Better service because of more informed service reps (they can view data on how customers are using the product/service)	4 (tied)	Reduction in cost of sales through automated reordering for customers  Improved user experience by making near-obsolescence products more attractive to customers (for example, by monitoring such a product and preempting its breakdown before the customer realizes)
5	More tailored and/or precise customer segmentation (for example, based on how customers use our products and/or services)	5 (tied)	Better service because of more informed service reps (they can view data on how customers are using the product and/or service)  More proactive service: identifying product problems before customers are even aware of them

**Exhibit III-15: Biggest Banking Improvements from IoT are Customized Products and Marketing**

<sup>34</sup> Jennifer Elias, "Banks Are Vying To Out-Nerd Each Other For Your Attention," *Fast Company*, Dec. 2, 2014, <http://www.fastcolabs.com/3039036/internet-of-things/with-cardless-atms-and-vr-banks-a0re-vying-to-out-nerd-each-other-for-your>





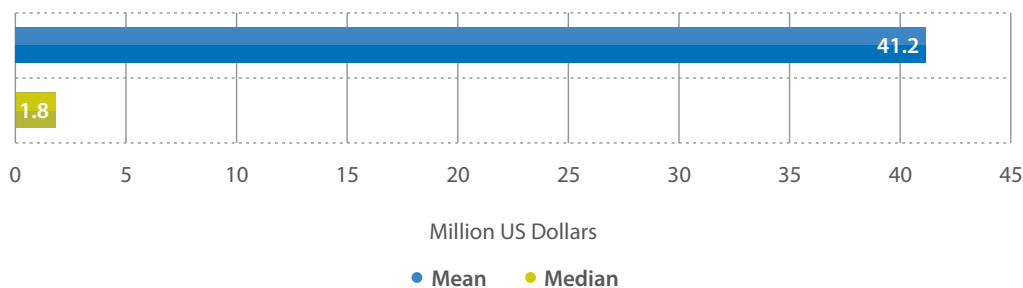
## Consumer Packaged Goods: Low Spending, Focused on the Supply Chain

A consumer dashes into a convenience store to grab a cold drink: Will it be a Coke or Pepsi product? Coca-Cola and other CPG companies are experimenting with IoT technologies as they vie to convince the customer to select their products right at that moment, in a 'noisy' store full of choices.

This industry does not rank among the large IoT spenders yet, but more funding is expected by 2018. CPG organizations are focusing their IoT efforts on supply chain and marketing.

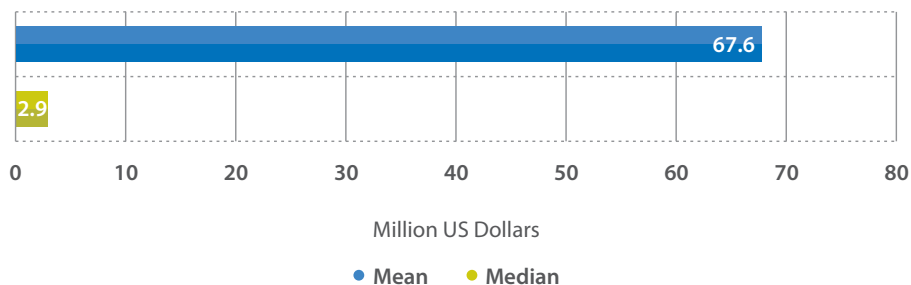
The sector spent an average \$41.2 million (0.2% of average revenue) on IoT efforts in 2015 and expect to spend \$67.6 million in 2018. Supply chain nets the biggest chunk of the IoT budget at 30%, but product and customer monitoring also each net about 26% of IoT funds. (See Exhibit III-19.) Spending priorities look similar in 2020 budgets. (See Exhibits III-17 and 18.)

**Q9 (Consumer Packaged Goods):  
2015 Spend on IoT Initiatives (Per Survey Respondent)**



**Exhibit III-17: CPG Companies Won't Spend Much on IoT This Year**

**Q10 (Consumer Packaged Goods): 2018 Projected  
Budget for IoT Initiatives (Per Survey Respondent)**

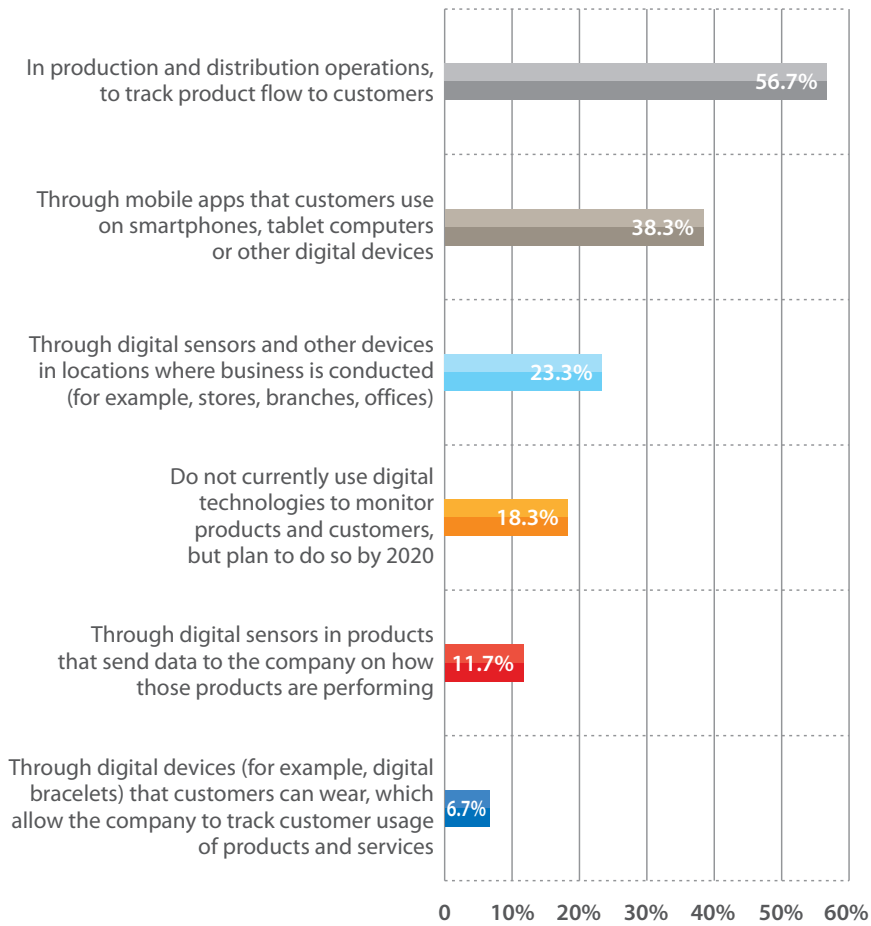


**Exhibit III-18: CPG Companies Will Spend Much More on IoT by 2018**





### Q3 (Consumer Packaged Goods): Ways in which Companies use IoT Technologies



#### Exhibit III-20: Most CPG Companies Use IoT to Track Product Flow

On the marketing side, last year Coca-Cola tested near-field communications technologies that let consumers enrolled in online loyalty programs get discounts while inside retail stores. Coke also tested Apple's iBeacon technology, which is a low-cost transmitter that can detect when an iPhone or iPad device is nearby. A CPG company like Coke can then sense a Coke loyalist at a retailer and send a marketing message or promotion to the person's Apple device. A Coca-Cola Enterprises digital director told a reporter, "Even in supermarkets there are tens of thousands of product SKUs. How do you get yours seen? This will start to help us cut through."<sup>36</sup>

36 Jessica Davies, "Coca-Cola explores iBeacons as marketing tool for World Cup sponsorship," The Drum, Jan. 13, 2014. <http://www.thedrum.com/news/2014/01/13/coca-cola-explores-ibeacons-marketing-tool-world-cup-sponsorship>



Consumer packaged goods companies haven't realized huge revenue gains yet, noting an average 13.1% revenue increase in 2014 over 2013. They project a 14.5% revenue increase from their IoT initiatives between 2015 and 2018.

In addition to the supply chain monitoring efforts, 38.3% of CPG companies now monitor customers via mobile apps, 23.3% monitor via sensors in physical locations, 11.7% use digital sensors in products to track performance, and 6.7% use wearable devices to gather data. Customer loyalty apps certainly make a natural fit for this group of companies.

Interestingly, apps will touch on health and well-being, too. Procter & Gamble sees demand for an Internet-connected toothbrush with a companion app to track your brushing habits and oral health.<sup>37</sup> The mobile app had been downloaded almost 300,000 times as this March, and 87% were actively using it in December 2014.

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<sup>37</sup> P&G press release, Mar. 2, 2015 <http://www.prnewswire.com/news-releases/oral-b-unveils-new-app-technology-at-mobile-world-congress-2015-300042104.html>

## Business Improvements and Keys to Success: The Present and the Future

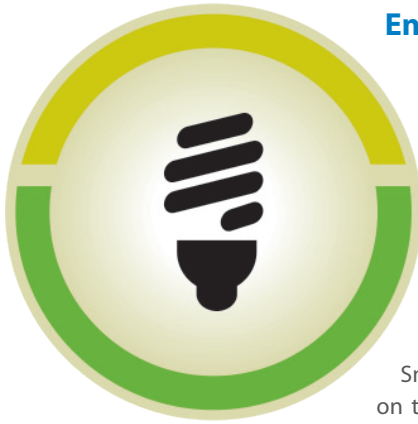
What business process improvements have CPG companies already realized through IoT efforts? CPG companies said two benefits were most important: creating more tailored products and services, and providing more proactive services by identifying product problems early. (See Exhibit III-21.)

CPG companies also note benefits in reducing product shrinkage and theft, and in creating smarter marketing campaigns. By 2020, these companies hope the top improvement will be greater insights for salespeople on how customers use the products, and more precise segmentation. Such insights will also help CPG companies shape their product portfolios, as well as the features of products in their portfolios.

Q12 and Q13 (Consumer Packaged Goods): Biggest Impacts of IoT Initiatives			
Top 5 to Date		Top 5 by 2020	
1(tied)	More tailored products and/or services More proactive service: identifying product problems before customers are even aware of them	1	Greater insights for salespeople on key aspects of company products (For example, product features that customers use the most)
2(tied)	Reduction in product shrinkage and/or theft More tailored marketing and/or marketing campaigns	2	Reduction in cost of sales through automated reordering for customers
3(tied)	Improving existing products through a much better understanding of what features and/or functions customers are using or not using Insights on new product testing for R&D Identification of distribution bottlenecks	3 (tied)	More tailored products and/or services More tailored marketing and/or marketing campaigns More proactive service: identifying product problems before customers are even aware of them
4	Identification of product and/or service defects in the production process	4 (tied)	Shifting of inventory to other locations while it's in the supply chain Improvement in existing products through a much better understanding of what features and/or functions customers are using or not using
5	More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)	5	More profitable pricing

**Exhibit III-21: Top IoT Impacts at CPG Companies**





## Energy: Focus on Monitoring Products and the Supply Chain

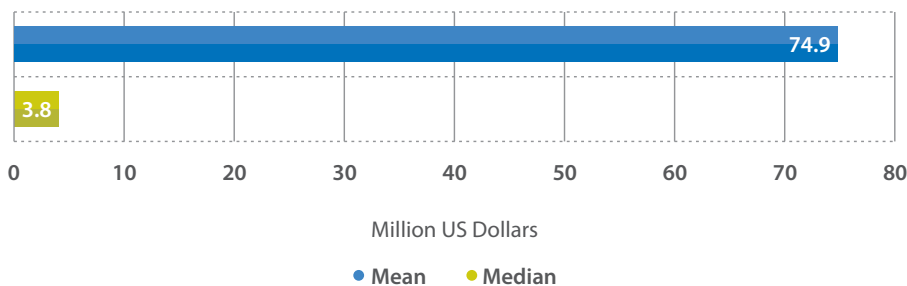
For energy companies, IoT technologies can eliminate some uncertainties – even the kind posed by weather. For example, at wind farms, forecasting energy output is a challenging problem. At these farms, full of expensive turbines, weather affects output: Changes in wind direction and speed equal more or less output. Envision Energy makes a Smart Wind Farm system that puts IoT sensors on those turbines, then uses sensor data to spot maintenance issues, boost efficiency, and improve output forecasting – even in the face of changing weather.

Envision helps customers use sensor data to make real-time decisions to adjust blades.<sup>38</sup>

The more questionable the energy output forecast, the more risk the energy seller faces, encouraging the seller to raise prices. Envision's system therefore reduces risk and leads to more competitive energy pricing, the company says.

In this industry, companies will be spending an average \$74.9 million apiece (a modest 0.2% of revenue) in 2015, and they plan to invest \$67.2 million in 2018. (See Exhibits III-23 and 24.) Energy companies doing projects such as adding sensors to oil facilities face many initial costs.

**Q9 (Energy):**  
**2015 Spend on IoT Initiatives (Per Survey Respondent)**



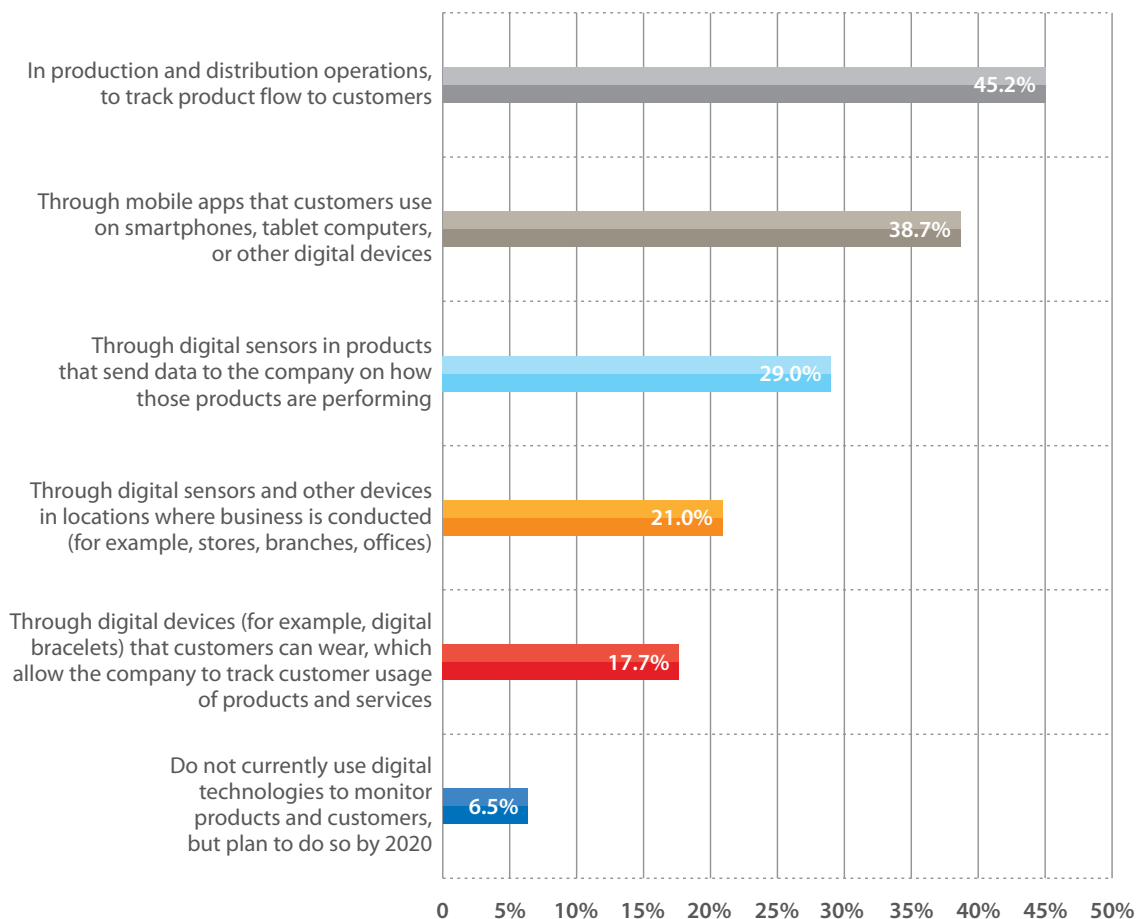
**Exhibit III-23: What Energy Companies Will Invest This Year in IoT**

38 Mike Kavis, "Envision Energy Leverages IoT Technologies to Optimize Renewal Energy, Forbes, com, Feb. 13, 2015. <http://www.forbes.com/sites/mikekavis/2015/02/13/envision-energy-leverages-iot-technologies-to-optimize-renewable-energy/>



Supply chain monitoring remains a crucial concern for energy companies, which is reflected in our data showing that 45.2% of energy companies are using IoT technologies to watch production and distribution and track product flow. Nearly 40% analyze customer data via mobile apps, and 29% have sensors in products. (See Exhibit III-26.) One challenge for energy companies is that facilities like oil fields are quite remote, which means you may be able to collect a ton of sensor data at a site, but you may not have enough bandwidth to send it all back and analyze it.

**Q3 (Energy): Ways in which Companies use IoT Technologies**



**Exhibit III-26: What Energy Companies Monitor Through the IoT**

Energy companies do not report flashy revenue gains from IoT projects yet. These companies logged a 12.5% average revenue increase from IoT efforts in 2014 over 2013 and expect to realize a 14.6% increase between 2015 and 2018.





Google's Nest smart thermostat (designed to save homeowners money) and smart energy meters often dominate IoT coverage. However, oil and gas energy companies see IoT projects and savings on a different scale. ConocoPhillips estimates it can cut \$250 million in drilling costs annually by analyzing data along the drill line and tweaking drill bits accordingly.<sup>39</sup> That's the kind of cost reduction that warms an energy company CEO's heart.

Q17 (Energy): Top 5 Success Factors for IoT Initiatives		
Rank	Success Factor	Type of Factor
1 (tied)	<p>Determining what data to capture from the IoT</p> <p>Having top management that believes the IoT could have a major impact on business and is willing to invest in it today</p> <p>Being able to gather, process, and analyze huge amounts of digital data and/or Big Data.</p> <p>Accelerating the pace at which key decisions are made in the organization about products, customers, and how to serve them.</p>	<p>Strategic</p> <p>Culture</p> <p>Technology</p> <p>Culture</p>
2 (tied)	<p>Getting managers and staff to change the way they think about customers, products, and processes for serving those customers based on new insights about how those customers are using company products.</p> <p>Acting rapidly to make adjustments to company products and processes based on what IoT data indicates</p>	<p>Culture</p> <p>Business Process</p>
3	Having skilled business analysts who understand what IoT data is revealing about company products in the field, the factory, and the supply chain, among others	Skills
4 (tied)	<p>Determining what technologies to develop internally or externally</p> <p>Integrating IoT data (from sensors and other digital device) into enterprise systems (for example, enterprise resource planning, customer relationship management, supply chain management, HR, and so on)</p>	<p>Technology</p> <p>Technology</p>
5 (tied)	<p>Having skilled technologists who know how to develop and/or integrate IoT technologies into company products and processes</p> <p>Gaining ownership or access rights to use the data generated from customer usage of company products</p>	<p>Skills</p> <p>Customer</p>

### ***Exhibit III-28: The IoT Factors That Energy Companies Rate Highest***

39 Chris Murphy, "Internet of Things: What's Holding Us Back," InformationWeek, May 5, 2014, <http://www.informationweek.com/strategic-cio/it-strategy/internet-of-things-whats-holding-us-back/d/d-id/1235043>



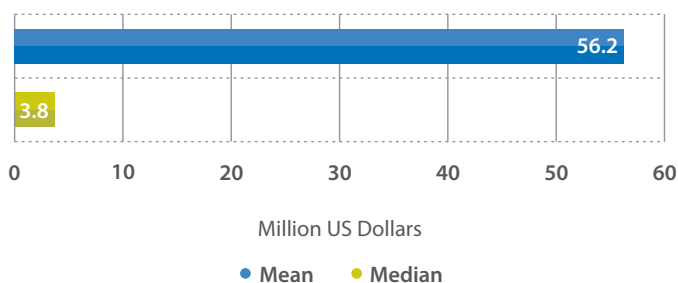
## Healthcare and Life Sciences: Modest Investments Today, But Bigger Plans Tomorrow

Internet of Things gets personal quickly in the realm of healthcare and life sciences. Fitbit wearable devices became a gift of choice during the 2014 holiday season – delivering a most personal view of your day and lifestyle, including steps and calories.

Nevertheless, healthcare and life sciences companies see personalized opportunity far beyond physical fitness devices. Patient monitoring and home elder care, for example, continue to drive connected device ideas. Yet many companies in this industry, which includes pharmaceuticals and biotech, hospitals and clinics, and makers of medical products and equipment, face special regulatory and privacy pressures. Those pressures play into the speed at which organizations can innovate and invest.

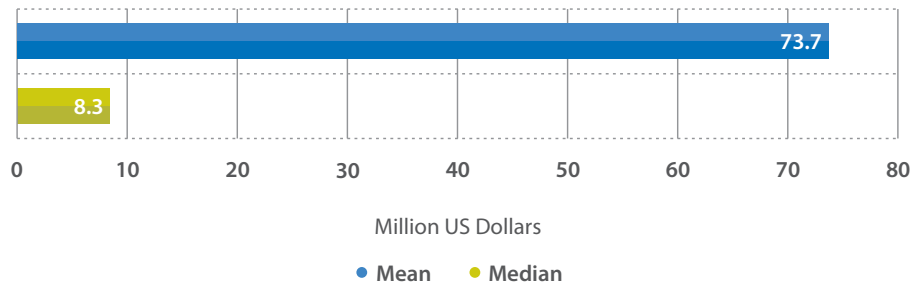
Thus healthcare and life sciences companies were not among the big spenders in our study, allocating an average \$56.2 million on IoT technologies in 2015 (0.3% of average revenue). Yet they plan to increase that 30% to \$73.7 million in 2018. Consistent with our study's overall finding that IoT followers don't reap as many early revenue gains as IoT leaders, the healthcare and life science companies reported a 12.5% average revenue increase from IoT technologies in 2014 over 2013. (That's less than half the average revenue gain industrial manufacturers reported on IoT investments in 2014.) Health care companies project a 12.3% increase from 2015 to 2018 – slow and steady. (See Exhibits III-29 and 30.)

### Q9 (Healthcare and Life Sciences): 2015 Spend on IoT Initiatives (Per Survey Respondent)



### Exhibit III-29: Modest Spend on IoT in 2015

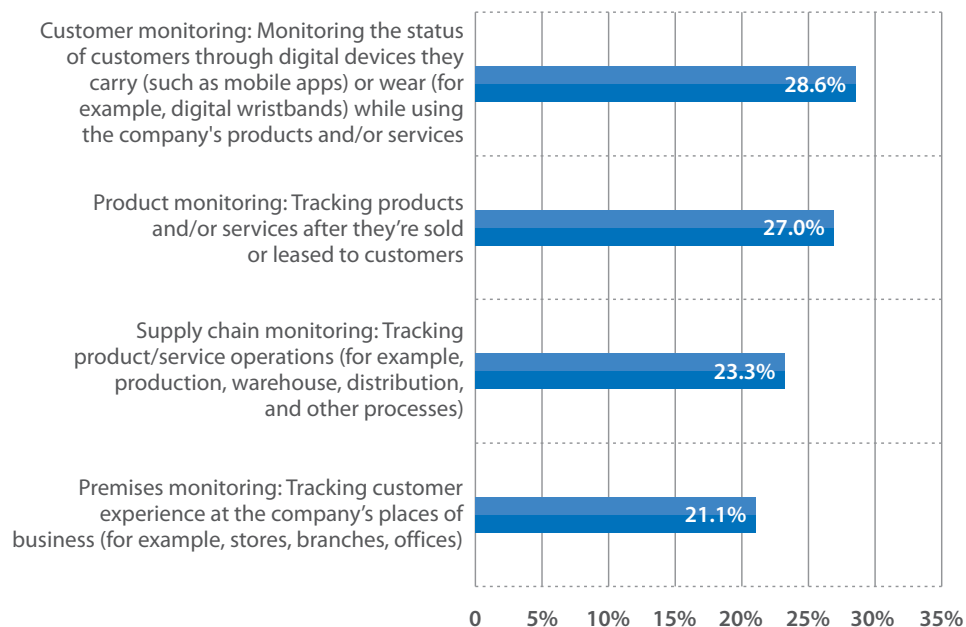
**Q10 (Healthcare and Life Sciences ):  
2018 Projected Budget for IoT Initiatives (Per Survey Respondent)**



**Exhibit III-30: Higher Spend on IoT in 2018**

Looking at how healthcare companies allocate IoT dollars, the watchword also seems to be caution. Investment is almost evenly split among the four buckets. (Exhibit III-31) In 2014, customer monitoring and product monitoring represent 29% and 27% of IoT spend, respectively, followed by supply chain and premise monitoring at 23% and 21%. Looking ahead to 2020 IoT budget plans, the order of spending priorities remains the same.

**Q11 (Healthcare and Life Sciences ) : Percentage of 2015 IoT Spend by  
Core IoT Business Area**



**Exhibit III-31: Monitoring Patients Gets the Biggest Share of the IoT Dollar**



## Business Improvements and Keys to Success: The Present and the Future

Where are healthcare and life sciences companies seeing early results? Leading off the business process improvement changes, these companies have created more tailored products and services. (See Exhibit III-33.) That shows both revenue and customer focus. (After all, is there anything you want to be more personalized than your healthcare?) The companies also say IoT tech helps them deliver better service thanks to more informed reps, do more precise customer segmentation, and tailor marketing campaigns.

More proactive medical service is high on the list of IoT impacts as well. Many medical equipment makers, hospitals, and doctors believe that sensors and wireless technologies could improve the percentage of people who take their prescribed medications. About 50% of U.S. patients do not continue their medications as prescribed, according to the Centers for Disease Control.<sup>41</sup> The cost of non-adherence? From \$100 billion to \$289 billion a year. Established software makers see new opportunities here, too. In January 2015, Oracle Corp. announced a cloud service monitoring patient adherence to drugs was in clinical trials.<sup>42</sup>

Looking ahead, healthcare organizations hope that by 2020 the top process improvement will be more proactive service via early identification of product problems. They're trying but know much work remains; that benefit ranks #3 on process improvements realized today.

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41 CDC presentation, "Medical Adherence," March 27, 2013. <http://www.cdc.gov/primarycare/materials/medication/docs/medication-adherence-01ccd.pdf>

42 Gartner Inc. blog post by Michael Shanler, Jan. 15, 2015. <http://blogs.gartner.com/michael-shanler/wearable-devices-ha-whats-your-appetite-for-ingestibles/>



Q17 (Healthcare and Life Sciences): Top 5 Success Factors for IoT Initiatives		
Rank	Success Factor	Type of Factor
1	Having skilled technologists who know how to develop and/or integrate IoT technologies into company products and processes	Skills
2	Determining what data to capture from the IoT	Strategic
3	Identifying and pursuing new business and revenue opportunities	Strategic
4	Accelerating the pace at which key decisions are made in the organization about products, customers, and how to serve them	Culture
5	Having skilled business analysts who understand what IoT data is revealing about company products in the field, the factory, the supply chain, and so on	Skills

### ***Exhibit III-34: The Criticality of IoT Technologists***

This focus on integration skills reflects the complex tech reality that healthcare organizations face. Existing electronic health records software systems, can be notoriously complicated and expensive – and differing EHR vendors’ products pose additional challenges. IoT technologies must get along in this environment. For example, hospitals can’t change systems the way a manufacturing or media company can. In some cases, years have been spent winning doctor and nurse buy-in. No wonder then that integration skills matter greatly.

So do business analyst skills: These companies need translators who can synthesize and explain what their IoT data says about products, supply chain, and more.

The #3 success factor is the ability to identify and pursue new business and revenue opportunities. In countries such as the U.S., where healthcare systems continue to undergo large change, including cost-cutting pressures, this will indeed be crucial.

Healthcare companies can’t take the same risks as say, retailers, in the world of connected devices. However, with skilled technologists, healthcare organizations can create rewards like healthier patients and safer hospitals. It’s hard to imagine connected devices that will become more precious to individuals than those that ensure health. While e-commerce companies wrote the book on personalization in the 1990s, healthcare and life sciences companies are writing a fascinating chapter now.





## High Technology: Meet the IoT Gadget Gurus

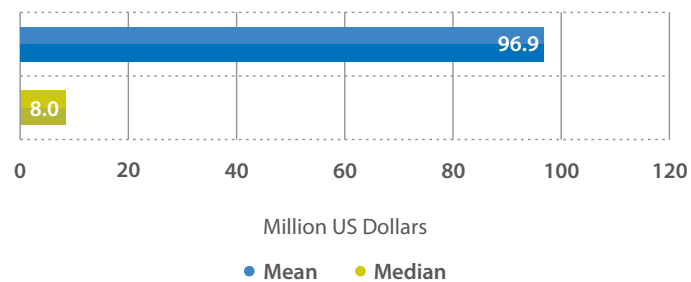
High-tech hardware and software drive the Internet of Things: Their computers, mobile devices, semiconductors, communication equipment, and software make it possible for companies to connect with customers. Because of the scale of opportunity, high-tech companies are busy factoring the IoT into their product strategies.

Hewlett Packard, for example, has equipped its printers with sensors and communication devices that monitor performance and alert customers when they need to restock supplies such as printer ink. As many software companies shift their products to the cloud model, they gain first-hand information on how well the software actually works.

Apple recently announced a smart home offering, and Google acquired Nest Labs, a leader in smart home technologies such as thermostats and smoke alarms. Only four years old at the time of its acquisition, Nest Labs commanded a handsome sale price of \$3.2 billion.<sup>43</sup> Last year, Intel announced its IoT Platform that combines chips and software, including security, into a single offering.<sup>44</sup>

In terms of spend, high tech places fifth among the 13 industries in our study. The average 2015 sector spend on IoT is \$96.9 million, which is 0.4% of revenue (the median is \$8.0 million or 0.1% of revenue). High-tech businesses project they will spend \$121.3 million on average (median is \$12.4 million) in 2018. (See Exhibits III-35 and 36.)

**Q9 (High Tech):**  
**2015 Spend on IoT Initiatives (Per Survey Respondent)**

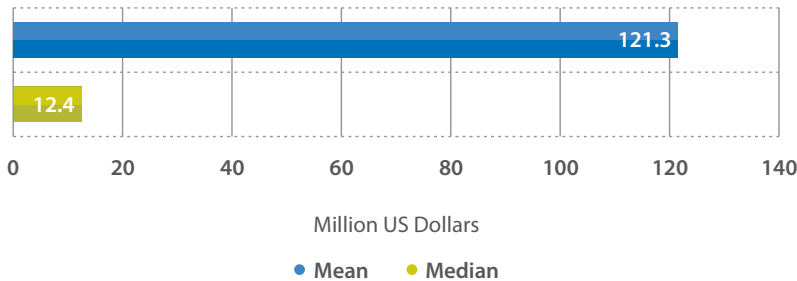


### Exhibit III-35: High Tech Spends Big on IoT

43 Rolfe Winkler and Daisuke Wakabayashi, "Google to Buy Nest Labs for \$3.2 Billion," *The Wall Street Journal*, Jan. 13, 2014.

44 Stephen Lawson, "Intel's IoT vision encompasses more than chips," Computerworld, Dec. 9, 2014, <http://www.computerworld.com/article/2857873/intels-iot-vision-encompasses-more-than-chips.html>

**Q10 (High Tech): 2018 Projected Budget for IoT Initiatives (Per Survey Respondent)**

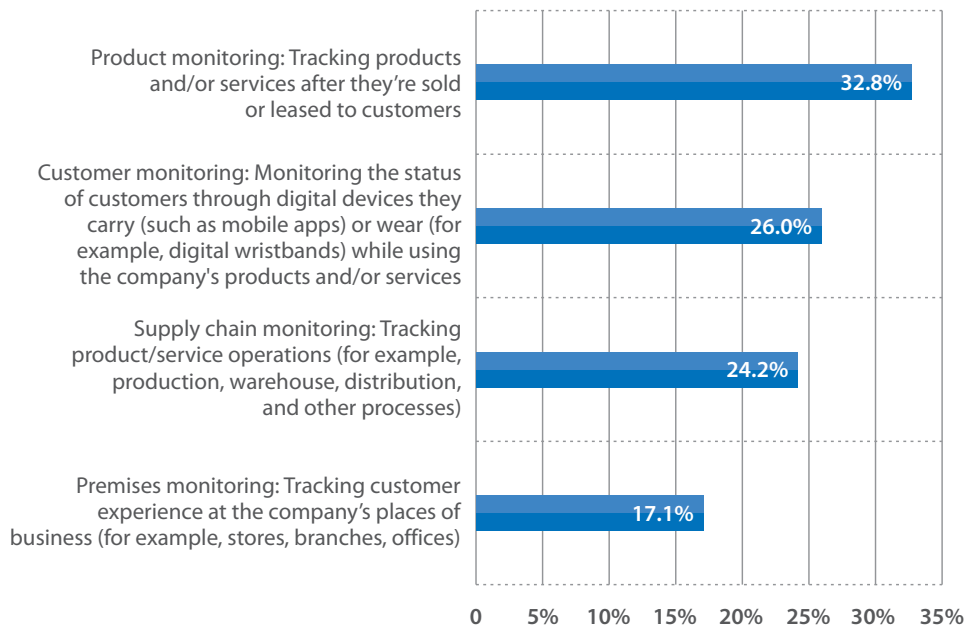


**Exhibit III-36: High Tech Expects its IoT Spend to Only Grow**

The revenue impact is expected to climb from 15% between 2013 and 2014 to 19% by 2018.

Forty six percent of high tech respondents say their organizations are using IoT to monitor both customers (16% with wearables) and products. Monitoring products is the largest IoT budget item with a projected 33% of IoT spend. (See Exhibit III-37.) The share of budget dedicated to monitoring customers is estimated to climb to 29% in 2020 from 26% in 2015.

**Q11 (High Tech): Percentage of 2015 IoT Spend by Core IoT Business Area**



**Exhibit III-37: Product and Customer Monitoring Get the Largest Pieces of the IoT Pie**

Supply chain monitoring is another primary use of IoT in high-tech companies: Nearly 50% of respondents say their companies use IoT technologies for this purpose. Supply chain monitoring will consume 24% of 2015 IoT budgets, but that amount is expected to decline slightly to 22% by 2020.

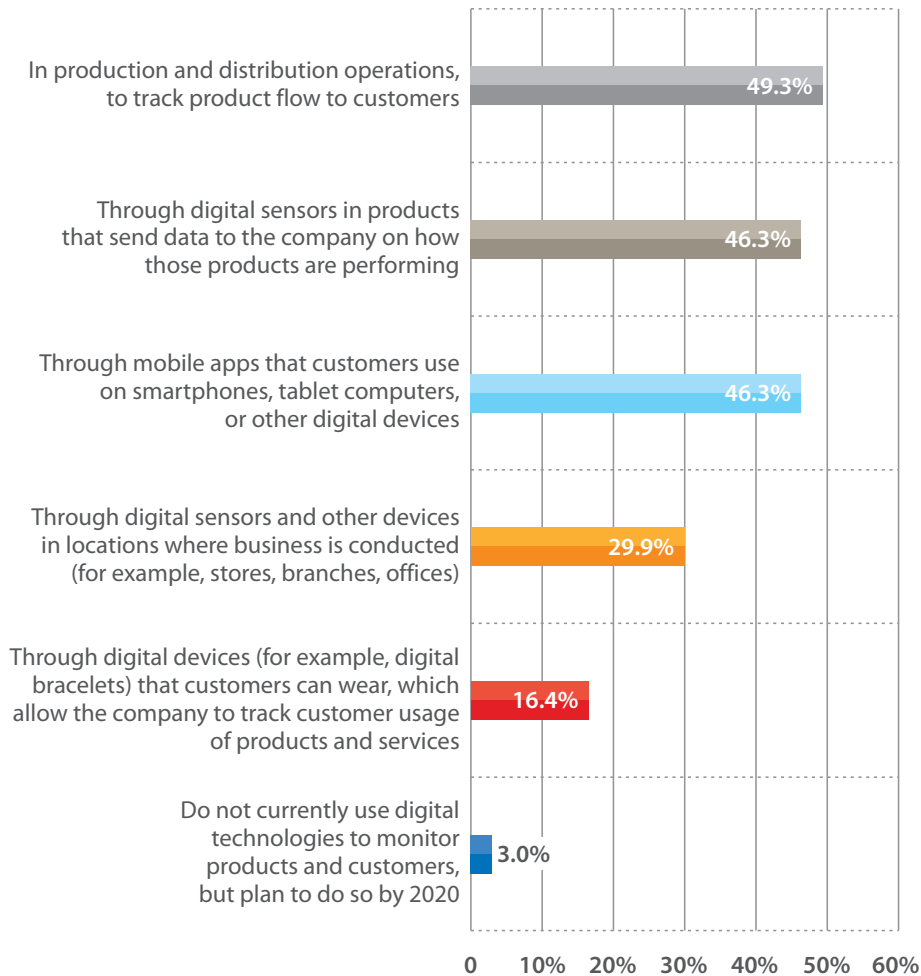
High-tech companies often have complex global supply chains where efficiency is critical. Global chip maker Intel, for example, installed sensors in CPU-testing modules in a Malaysian semiconductor factory. Using the sensor data, the company improved productivity by significantly reducing the number of components that didn't meet specifications. The effort has shaved millions of dollars off Intel's manufacturing expense at the plant. The company plans to roll out IoT technologies to its other plants.<sup>45</sup>

Thirty percent of respondents say their companies use IoT to monitor the premises in which they do business with customers. Between 2015 and 2020, monitoring premises will take approximately 17% of IoT budgets.

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45 Tim Hornyak, "Intel saves \$9 million in factory IoT," Computerworld, Oct. 1, 2014, <http://www.computerworld.com/article/2690054/data-center-cloud/intel-saves-9-million-in-factory-iot.html>

### Q3 (High Tech): Ways in which Companies use IoT technologies



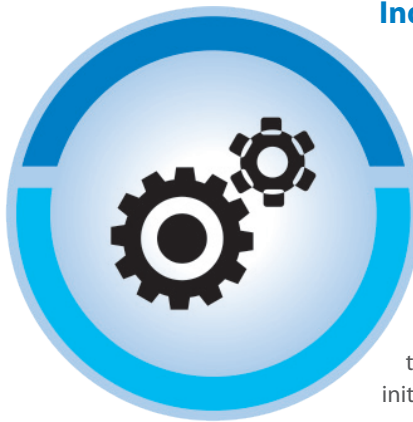
**Exhibit III-38: Nearly Half Track Products in the Supply Chain and Customers' Hands**

## Business Improvements and Keys to Success: The Present and the Future

Accordingly, these companies say the success of IoT projects starts with improving the ability to gather and analyze data. Tied for second place are having skilled analysts who can decipher IoT Big Data and getting employees to think differently in a world of continuous product usage input. (See Exhibit III-40.)

Five Top Factors of IoT Success		
Rank	Success Factor	Type of Factor
1	Being able to gather, process, and analyze huge amounts of digital data/Big Data	Technology
2 (tied)	Having skilled business analysts who can interpret what IoT data is revealing about company products in the field, the factory, the supply chain, and so on  Getting managers and teams to change the way they think about customers, products, and processes and serve those customers based on new insights about how those customers are using company products	Skills  Culture
3 (tied)	Accelerating the pace at which key decisions are made in the organization about company products and customers, and how to serve them  Having skilled technologists who know how to develop and/or integrate IoT Things technologies into company products and processes (tied)	Organizational  Skills
4	Identifying and pursuing new business and revenue opportunities	Strategic
5 (tied)	Determining what technologies to develop internally or externally  Determining what types of IoT data will have the greatest impact on business	Technology  Strategic

***Exhibit III-40: High-Tech Companies Say Managing Big Data is the Top IoT Success Factor***

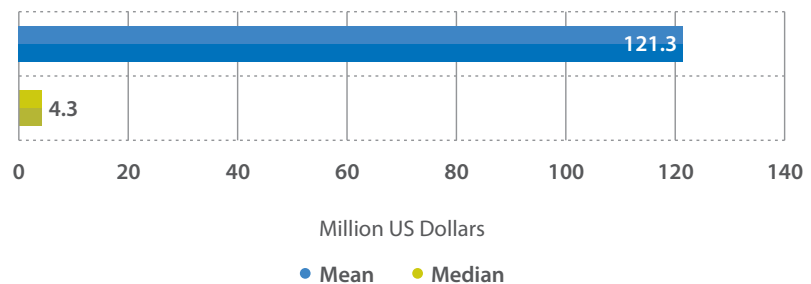


## Industrial Manufacturing: The Rock Stars of the IoT

Industrial manufacturers, churning out everything from motor vehicle parts to construction equipment, may not be thought of as glamorous by Silicon Valley standards. They are however, the rock stars of the Internet of Things, according to our research data. Among the 13 industries studied, industrial manufacturing achieved the highest revenue gain from their IoT initiatives last year.

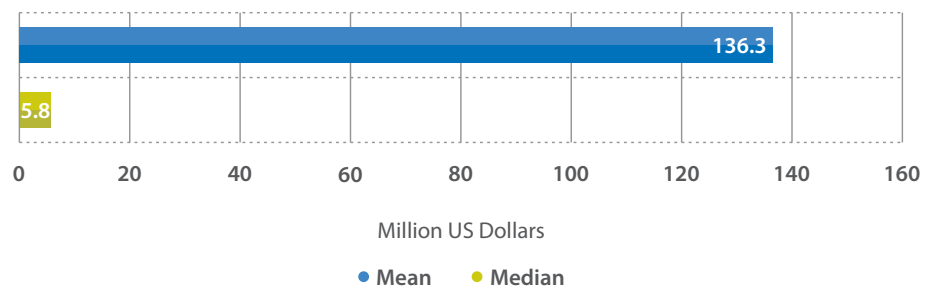
It's informative to examine where these early winners invest and focus their efforts. Industrial manufacturers will spend an average of \$121.3 million on IoT in 2015 (0.6% of average revenue), and they plan to increase that spending to \$136.3 million in 2018. (See Exhibits III-41 and 42.)

### Q9 (Industrial Manufacturing): 2015 Spend on IoT Initiatives (Per Survey Respondent)



### Exhibit III-41: A Hefty IoT Budget This Year

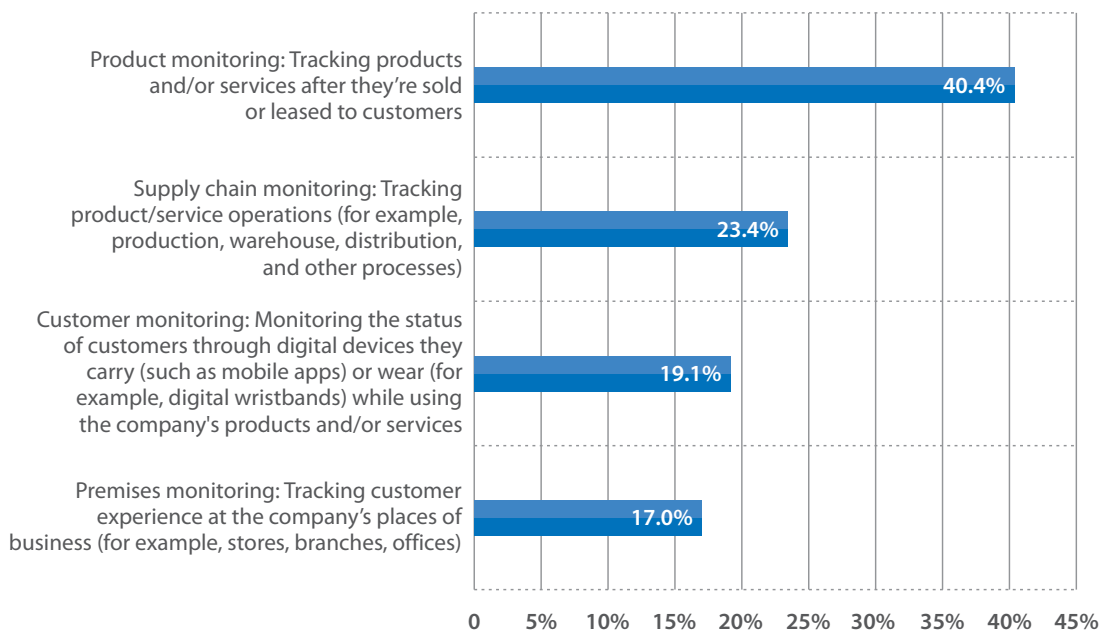
### Q10 (Industrial Manufacturing): 2018 Projected Budget for IoT Initiatives (Per Survey Respondent)



### Exhibit III-42: An Even Heftier IoT Budget Projected for 2018

Product monitoring technologies win the biggest chunk of IoT spend (40%), followed by premises, customer, and supply chain monitoring applications. (See Exhibit III-43.)

**Q11 (Industrial Manufacturing): Percentage of 2015 IoT Spend by Core IoT Business Area**



**Exhibit III-43: Biggest IoT Spend Area is Product Monitoring**

These companies reported a 28.5% average revenue increase from their IoT investments in 2014 over 2013 and project a 27.1% revenue increase from 2015 to 2018.

What's behind those revenue gains? For starters, greater insight into product quality than ever before: 33.8% of these companies have implemented digital sensors that send back data on product performance. (See Exhibit III-44.)

Just as importantly, these companies have not only talked about customer care but actually moved closer to customers: 21.6% monitor customer data through mobile apps and 12.2% already monitor customer data gleaned from wearable devices.

While supply chain monitoring today gets the smallest piece of the IoT budget (17%), it is expected to win 27% by 2020, as sensors, digital video, software, and other IoT technologies help manufacturers construct a much more precise understanding of quality and throughput issues on assembly lines.





## Business Improvements and Keys to Success: The Present and the Future

The top five business process improvements already realized from IoT Initiatives start with more proactive service: Companies identify problems before customers are aware of them. They also improve service through better-informed reps, who have a fuller, data-enriched picture of how customers use the product or service. At the same time, these companies fine-tune products according to a richer picture of the features customers are using — or not using. (PC customers would call this killing the crapware, or the pre-loaded applications no one touches.) (See Exhibit III-45.)

Farm equipment maker John Deere, for example, uses IoT technologies to reduce both the cost of manufacturing and the cost of maintenance.<sup>47</sup> In another example, Polymer Aging Concepts created sensors that warn of upcoming failures in motors, generators, and dry transformers.<sup>48</sup>

The final two improvements center around cost reduction, via identifying product/service defects in the production process, and diagnosing problems remotely. Fewer field visits equals less cost. Just ask Harley-Davidson, the \$6 billion motorcycle manufacturer. A plant in York, Pa., that the company renovated in 2013 tracks aspects of production including the speed of fans during painting, temperature, and humidity, and adjusts those factors accordingly and automatically. Harley used sensors and manufacturing execution system (MES) software to achieve its goal of completing the building of a bike every 86 seconds. For example, MES data identified rear fender installation as a problem slowing down the process.<sup>49</sup> Harley infrastructure design manager, Dave Gutshall, also told a 2014 conference audience that thanks to the sensor network at the York plant, manufacturing line downtime has been reduced from hours to minutes or seconds. “Before, machines would break and no one knew why. Now, the minute you see a [problem] you fix it.”<sup>50</sup>

By 2020, however, among the industrial manufacturing managers whom we surveyed, the business improvement process gains turn more toward revenue generation. By that time, these companies hope that the top two business improvements related to IoT are automated reordering for customers (which not only encourages more sales but also lowers the cost of sales) and more tailored products and services. Even industrial manufacturers want to use data to serve up the right offer for the particular customer at the right time.

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47 Will Kelly, “Of Rust Belts and Beacons: IoT and Wearable Trends For 2015,” TechRepublic, March 6, 2015, <http://www.techrepublic.com/article/of-rust-belts-beacons-iot-wearable-trends-in-industry-for-2015/>

48 John Zeger, “Six Key Predictions for Manufacturing in 2015,” IndustryWeek, Dec. 17, 2014, <http://www.industryweek.com/competitiveness/six-key-predictions-manufacturing-2015?page=2>

49 James R. Hagerty, “How Many Turns in a Screw? Big Data Knows,” The Wall Street Journal, May 15, 2013, <http://www.wsj.com/articles/SB10001424127887324059704578472671425572966>

50 Mary Catherine O’Connor, “The IoT Forecast for 2015,” The Internet of Things Journal, Dec. 23, 2014, <http://www.iotjournal.com/articles/view?12557>



How will they do it? Consider the top five success factors among these IoT leaders (See Exhibit III-46):

- Finding and pursuing new business and revenue opportunities.
- Capturing the right IoT data. This is strongly tied to identifying the best IoT opportunities. If you don't know what they are, you're likely to collect the wrong data.
- Changing longtime beliefs about customers, products, and services with new data regarding usage.
- Rapidly adjusting products and processes based on IoT data.
- Picking up the pace on key decisions about products, customers, and customer service.

Q17 (Industrial Manufacturing): Five Top Success Factors for IoT Initiatives		
Rank	Success Factor	Type of Factor
1	Identifying and pursuing new business and revenue opportunities	Strategic
2	Determining what data to capture from the IoT	Strategic
3	Getting managers and staff to change the way they think about customers, products, and processes for serving those customers based on new insights about how those customers are using company products	Culture
4	Acting rapidly to make adjustments to company products and processes based on what IoT data indicates	Business Process
5	Accelerating the pace at which key decisions are made in the organization about products and customers, and how to serve them	Culture

***Exhibit III-46: Identifying the Best IoT Opportunities out of Many is the Top Success Factor***



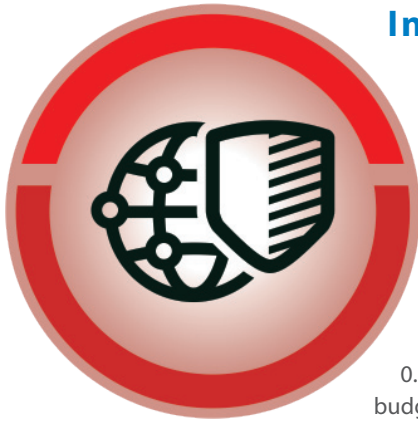
The fifth-rated success factor is crucial. If a company invests in IoT, but does not nurture a corporate culture that praises speed, it could fail: much like a company that buys a cloud service — then makes it too time-consuming for internal teams to gain access.

General Electric is betting big on IoT to accelerate the speed at which its company improves. GE has been investing substantially in IoT technologies to improve manufacturing production. “Productivity gains will be insane when people automatically receive the information they need when they need it, versus having to sit in front of a monitor searching for it,” Mark Bernardo, general manager of automation software for GE Intelligent Platforms, told a publication in 2013.<sup>51</sup> “We see that as a game changer, so that’s where we’re focusing our attention.” Plant productivity jumped when the company incorporated mobile technology into its factories’ SCADA systems (supervisory control and data acquisition), which help plant managers continually monitor equipment and manufacturing processes. So SCADA data was made available on mobile devices. “That unleashed people from being chained to [a PC in] a control room or a production line.” Plant managers and staff were able to solve problems faster and better. “Their ability to solve problems went up dramatically,” he told the publication. “It’s a level of collaboration you don’t have when one guy is in a control room three floors higher than the operator and your maintenance person is in the next building.”

Other industries have much to learn from GE and other industrial manufacturers that are ahead of the pack on so many IoT fronts.

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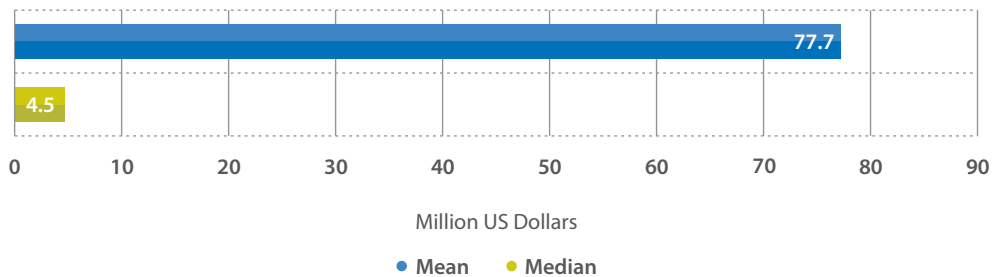
51 Alan Joch, “United Airlines and GE Make Room for Mobility,” BizTech, Dec. 13, 2013, <http://www.biztechmagazine.com/article/2013/12/united-airlines-and-ge-make-room-mobility>



## Insurance: Data Streams Reduce Risk

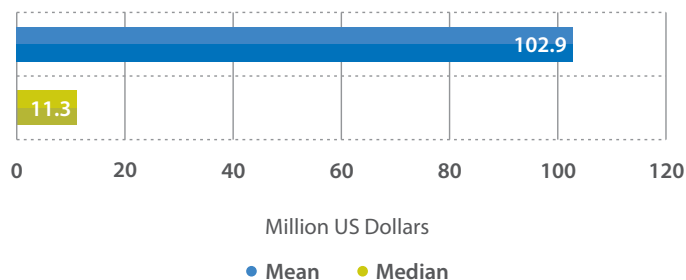
In the insurance industry, IoT plays an important role in managing risk, which is central to improving pricing, products, and marketing. In terms of IoT spend, the insurance sector falls roughly in the middle of the 13 industries we examined. Insurance companies expect to spend an average \$77.7 million on IoT in 2015, which represents 0.3% of average revenue. By 2018, however, IoT budgets in the sector are expected to jump 32% to \$102.9 million. (See Exhibits III-47 and 48.)

**Q9 (Insurance):**  
2015 Spend on IoT Initiatives (Per Survey Respondent)



**Exhibit III-47: Middle of the Pack in IoT Spend**

**Q10 (Insurance): 2018 Projected**  
Budget for IoT Initiatives (Per Survey Respondent)



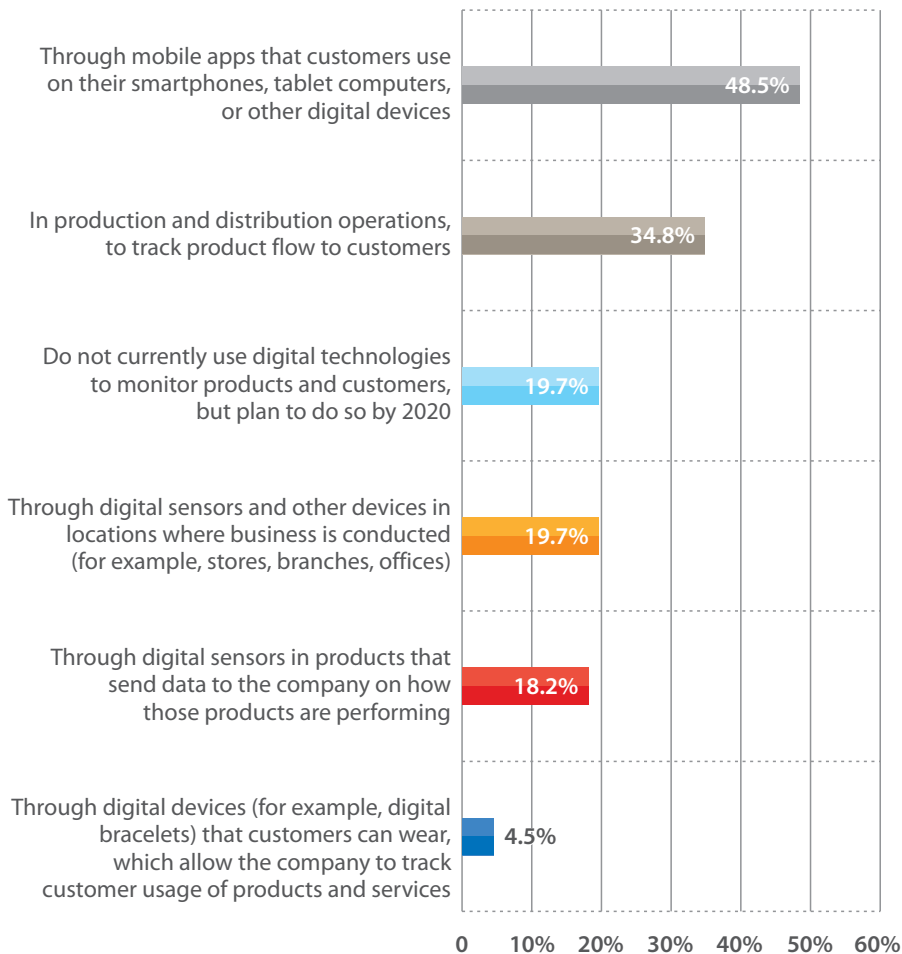
**Exhibit III-48: A Bigger IoT Appetite by 2018**



By 2020, 36% of insurance companies are expected to offer products where pricing is based on the customer's driving distance, locations, speed, and braking behavior.<sup>52</sup> The number of telematics-based policies worldwide is projected to balloon from 5.5 million in 2013 to more than 100 million by 2018.<sup>53</sup>

Smart devices are also reducing homeowner losses and insurance claims. According to a 2014 study, smart devices in homes can cut claims by 20% to 30%, reduce fire and water damage claims by 70%, and slash losses from theft by up to 80%.<sup>54</sup>

### Q3 (Insurance): Ways in which Companies Use IoT Technologies



### Exhibit III-50: How Insurers Use IoT

52 National Association of Insurance Commissioners, "Usage-Based Insurance and Telematics," [http://www.naic.org/cipr\\_topics/topic\\_usage\\_based\\_insurance.htm](http://www.naic.org/cipr_topics/topic_usage_based_insurance.htm)

53 ABI Research, "Global Insurance Telematics Subscriptions to Exceed 100 million by 2018, but Auto Insurance Faces Dramatic Changes," June 6, 2013, <https://www.abiresearch.com/press/global-insurance-telematics-subscriptions-to-exceed/>

54 The Boston Consulting Group, "Insurance and Technology: Evolution and Revolution in a Digital World," Sept. 8, 2014, [https://www.bcgperspectives.com/Images/evolution\\_revolution\\_how\\_insurers\\_stay\\_relevant\\_digital\\_world.pdf](https://www.bcgperspectives.com/Images/evolution_revolution_how_insurers_stay_relevant_digital_world.pdf)



The most common IoT tool for insurers is the mobile app, which 49% use today to track customers' usage of their policies.

Supply chain monitoring is the second largest IoT application in the industry, used by 35% of companies. Seventeen percent of 2015 IoT budgets are allotted to this use, dropping to 15% of IoT spend by 2020.

An insurance company's supply chain is primarily data, and IoT is boosting the quality, accuracy, and volume of that data. Providing more data to the insurance industry represents a burgeoning business. Europe-based Octo Telematics has collected data on more than 150 billion miles of driving. The number of cars with sensors continues to rise: Nearly 40% of 2013 model cars had sensors and other devices. By 2018, the number is expected to double.<sup>55</sup>

Twenty percent of insurance companies use IoT to monitor the places in which they do business with customers, and this type of spending will account for 15% of IoT budgets between now and 2020.

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55 National Association of Insurance Commissioners, "Usage-Based Insurance and Vehicle Telematics," March 2015, [http://www.naic.org/documents/cipr\\_study\\_150324\\_usage\\_based\\_insurance\\_and\\_vehicle\\_telematics\\_study\\_series.pdf](http://www.naic.org/documents/cipr_study_150324_usage_based_insurance_and_vehicle_telematics_study_series.pdf)

## Business Improvements and Keys to Success: The Present and the Future

Given valuable, precise IoT data, insurance companies have realized business process improvements such as stronger ability to tailor products, services, and marketing campaigns. Going forward, insurance companies plan to hone their IoT capabilities in order to improve customer segmentation and tailor products for those segments. (See Exhibit III-51).

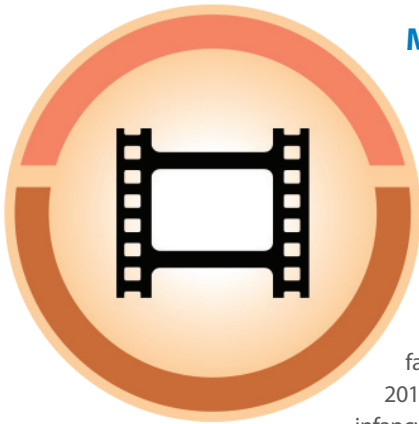
Q12 and Q13 (Insurance): Biggest Impacts of IoT Initiatives			
Top 5 to Date		Top 5 by 2020	
1 (tied)	More tailored products and/or services More tailored and/or precise customer segmentation (for example, based on how customers use company products and/or services)	1	More tailored and/or precise customer segmentation (for example, based on how customers use company products and/or services)
2	More tailored marketing and/or marketing campaigns	2	More tailored products and/or services
3 (tied)	More proactive service: identifying product problems before customers are even aware of them Better service because of more informed service reps (they can view data on how customers are using the product and/or service)	3	Better service because of more informed service reps (they can view data on how customers are using the product and/or service)
4	More profitable product pricing	4	Greater insights for salespeople on key aspects of company products (for example, product features that customers use the most)
5 (tied)	Greater insights for salespeople on key aspects of company products (for example, product features that customers use the most) Better working environments (through monitoring of light, heat, and so on)	5 (tied)	More proactive service: identifying product problems before customers are even aware of them Lower field service costs through remote diagnosis of product problems (and, therefore, lower number of technician dispatches into the field into the field) Improved user experience by making near-obsolescence products more attractive to customers (for example, by monitoring such a product and preempting its breakdown before the customer realizes)

**Exhibit III-51: Customized Products and Marketing  
Top the List of IoT Benefits**

Key success factors cited by these companies start with identifying new business and revenue opportunities and rapidly refining products. Insurance companies also note the importance of making IoT data efforts work within the organization: determining what data to capture, learning to process huge amounts of it, and deciding which technologies should be developed internally versus externally. (See Exhibit III-52.)

Q17 (Insurance): Five Top Success Factors for IoT Initiatives		
Rank	Success Factor	Type of Factor
1	Identifying and pursuing new business and revenue opportunities	Strategic
2	Acting rapidly to make adjustments to company products and processes based on IoT data	Business Process
3	Determining what data to capture from the IoT	Strategic
4	Being able to gather, process, and analyze huge amounts of digital data/Big Data	Technology
5	Determining what technologies to develop internally or externally	Technology

***Exhibit III-52: Identifying the Right IoT Opportunities  
Tops the List of Success Factors***



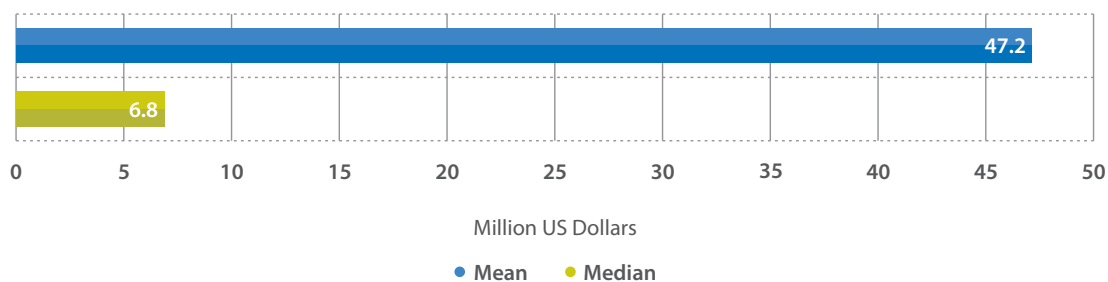
## Media and Entertainment: Entering New Frontiers of Content and Advertising

Connected devices don't get any more hyped than the Apple Watch. For media companies, apps for wearable devices can drive new subscription and advertising revenue, providing welcome relief from the tough business of online banner advertisements. In fact, the Apple Watch just went on sale in April 2015, so the business model and ecosystem is in its infancy. Media companies will need to move carefully to craft the right wearable media strategy.

None of them wants to be left behind, however. The bulk of IoT activity in the media world today centers around mobile apps: 62.5% of these companies say they monitor customer data through mobile apps.

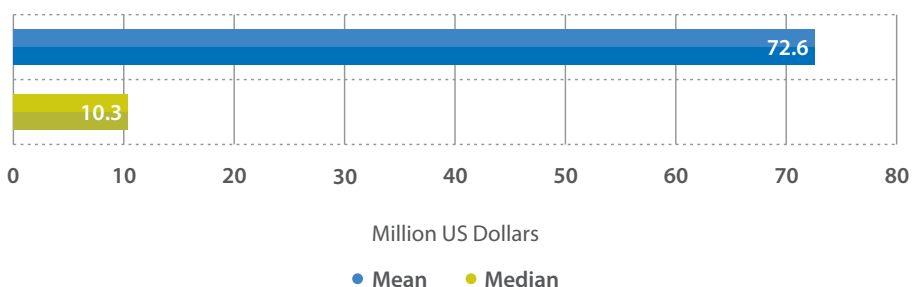
In this industry segment, which includes publishers, broadcasters, and entertainment companies, organizations plan to spend an average of \$47.2 million (a high 0.6% of average revenue) in 2015. However, they project, 2018 IoT spend will soar to an average 54% to \$72.6 million. (See Exhibits III-53 and 54.) In return for these IoT investments, the companies report a 17.4% average revenue increase in 2014 over 2013, with expectations for a 16.5% revenue increase between 2015 and 2018.

**Q9 (Media and Entertainment):  
2015 Spend on IoT Initiatives (Per Survey Respondent)**



**Exhibit III-53: How Much Media Companies Spend on IoT**

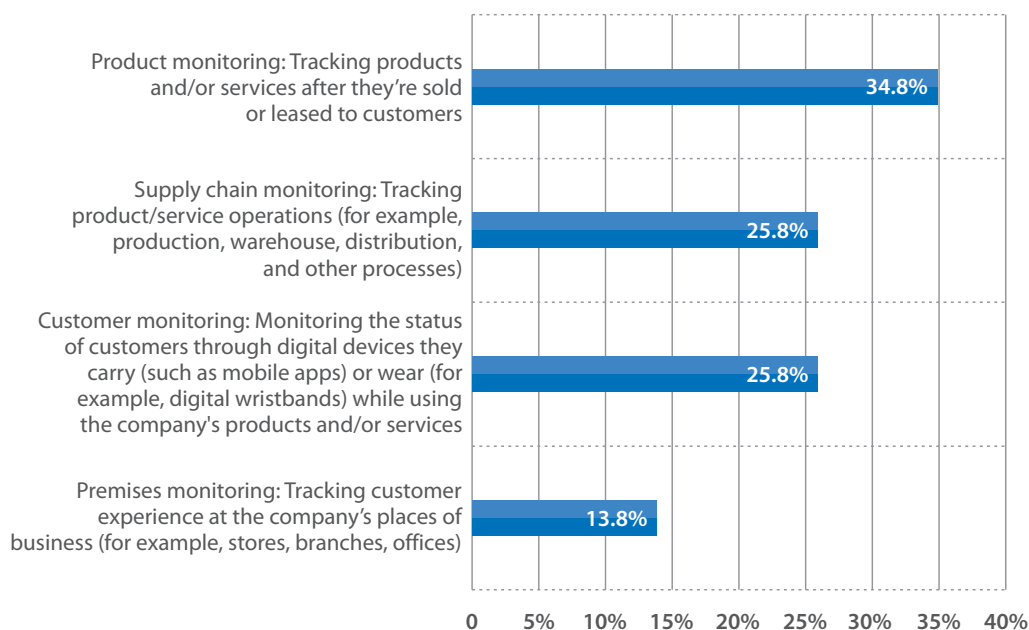
**Q10 (Media and Entertainment): 2018 Projected  
Budget for IoT Initiatives (Per Survey Respondent)**



**Exhibit III-54: Media IoT Spend Is Set to Rise Dramatically**

The bulk of their 2015 IoT spend, 34.8%, goes to product monitoring, while customer and supply chain monitoring both garner 25.8%. Premises monitoring wins 13.8%. (See Exhibit III-55.) Looking ahead, companies predict that those top two budget priorities will flip, with customer monitoring gaining 36.3% of IoT spend by 2020. That makes sense given that consumer consumption habits deliver so much value to media companies – and consumer data will be a commodity to splice and sell.

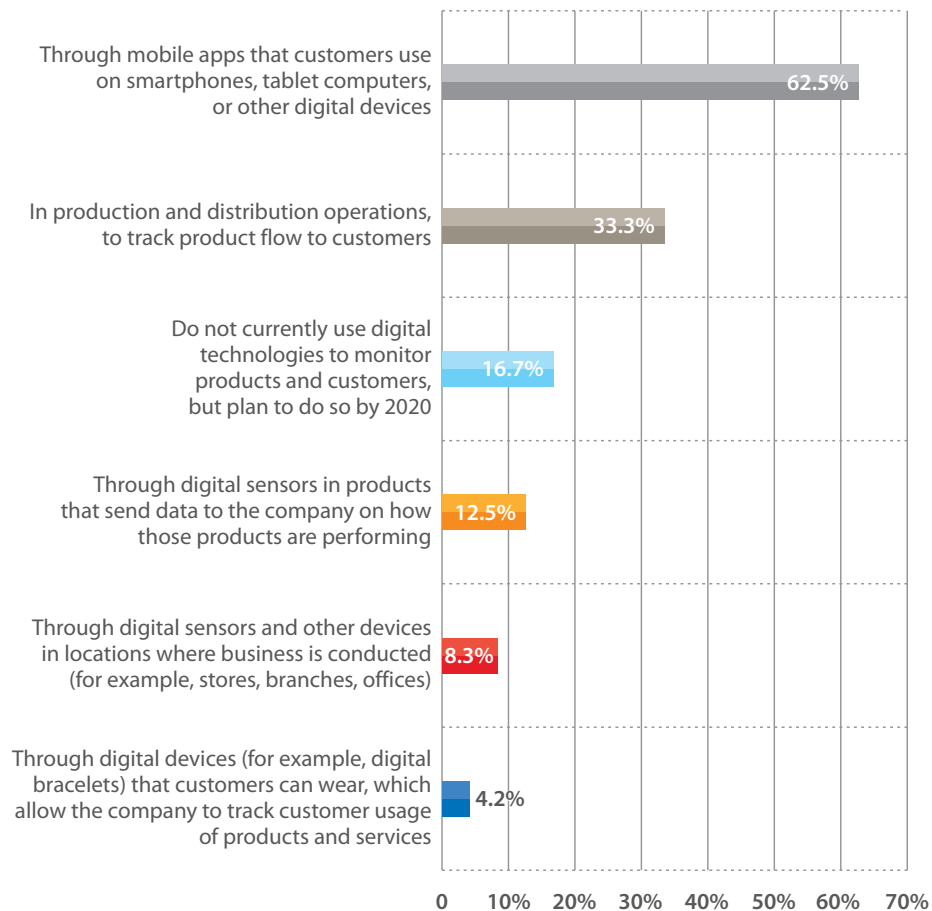
**Q11 (Media and Entertainment): Percentage of 2015 IoT Spend by Core IoT Business Area**



**Exhibit III-55: Monitoring Products Commands the Largest IoT Share**

Today, in addition to the mobile apps efforts, 33.3% of these companies monitor production and distribution operations to track product flow. On a smaller scale, media companies' IoT efforts also include digital sensors in products (12.5%), wearable devices (4.2%), and tracking devices in business locations (8.3%). (See Exhibit III-56.)

### Q3 (Media and Entertainment): Ways in which Companies Use IoT Technologies



**Exhibit III-56: Most Popular IoT Device for Media is Mobile Apps (by Far)**



Devices like the Apple Watch could create one of the biggest media viewing shifts. Many publishers (for example, Tribune Co. and New York Times Co.), TV news networks, and radio stations have prepared mobile apps for customers to read, view, listen to, or watch their content, though the advertising model will take time to evolve.

Media and entertainment companies also look at the watch as a new way to entice paying subscribers to their content. (You can envision die-hard sports fans paying for some content via a watch.) Some media experts also believe the Apple Watch will be a smart way for media companies and their advertisers to provide coupons and promotions (which in this study we have categorized under 'More tailored marketing campaigns').

One bonus is the watch is always on the shopper's wrist, not hidden away in a bag or pocket like a phone. As one media consultant, Melvin Wilson of IPG Mediabrands, told a publication, "As you walk through a supermarket you might get a notification on your Apple Watch for a loyalty program or special offer. Later, you might see Apple Watch specific ads, but brands will need to see scale before they do more than just experiment."<sup>57</sup>

What do media companies say are the keys to successful IoT efforts? (See Exhibit III-58.) For starters, it is important to understand that these companies, more than most, feel they are drowning in data. The companies collect everything from demographic data on users to detailed information on individual programs viewed or stories read – time spent on each, pages viewed, and so on. Many media companies are still struggling not only with how to collect the right data, but also how to analyze it, and most of all, monetize it. Thus the number one success factor media companies cite for IoT efforts is being able to gather, process, and analyze huge amounts of data.

Next, these companies point to knowing what IoT data to capture in the first place, and having skilled technologists and business analysts who understand the data. Content creators also need to have insight into this data in order to excel at their jobs.

This drives a significant cultural change within media companies. Inside some media startups such as Quartz (Qz.com), the traditional lines between journalists and developers are blurring, with developers and data gurus working right alongside writers and editors. Quartz promotes the idea of data-driven journalism: It's using data to tell better stories and to serve customers and advertisers better.<sup>58</sup>

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57 Michael Sebastian, "Apple Watch Creates Wrist-y Business for Publishers, Advertisers," Advertising Age, April 24, 2015, <http://adage.com/article/media/apple-watch-creates-wrist-y-business-media-advertisers/298230/>

58 From Quartz' website, <http://qz.com/about/hiring>







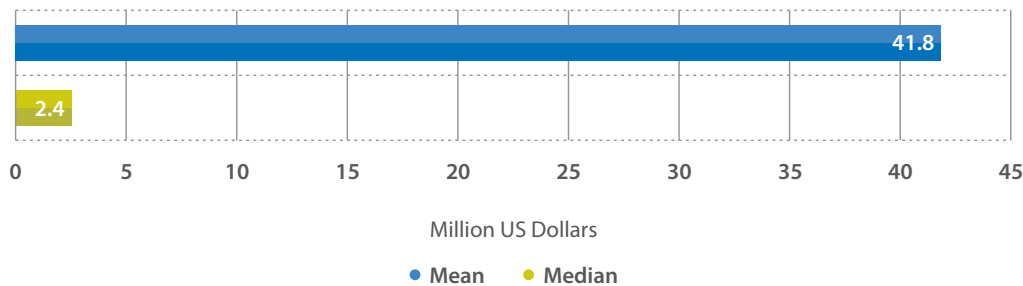
## Retail: Shopping at the Push of a Button

Amazon Dash must be giving some retail store managers nightmares. Unveiled in April 2015, this small, Wi-Fi-enabled gadget sticks to an item, say a washing machine, and lets a consumer simply press a button to reorder products like laundry detergent via Amazon Prime for home delivery.<sup>59</sup> No more being low on detergent, paper towels, or other necessities.

This example gets to the heart of what retailers want to do with IoT technologies: build loyalty and complete the sale — when, where, and how the customer desires.

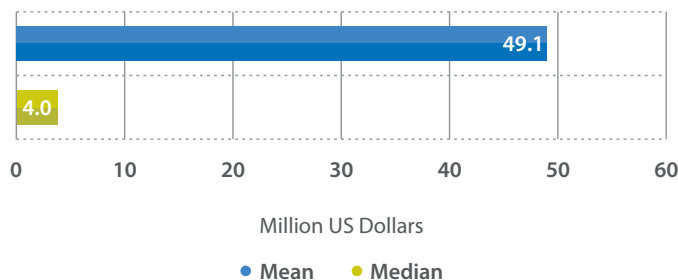
Amazon is not the only retailer that would like to use the IoT to facilitate easy reordering when household products run low. Nevertheless, retailers' ambitions may be bigger than their budgets given retail's IoT spending plans in 2015. The average retailer will spend a modest \$41.8 million (0.3% of average revenue) on IoT in 2015, with plans to spend \$49.1 million in 2018. (See Exhibits III-59 and 60.)

**Q9 (Retail): 2015 Spend on IoT Initiatives (Per Survey Respondent)**



**Exhibit III-59: A Modest IoT Budget for 2015**

**Q10 (Retail): 2018 Projected Budget for IoT Initiatives (Per Survey Respondent)**

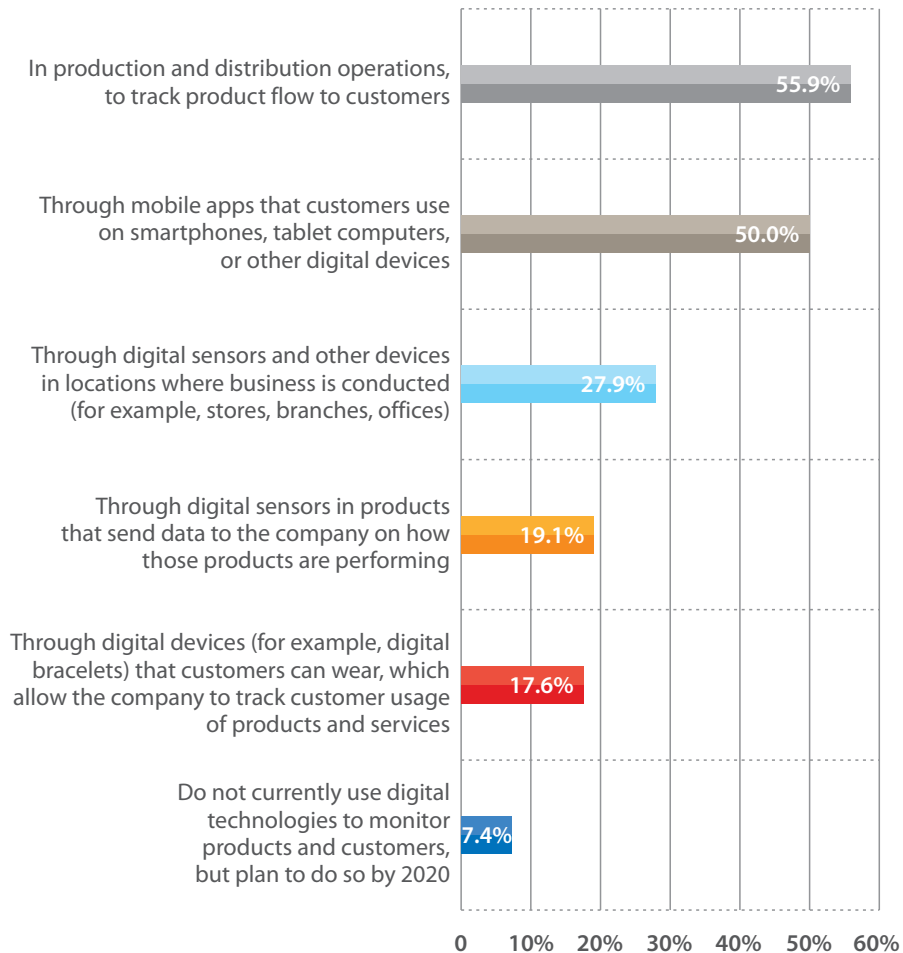


**Exhibit III-60: Conservative IoT Budgets are Expected to Continue Through 2018**

59 Mary Nohorniak, "Amazon Dash is Brilliant," USA Today, April 2, 2015, <http://www.usatoday.com/story/tech/2015/04/02/amazon-dash-is-smart-not-lazy/70824080>



### Q3 (Retail): Ways in which Companies use IoT Technologies



### Exhibit III-62: Most Popular IoT Tools in Retailers' Supply Chains

For their IoT investments, retail companies report an average revenue increase of 14.7% in 2014 over 2013, and project a 13.3% increase between 2015 and 2018.

## Business Improvements and Keys to Success: The Present and the Future

Our research of this industry included both brick-and-mortar and online retailers. Retailers such as Walmart have a long history of using RFID in the supply chain and in stores. Even so, IoT technologies and data will enable larger changes in supply chain and marketing processes.

With regard to business process improvements, retailers say IoT technology's top impact to date has been in the realm of supply chain. IoT projects help companies shift inventory to other locations while it's in their supply chain. (See Exhibit III-63.)

The other top four business process improvements center mostly around revenue generation and marketing. Retailers are using IoT to improve customer segmentation, tailor marketing campaigns and products, and provide fresh data to sales people on how customers actually use products.

Luxury retailer Burberry, known for its iconic trench coats, uses content-driven data and sensor technologies to woo its current audience: young 'millennial' shoppers. Its flagship London store uses RFID tags on clothing to offer videos about an item's craftsmanship and suggest outfit combinations as the consumer shops.<sup>60</sup>

Like consumer packaged goods companies, retailers want to use mobile apps to send deals to customers as they cruise the aisles of a grocery or department store. (Customers should be forewarned that those same IoT sensors can also target shoplifters.)

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60 Scott Davis, "Burberry's Blurred Lines: The Integrated Customer Experience," Forbes, March 27, 2014, <http://www.forbes.com/sites/scottdavis/2014/03/27/burberrys-blurred-lines-the-integrated-customer-experience/>

Q12 and Q13 (Retail): Biggest Impacts of IoT Initiatives			
Top 5 to Date		Top 5 by 2020	
1	Shifting of inventory to other locations while it's in the supply chain	1 (tied)	More tailored and/or precise customer segmentation (for example, based on how customers use company products and/or services) Lower sales costs through automated reordering
2 (tied)	More tailored and/or precise customer segmentation (for example, based on how customers use our products and/or services) Reduction in cost of sales through automated reordering for customers	2	More tailored products and/or services Reduction in cost of sales through automated reordering for customers
3	More tailored marketing and/or marketing campaigns	3	Shifting of inventory to other locations while it's in the supply chain
4	More tailored products and/or services	4 (tied)	Greater insights for salespeople on key aspects of company products (for example, product features that customers use the most) Improvement in existing products through a much better understanding of what features or functions customers are using or not using (tied)
5	Greater insights for salespeople on key aspects of company products (for example, product features that customers use the most)	5	Better service because of more informed service reps (they can view data on how customers are using the product and/or service)

### ***Exhibit III-63: Flexible Inventory the Top IoT Benefit to Date***

What separates retailers that get high ROI from their IoT projects from those that don't? The most important IoT success factor retailers rated is the ability to identify and pursue new business and revenue opportunities. (See Exhibit III-64.)

Three of the other top five success factors cited by retailers boil down to culture change. Those culture changes include getting managers and staff to tweak their thinking based on IoT data, speeding up decision making, and getting support and investment from top management.

Q17 (Retail): Five Top Success Factors for IoT Initiatives		
Rank	Success Factor	Type of Factor
1	Identifying and pursuing new business and revenue opportunities	Strategic
2	Getting managers and staff to change the way they think about customers, products, and processes for serving those customers based on new insights about how those customers are using company products	Culture
3	Accelerating the pace at which key decisions are made in the organization about products and customers, and how to serve them	Culture
4	Having top management that believes the IoT could have a major impact on business, and is willing to invest in it today	Culture
5	Making large changes in the marketing, sales, and service processes	Business Processes

***Exhibit III-64: Strategy and Culture Top the List of IoT Success Factors***

Supermarket chain Kroger faced these cultural issues when it rolled out a sensor-driven system that targeted a classic customer pain point: long checkout lines. An IoT initiative that we would classify as premise monitoring, Kroger's QueVision system uses sensors over store doors and registers, predictive analytics, and point-of-sale data to keep lines short. The project aims for customers to never have more than one person ahead of them. Rolling out the system required buy-in not only from top executives but also store managers and cashiers. Those managers contributed ideas that helped the program succeed, like showing wait times on big displays that both employees and customers could see. By 2014, Kroger says the technology helped slash the typical customer wait time from more than four minutes to less than 30 seconds — all with an eye to customer satisfaction and loyalty.<sup>61</sup>

That's just one example of how IoT can rewrite the rules for retailers. Amazon won't be the only company to keep rivals up at night.

61 Laurianne McLaughlin, "Kroger Solves Top Customer Issue: Long Lines," InformationWeek, April 2, 2014, <http://www.informationweek.com/strategic-cio/executive-insights-and-innovation/kroger-solves-top-customer-issue-long-lines/d/d-id/1141541>



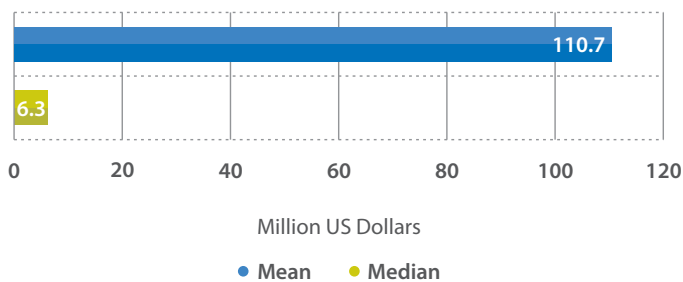
## Telecommunications: Owners of the Data Channels Set to Capitalize on IoT

Telecom owns the wireline and wireless infrastructure through which data must travel. That primary position in the value chain, of course, will translate into major IoT opportunities for the industry. Cisco estimates that mobile data traffic will soar eightfold between 2014 and 2018, reaching 685,000 terabytes per month.<sup>62</sup> Worldwide, the number will leap from 4.2 exabytes per month to 16.1.<sup>63</sup>

With those kinds of statistics staring at them, both wireless and wireline providers are jumping in the IoT game. Wireline companies such as Verizon have been broadening their offerings from telephony to broadband and television to compete with cable companies and their ability to monitor homes and offices. Verizon's IoT business grew by 45% between 2013 and 2014, reaching \$585 million.<sup>64</sup> Wireless companies will also gain as consumers and businesses need to send increasing amounts of data.

Telecom companies rank as big IoT spenders. The average 2015 IoT spend in the sector ranks fourth among the 13 we studied — \$110.7 million, which is 0.5% of revenue (median is \$6.3 million and 0.1% of median company revenue). By 2018, telecom companies are projected to have the largest per company spend, \$169.5 million (the median is \$13.1 million). That would be more than a 50% increase over 2015. (See Exhibits III-65 and 66.)

**Q9 (Telecommunications):  
2015 Spend on IoT Initiatives (Per Survey Respondent)**



### Exhibit III-65: Telecom Companies Spending Big on the IoT

62 Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2014-2019, Table 6, [http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white\\_paper\\_c11-520862.html](http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white_paper_c11-520862.html)

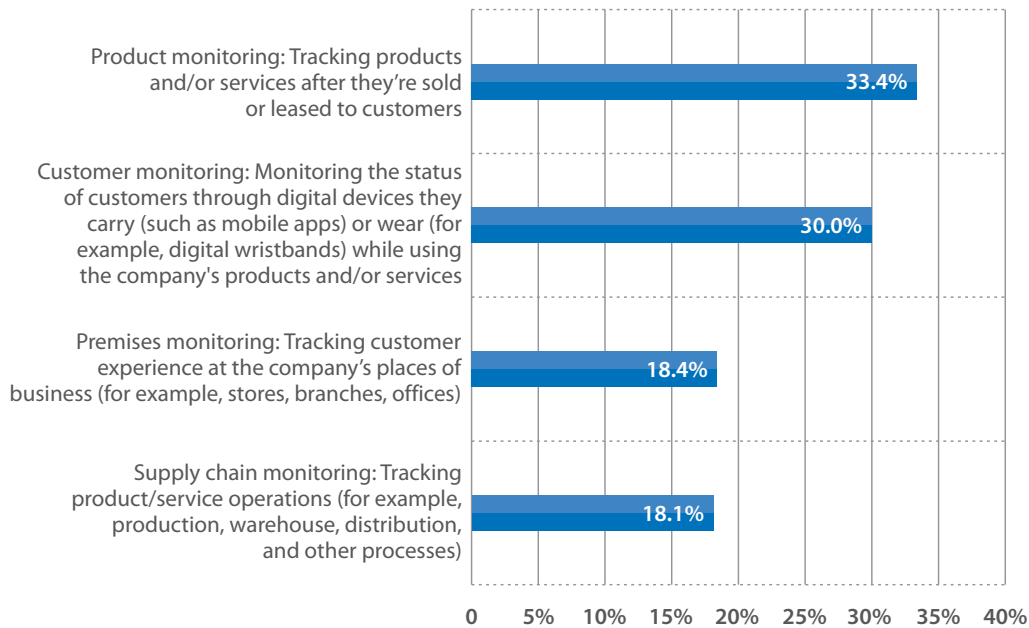
63 Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2014-2019, [http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white\\_paper\\_c11-520862.html](http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white_paper_c11-520862.html)

64 Arik Hesseldahl, "More Than a Billion Enterprise Devices Are on the Internet of Things," Re/Code, Feb. 23, 2015. <http://recode.net/2015/02/23/more-than-a-billion-enterprise-devices-are-on-the-internet-of-things/>





#### Q11 (Telecommunications): Percentage of 2015 IoT Spend by Core IoT Business Area



#### ***Exhibit III-67: Product and Customer Monitoring Consume the Lion's Share of the IoT Budget***

Monitoring customers puts telecom companies squarely between consumers and the companies that want to reach them with advertising. As increasing numbers of individuals use mobile devices to find and buy products, telecom companies will have a powerful platform to gain a larger slice of the advertising pie.

Product monitoring is also central to telecom companies—40% are using sensors for this purpose.



AT&T, for example, generates \$1 billion in annual revenue from 15 million connected devices plugged into its cellular networks, not including cars.<sup>65</sup> New innovations will only add to such numbers across the industry. A case in point is the startup Bluesmart. The company recently announced a \$299 suitcase and a partnership with Telefonica, the Spanish telecommunications company, to track luggage anywhere Telefonica has coverage.<sup>66</sup>

More than 40% of the telecom companies surveyed use IoT to monitor their supply chains. Telecom companies have vast infrastructures that rely on complex equipment. Devices that use sensors and data to anticipate and troubleshoot maintenance problems can significantly reduce costs while improving customer experience. Telecom companies are devoting 18% of their IoT budgets to monitor supply chains, and that percentage will remain at roughly the same level through 2020.

Finally, nearly 30% of telecom companies are using sensors and other digital devices to monitor the locations in which they do business with customers, such as data centers where energy savings add up. Premises monitoring accounts for 18% of 2015 IoT spend, and is projected to be at a similar level in 2020.

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<sup>65</sup> Stacey Higginbotham, 'Will mobile carriers bend their metrics for the Internet of Things', Fortune, March 11, 2015, <http://fortune.com/2015/03/11/will-mobile-carriers-bend-their-metrics-for-the-internet-of-things/>

<sup>66</sup> Ibid



What do telecom companies call the keys to success for IoT projects? They stress the importance of cultural issues, such as building internal capabilities like skilled analysts, encouraging managers and staff to change the way think, and accelerating the pace of decisions based on data. (See Exhibit III-70.)

Q17 (Telecommunications): Five Top Success Factors for IoT Initiatives		
Rank	Success Factor	Type of Factor
1	Having skilled business analysts who know how to understand what IoT data is revealing about company products in the field, the factory, the supply chain, and so on	Skills
2	Identifying and pursuing new business and revenue opportunities	Strategic
3 (tied)	Getting managers and staff to change the way they think about customers, products, and processes for serving those customers based on new insights about how those customers are using company products  Having skilled technologists who know how to develop and/or integrate IoT technologies into company products and processes	Culture  Skills
4	Determining what data to capture from the IoT	Strategic
5	Accelerating the pace at which key decisions are made in the organization about products and customers, and how to serve them	Organizational

**Exhibit III-70: Big Data Skills Top Telcos' Key IoT Success Factors**



## Travel, Transportation, and Hospitality: Big Investments to Delight Customers

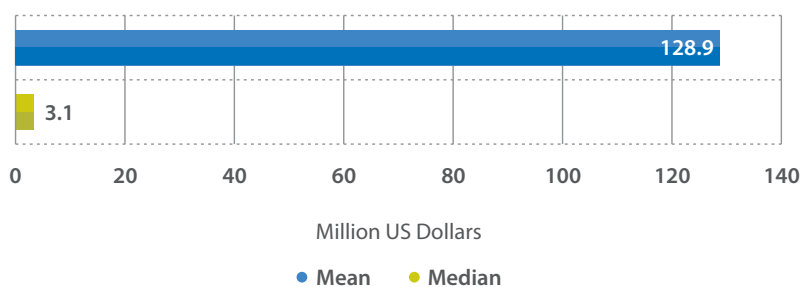


Visitors to Disney theme parks often hear employees say, “Have a magical day.” Disney hopes those trips will feel even more magical, thanks to MyMagic+, a reportedly \$1 billion program at its DisneyWorld park in Orlando, Florida. This includes electronic wristbands that add customer conveniences — like making cash-free food purchases and pushing strollers through turnstiles without fumbling for tickets — while also collecting a ton of data to help Disney shape offerings.<sup>67</sup>

Travel industry companies like Disney must delight their customers in order to keep them coming back, so experimenting early with the Internet of Things makes business sense. A striking 71.9% of these companies already monitor customers through mobile apps — one of the largest percentages among vertical industries. About one in eight (12.5%) monitors customers through wearable devices like Disney's bracelets that track product and service usage.

This industry segment, which includes airline, hotel, travel agency, and resort companies, has not been shy about investment. These companies plan on spending an average of \$128.9 million on IoT (0.60% of average revenue) in 2015, and plan an average of \$108.9 million in 2018. (See Exhibits III-71 and 72.) (It may seem strange at first glance that the spend goes down, but efforts like Disney's have a startup cost, and for everyone, mobile apps development presumably gets less expensive in the future.)

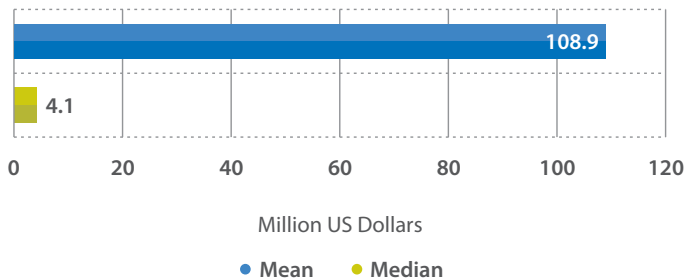
### Q9 (Travel, Transportation, and Hospitality): 2015 Spend on IoT Initiatives (Per Survey Respondent)



### Exhibit III-71: Spending the Most on Internet of Things This Year

67 Brooks Barnes, "Thomas Staggs: Disney's Heir, Apparently," *The New York Times*, April 25, 2015, <http://www.nytimes.com/2015/04/26/business/media/thomas-staggs-disneys-heir-apparently.html>

**Q10 (Travel, Transportation, and Hospitality): 2018  
Projected Budget for IoT Initiatives (Per Survey Respondent)**



***Exhibit III-72: Still Spending Heavily, But a Little Less So***

Disney's MyMagic+ initiative rolled out to all 30 million annual visitors in March 2014. For Disney's last fiscal year (which ended Sept. 27, 2014), the \$48 billion company said nearly 10 million DisneyWorld visitors had used the MagicBand bracelets. Those who use the bands spend more than the average guest, Disney says, without revealing specific numbers.<sup>68</sup>

In the travel segment, customer monitoring technologies (like Disney's MagicBands) and product monitoring win the biggest slices of the IoT budget, at 30% and 26.4% respectively, followed by premises monitoring (22.3%) and supply chain monitoring (21.2%). (See Exhibit III-73.) Those priorities do not change order in 2020 budget plans. Travel customers, when they're happy and unhappy, have much power to influence a brand's reputation. And travel companies must understand customer habits. So it's logical that customer monitoring will dominate budget priorities for the near future.

For their IoT investments, travel companies realized an average revenue increase of 16.2% in 2014 over 2013, and they project an additional increase of 15.6% between 2015 and 2018. That's not as large an average revenue increase as industrial manufacturing companies reaped, but more than healthcare companies realized — and certainly enough to get the attention of the CEO and board.

Where do IoT technologies show up in action across the travel industry? In addition to the mobile apps and wearable devices, 20.3% of travel companies do premises monitoring at their locations, and 32.8% do supply chain monitoring. (See Exhibit III-74.) It's the apps that customers notice most — and some apps solve classic travel gripes. Royal Caribbean International, for example, lets passengers track bags (tagged with RFID), book excursions, and make dinner reservations through its Royal iQ mobile app.<sup>69</sup>

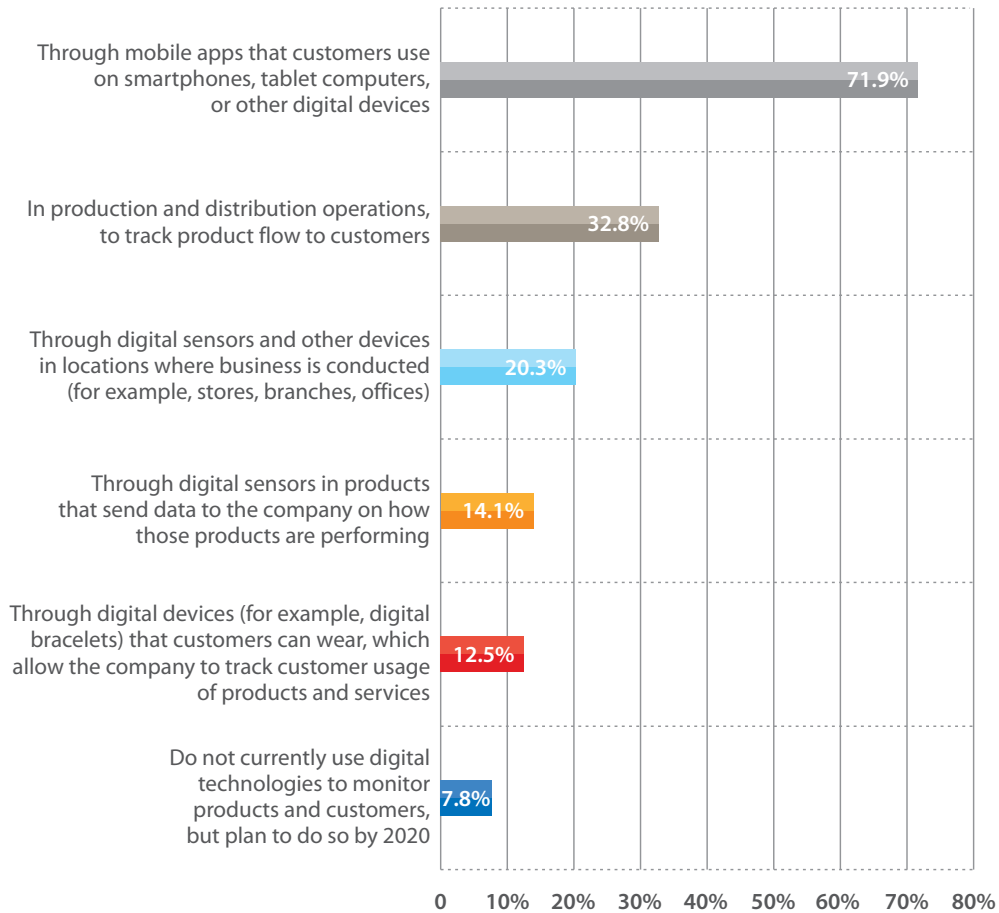
68 Michal Lev-Ram, "Disney CEO Bob Iger's Empire of Tech," Fortune, Dec. 29, 2014, <http://fortune.com/2014/12/29/disney-ceo-bob-iger-empire-of-tech/>

69 Royal Caribbean website, <http://www.royalcaribbean.com/royaliq>





**Q3 (Travel, Transportation, and Hospitality): Ways in which Companies use IoT Technologies**



**Exhibit III-74: Mobile Apps Rule in Tracking Customers**



Looking ahead to 2020, travel companies expect more tailored products and services to be the top business process improvement related to IoT efforts. Travel offers and packages will only become more personalized in the future.

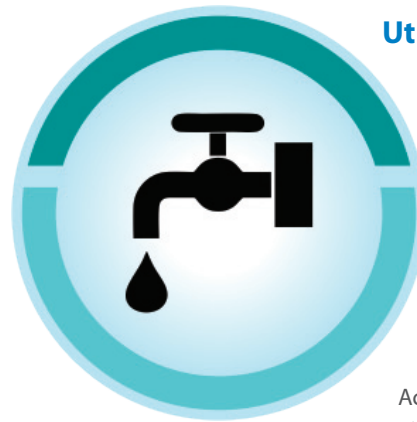
What do travel companies believe is critical to success with IoT initiatives? The top factor: identifying and pursuing new business and revenue opportunities. Second, travel companies cite top management that believes in the potential of IoT projects to impact the business and invests accordingly. (See Exhibit III-76.) If Disney's C-suite didn't support MagicBands, the idea would have died a quick death.

These companies cite two other cultural factors: getting managers and colleagues to change their thinking about how to run the business based on IoT data, and accelerating the pace of decision-making. Travel companies, more than some, may be more willing to make a great cultural change to avoid becoming dinosaurs. These people lived through the death of old world travel agencies and the rise of Orbitz — and are now witnessing the rise of Airbnb.com.

Q17 Travel, Transportation, and Hospitality: Five Top Success Factors for IoT Initiatives		
Rank	Success Factor	Type of Factor
1	Identifying and pursuing new business and revenue opportunities	Strategic
2	Having top management that believes the IoT could have a major impact on business and is willing to invest in it today	Culture
3 (tied)	Determining what data to capture from the IoT Having skilled technologists who know how to develop and/or integrate IoT technologies into company products and processes	Strategic Skills
4	Getting managers and staff to change the way they think about customers, products, and processes for serving those customers based on new insights about how those customers are using company products	Culture
5 (tied)	Accelerating the pace at which key decisions are made in the organization about products, customers, and how to serve them Acting rapidly to make adjustments to company products and processes based on what our IoT data indicates	Culture Business Processes

***Exhibit III-76: Strategy and Culture Factors Top the List of IoT Challenges***

Disney's MagicBands program, in the making since 2010, has plenty of room to expand. Today, MagicBands (with an RFID chip and a radio transmitter) transmit to thousands of radio receivers in the park, for example, even in restaurants, where food can be ordered in advance. The wristbands arrive in the mail after visitors book their trips online. Customers who sign up for an express service find the bands can be used to get on an airport shuttle to the park, check into the hotel, and so on. Tomorrow, it's up to Disney to figure out how to use MagicBands to eliminate other types of waits and hassles that annoy customers. All that collected MagicBand data will inform these decisions.



## Utilities: IoT Heats Up Turf Wars

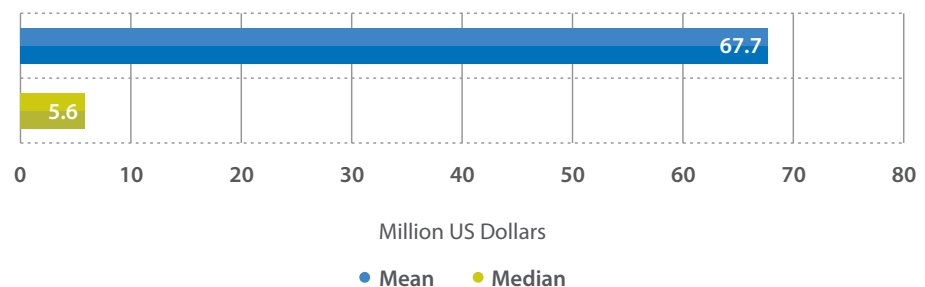
Utilities must run an IoT race against high-tech, telecom, and retail companies. Competitors for home monitoring devices include organizations such as home-improvement retailer Lowe's and cable operator Comcast, which sell devices that help homeowners manage everything from energy consumption to home security.

Utilities understand the competition is fierce. According to analysis by research firm IHS, most utility companies have plans in place to capitalize on IoT trends. Reflecting those plans, sales of smart grid sensors are expected to soar: In 2014, they accounted for 20% of total sensor revenue. By 2021, the percentage is expected to reach 75%.<sup>70</sup>

Nonetheless, the average 2015 utility industry IoT spend is relatively low, at \$67.7 million or 0.5% of revenue (the median is \$5.6 million and 0.2% of median company revenue). (See Exhibit III-77.)

In the future, average IoT expenditure is expected to decline. According to respondents from the industry, average annual expenditures on IoT will fall slightly to \$63.3 million by 2020 (median spend of \$3.2 million). (See Exhibit III-78.)

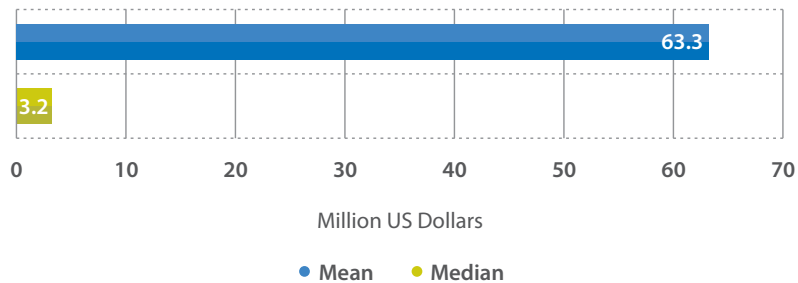
### Q9 (Utilities): 2015 Spend on IoT Initiatives (Per Survey Respondent)



### Exhibit III-77: Modest Spending on IoT This Year

70 David Deans, "How forward-thinking utilities are adopting the Internet of Things," Telecom Tech News, March 26, 2015, <http://www.telecomstechnews.com/news/2015/mar/26/forward-thinking-utilities-adopt-the-internet-of-things/>

**Q10 (Utilities): 2018 Projected Budget for IoT Initiatives  
(Per Survey Respondent)**



***Exhibit III-78: More Modest Spending on IoT in 2018***

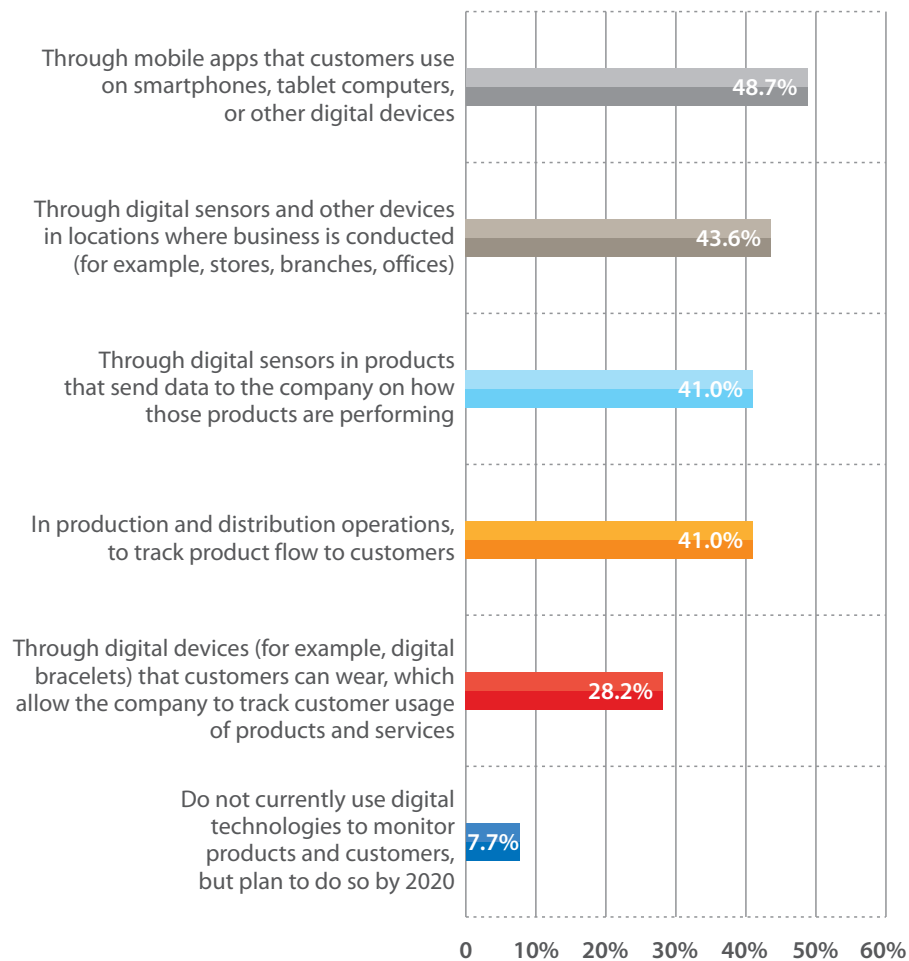
The revenue impact reflects the investment commitment: Utilities reported an 11% average revenue increase between 2013 and 2014 from IoT efforts. They project a 14% increase between 2015 and 2018.

In response to the prevalence of smart devices in homes and businesses, nearly 50% of the utilities surveyed use IoT to monitor customers. Nearly 30% are doing so with wearables. Utilities expect to devote 23% of their 2015 budgets to monitor customers, with that figure rising to 25% by 2020.

Utilities also grapple with energy efficiency in offices and plants, and 44% are using sensors and devices to realize that efficiency. Monitoring premises accounts for 20% of the current year's IoT budget and will rise to 22% by 2020. (See Exhibit III-79.)



### Q3 (Utilities): Ways in which Companies use IoT Technologies



**Exhibit III-80: How Utilities Use the IoT**





Given their history of heavy regulation and lack of competition, utilities have for years faced big challenges in changing their internal culture in order to capitalize on new technologies. (See Exhibit III-82.) The most important IoT project success factors these companies cite are unsurprising: getting management buy-in to the power of IoT, and changing manager and employee thinking about how the IoT could affect its customers, products, and processes.

Q17 (Utilities): Five Top Success Factors for IoT Initiatives		
Rank	Success Factor	Type of Factor
1	Having top management that believes the IoT could have a major impact on our business, and is willing to invest in it today	Culture
2	Getting IoT technologies to operate reliably in the field (digital sensors, microprocessors, embedded software, and so on)	Technology
3	Getting managers and staff to change the way they think about customers, products, and processes for serving those customers based on new insights about how those customers are using company products	Culture
4 (tied)	Determining what technologies to develop internally or externally	Technology
	Integrating our Internet of Things data (from sensors and other digital device) into our enterprise systems (for example, enterprise resource planning, customer relationship management, supply chain management, HR, and so on)	Technology
5 (tied)	Having skilled business analysts who know how to understand what IoT data is revealing about company products in the field, the factory, the supply chain, and so on	Skills
	Being able to gather, process, and analyze huge amounts of digital data/Big Data	Technology

***Exhibit III-82: Culture Change Dominates the IoT Agenda***

# Section IV

## Learning from the Leaders



Companies that increased revenue the most from IoT technologies (a group we'll refer to as the IoT Leaders) will invest more than three times what the companies with the lowest revenue gain (IoT Followers) will in 2015: \$229 million vs. \$68 million. However, investing heavily in IoT technologies does not guarantee benefits. In fact, nearly two-thirds of the Leaders will spend less than \$75 million each in 2015 on IoT, while 6% of the Followers will invest more than \$250 million apiece.

**IoT Leaders differ from Followers in seven primary ways:**

- They digitally reimagine their businesses to produce substantial value for customers in the form of lower costs, fewer product problems, products more tailored to their needs, and other benefits (not just value for themselves)
- They deliver that value through new business models, product and service offerings, product bundles, and data
- They see the breakthrough potential of the IoT – to get the ultimate truth on how their products and services perform and are used by customers
- They organize themselves to act rapidly based on this performance and customer usage data
- They are better at dealing with organizational resistance to the truths that IoT technologies reveal about their performance for customers
- They make IoT reliable in the field, especially in reducing the risks of security breaches
- They invest deliberately, earning small project wins before making broad investments

## What the IoT Leaders Do Differently

Some companies are making large investments in IoT initiatives: General Electric, \$1 billion over the last four years, and The Walt Disney Co., reportedly more than \$1 billion on just one initiative (at its Orlando, Fla., theme park), to name just two examples.<sup>73</sup>

These are not rare instances, our research shows. From our survey, 57 respondents (7% of the survey base) said their companies each will spend \$500 million or more this year on IoT initiatives. Of those, 26 will invest at least \$1 billion each. (See Exhibit IV-1.) Note that *not one* was an industrial manufacturer, the sector that ranks second in average spend per company.

Q9 (Global Industries): Companies Spending \$1 Billion or More on IoT Initiatives in 2015
Six banking and financial services companies
Five automotive companies
Four high-tech companies
Four travel, transportation, and hospitality companies
Three insurance companies
Two telecommunications companies
One retailer
One healthcare and life sciences company

### *Exhibit IV-1: Who are the Biggest Spenders on IoT?*

Then again, spending aggressively on the IoT is not a strategy. With industrial manufacturers ahead of the pack in many aspects, it would be easy to assume that benefits from IoT depend largely on how much a company has to invest. Yet we discovered this wasn't the case. After comparing best practice – and trailing – companies in our IoT study, we found other factors to be more important. Let's first discuss how we identified the IoT 'best practice' companies.

73 Cliff Kuang, "Disney's \$1 Billion Bet on a Magical Wristband," Wired, March 10, 2015, <http://www.wired.com/2015/03/disney-magicband/>

## How We Determined 'Best Practice' Companies

In order to provide guidance on optimal strategies, we looked deeply at two groups of research participants: those getting the most benefits to date from the IoT and those getting the fewest benefits. (We followed a similar approach in our five previous studies on digital technologies.)

We selected as 'best practice' companies those that reported the highest revenue increases in 2014 from their IoT initiatives. Each company reported a revenue gain of more than 30%. We call this group the 'IoT Leaders.' In all, they represented 8% of the total base of completed surveys, or 65 out of 795 surveys. They had an average 64% gain in revenue last year in the area of their business that was touched by their IoT initiative. That doesn't necessarily mean in total company revenue; we believe that in most cases it doesn't. (The IoT initiative could be one division, one product line, one region of the world, etc.)

We then compared the Leaders' survey answers to those of the firms with the lowest revenue gain last year from IoT initiatives. We refer to this group as the 'IoT Followers.' They numbered 180 in total, or about the bottom quartile (23%) of the survey population on the revenue impact question. Their revenue gains were between 0% and 5%, with an average increase of 2.5%. That means Leaders' revenue increase from IoT was more than 25 times that of Followers'.

## Investing Money Doesn't Equal Success

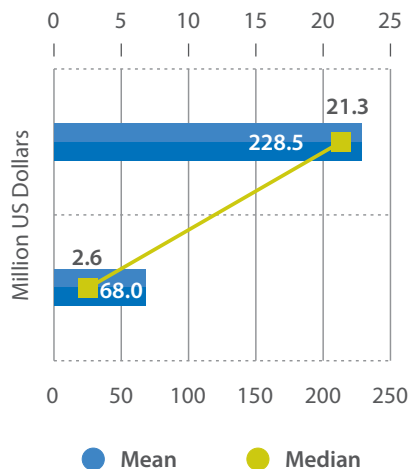
So what did we find? First, industrial manufacturers had a much higher percentage of companies in their industry – 19% – with revenue increases from IoT of more than 30% last year. That is, the industrial manufacturing sector had the highest percentage of IoT Leaders among their ilk of any of the 13 sectors. Banking and financial services (13%) and telecommunications (11%) were next. At the bottom: media and entertainment (1%). Publishers, broadcasters, and the like as a whole are struggling to generate significant revenue from IoT. (See Exhibit IV-2.)

Leaders had an average 64% gain in revenue in the area of their business that was touched by their IoT initiative.





**Q9 (IoT Leaders vs. Followers): 2015 Spend on IoT Initiatives  
(Average Per Respondent)**



### ***Exhibit IV-3: Leaders Spend More on IoT***

In addition to believing that a big pool of investment money is important to IoT success, you might assume that a high-priced product or service also helps. The assumption might be that companies selling high-ticket items such as aircraft and truck engines, boats, planes, industrial turbines, and office buildings can afford to ‘bake in’ extensive sensors and other digital devices for their high-ticket products.

Interestingly though, our study found that the companies with the highest revenue from IoT initiatives were not all sellers of high-ticket products or services. In fact, 17 of the 65 Leaders said the average price of their offerings was *less* than \$1,000, including five survey takers who said the average price of their offerings was less than \$100. The average price of Leaders’ offerings was \$2,559 – far less than what it costs to buy an aircraft engine from General Electric.



## Seven Lessons from the IoT Leaders

So if sheer spend doesn't guarantee success with IoT, what does? After poring through the data on the Leaders and Followers and connecting it to what we heard in our interviews, we found seven primary elements of success with IoT. We see these distinctions as strong guides for all companies that are investing today – or plan to invest – in IoT technologies in the years ahead:

### *1. Leaders digitally reimagine their businesses to provide a whole new level of value exchange between the business and its customers.*

The data that companies are now able to get affordably and reliably through IoT technologies – data about customers, the places they do business with customers, and (most of all) how customers are using their products – doesn't come automatically from customers. To ask for that data, companies must give customers something big in return – something that customers highly value. Put another way, companies must deliver significant value to customers in order to get value in return from their IoT data. Thus, IoT requires substantial *value exchange* between a company and its customers.

That is profoundly different from previous waves of technology investments, which didn't require a company to get data on how customers were using its products or services. For example, companies implementing enterprise resource planning systems during the last 20 years haven't had to ask customers for their approval, because those customers didn't have to fork over their own data. ERP systems enabled companies to better organize and manage their own data – from their finance, supply chain, and other internal operations. The same was true with customer relationship management systems; the data in those systems was data that a company generated in marketing, selling to customers, and servicing those customers. However, product usage data always remained with the customer.

IoT data is very different – particularly post-sales data that monitors product usage. When customers take possession of those products, the company's right to monitor product usage data doesn't come automatically. Companies must secure those rights. As a result, something of value must be handed to customers in return. Executives who want their companies to capitalize on IoT technologies must focus as much or more on delivering *customer delight* as they do on delivering shareholder delight by increasing revenue and decreasing costs. Without the first, the second won't happen.

That's the value exchange we're talking about.

"There has to be a value exchange," said Jonathan Ballon, a vice president in Intel Corp.'s Internet of Things group. Naresh Shanker, CIO of Hewlett Packard's personal systems and printing business (soon to be called HP Inc. after its split from HP's other businesses later this year), told us something similar. "There has to be customer value – cost savings, very high quality ink, a great customer experience – all of that," he said. "At the end of the day, the fundamental driver for us is you have a great and simple user experience; it has to be driven from a customer value point of view. If you drive it from those two dimensions, you create lifelong customer value."

Naresh Shanker, CIO of Hewlett Packard's personal systems and printing business, says: "At the end of the day, the fundamental driver for us is you have a great and simple user experience; it has to be driven from a customer value point of view. If you drive it from those two dimensions, you create lifelong customer value."

From our research, we found that value for the customer from their suppliers' IoT initiatives can take a multitude of forms. The ones in Exhibit IV-4 are some of the most noteworthy that we found in this study.

Primary Sources of Customer Value From IoT Initiatives		
What Types of Value They Produce	How They Produce That Value	Examples
Solve product problems before they occur	Enable predictive and preemptive maintenance through product monitoring Provide software-enabled product updates Enable supply chain monitoring that catches defective products before they're shipped	GE monitors jet engines Sensors in wind farm turbines identify maintenance problems Australian water utilities use the IoT to detect water leaks
Solve people problems before they occur	Assist customers with how to operate products safely Provide software-enabled product updates Monitor the premises in which customers do business with you to make sure they're safe	Home monitoring of acute-care patients (for example, Boston Scientific's wireless telemetry monitoring system for heart patients) Driverless and driver-assisted cars, reducing accidents from faulty usage of products (for example, Google believes driverless cars could substantially reduce the 1.2 million deaths that happen annually from car crashes) Digital cameras that monitor bank branches, hotel floors, office complexes, parking garages, and so on
Reduce customers' logistical problems in using your offerings	Design friction-free experiences for customers by making it easier to get access to your offerings (for example, shorter queues), sensing when supplies are low and automatically refilling them, etc. Help customers track where their products are after they buy them	HP Instant Ink's just-in-time ink cartridge supply Amazon's home grocery item replenishment services DisneyWorld's MyMagic+ service taking away the ordeals of families in having to navigate long lines Bluesmart (luggage maker) and Telefonica's partnership for tracking consumers' luggage Kroger reducing grocery store checkout lines through premises monitoring technologies Tesla saving customers' time with over-the-air car fixes Retailers, restaurant chains, and others using premises technologies to shorten lines Car makers reducing the time drivers spend in traffic (Google says drivers globally waste 6 billion minutes in traffic every day)
Lower the cost of using your product	Automatically sense issues and guide customers on how to use the product more efficiently	HP Instant Ink's monitoring of customers' printer ink supply
Give customers more of the features they want	Gain a much deeper understanding from product usage data about customer segments and their preferences in features/ functions Introduce new products that target customers better, using deeper knowledge of customer preferences and behaviors	Auto insurance companies tailoring premiums based on actual driving behavior: miles driven, speed and braking, and so on Tesla making software-downloaded vehicle upgrades (for example, wider driving ranges for electric batteries)
Alert customers to new deals they may want	Use sensors that track customer proximity to locations and provide promotions based on past buying behavior	Telcos and retailers partnering to help retailers identify customers through their mobile devices and push out promotions to mobile apps
Lower customers' total operating costs	Put sensors in the field to monitor conditions and recommend adjustments to equipment and processes	GE's aircraft engine division helping airlines get better fuel mileage ConocoPhillips saving hundreds of millions of dollars in oil and gas drilling Smart devices in homes reducing fire and water damage claims by alerting consumers to pending problems
Reduce fraudulent use of products	Use customer verification technology to authenticate that the customer is the user of the product	Citigroup exploring biometrics such as fingerprints Visa using mobile phone location data to identify credit card customers

**Exhibit IV-4: What's in IoT for Customers? The Value That Companies Can Deliver**



2. By delivering new and substantial value to customers, Leaders are better able to make money from that value through new business models, product and service offerings, product bundles, and selling data.

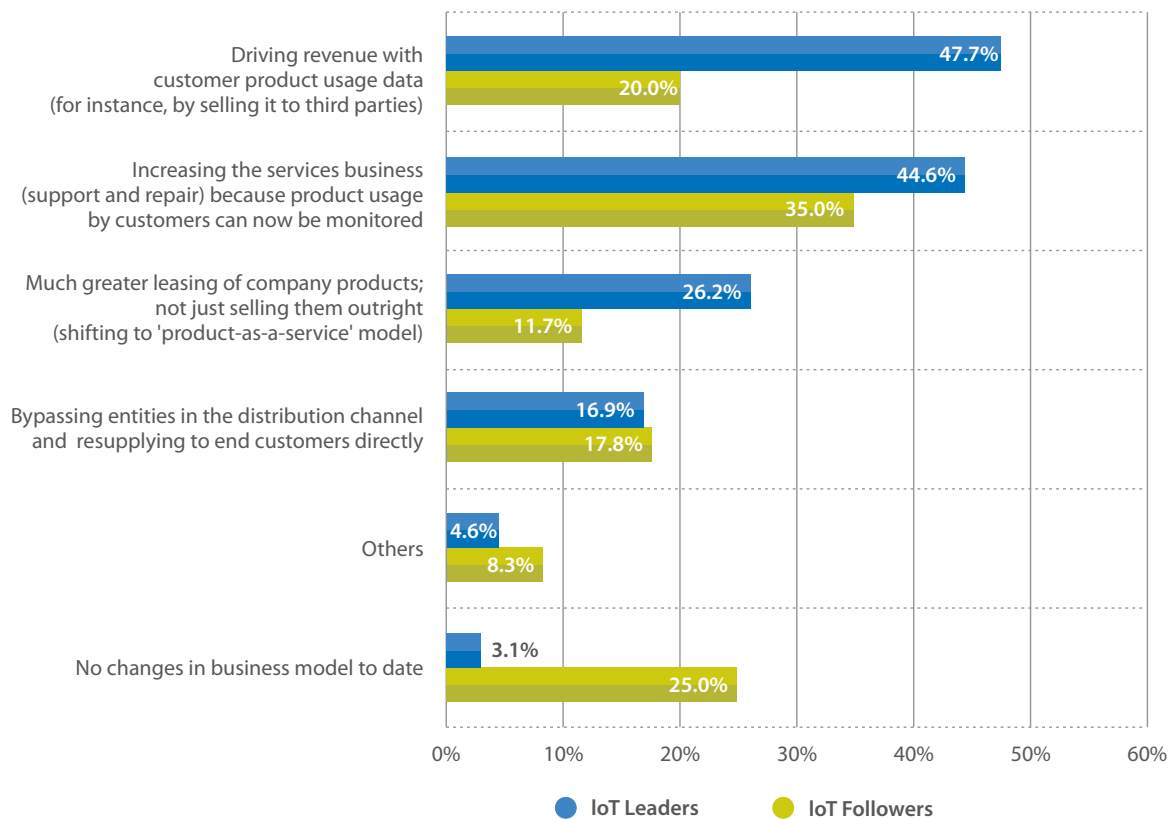
In comparing the results of Leaders and Followers by the percentage that adopted new business models, leaders were twice as likely to make some business model changes:

- Selling data that tracks how customers use products: 48% of Leaders have done so vs. 20% of Followers.
- Shifting toward product leasing and a 'product-as-a-service' model because customer data enables the company to price its offering by usage: 26% of Leaders have done this vs. 12% of Followers.

Additionally, a higher percentage of Leaders (45%) have bolstered their product support and repair business because they can monitor how customers use their products, compared with 35% of Followers. (See Exhibit IV-6.)

Still, it's very much the early days of making radical business model changes from IoT efforts. Even for Leaders, less than half have made all of the business model changes of the type we're pointing to here. However, since only 3% of Leaders said they haven't made any business model changes, that shows the overwhelming majority have made at least one business model change. In contrast, 25% of Followers hadn't made any changes to their business model because of the IoT.

**Q15 (IoT Leaders vs. Followers): Percentage of Companies that have made Business Model Changes because of IoT Initiatives**



**Exhibit IV-6: Leaders Outpace Followers in Changing the Business Model**



Other big differences stood out between Leaders and Followers and how they recognize potential revenue opportunities from the IoT. We noticed these differences in the way they rated the key success factors of IoT initiatives. (See Exhibit IV-7.) Leaders rated every success factor to be more important than did the Followers. Some of the biggest gaps between how Leaders and Followers rated success factors were on issues related to new business models:

- Gaining ownership or access rights to use information from product usage data
- Directly distributing products or product resupplies and cutting out middlemen, as well as managing conflict with distribution partners on the usage of data
- Changing the business model
- Determining whether and how to sell product usage data to third parties

Q17 (Leaders vs. Followers): How they Rate the Key Success factors of Getting Benefits From IoT (Scale of 1-5, 1= no importance, 5= very high importance)				
IoT Initiative Success Factors	Category	Leaders' Score	Followers' Score	Point Gap
Identifying and pursuing new business and revenue opportunities	Strategic	4.12	3.53	59
Getting managers and staff to change the way they think about customers, products, and processes for serving those customers based on new insights about how those customers are using company products	Cultural	4.12	3.32	80
Determining what data to capture from the IoT	Strategic	4.11	3.38	73
Having skilled technologists who know how to develop and/or integrate IoT technologies into company products and processes	Skills	4.03	3.17	86
Getting product and functional managers to act on the trend data being gathered on how customers are using company products	Cultural	4.02	3.03	99
Accelerating the pace at which key decisions are made in the organization about products, customers, and how to serve them	Cultural	3.98	3.24	74
Having top management that believes the IoT could have a major impact on our business and is willing to invest in it today	Cultural	3.97	3.32	65
Determining what technologies to develop internally or externally	Technology	3.97	3.22	75
Integrating IoT data (from sensors and other digital devices) into enterprise systems (for example, enterprise resource planning, customer relationship management, supply chain management, HR, and more)	Technology	3.95	3.17	78
Having skilled business analysts who know how to understand what IoT data is revealing about company's products in the field, the factory, the supply chain, and so on	Skills	3.95	3.23	72
Gaining ownership or access rights to use the data generated from customer usage of company products	Customer	3.94	3.03	91
Having a group analyze IoT data to understand how customers are using company products	Organizational	3.91	3.00	91
Being able to gather, process, and analyze huge amounts of digital data/ Big Data	Technology	3.89	3.42	47
Determining what types of IoT data will have the greatest impact on the business	Strategic	3.89	3.22	67
Getting IoT technologies to operate reliably in the field (digital sensors, microprocessors, embedded software, and so on)	Technology	3.88	3.15	73
Making large changes in the marketing, sales, and service processes	Business Process	3.78	3.09	69
Managing potential or real conflict with the channel partners (for example, brokers, retailers, distributors, and so on) over what can be done with the customer usage data the company is getting from digital sensors in its products	Channels	3.77	2.88	89
Being willing to directly distribute company product (or product supplies that keep products running) to customers and cut out middlemen since 'smart, connected' products can indicate when customers need to be resupplied	Channels	3.75	2.81	94
Acting rapidly to make adjustments to company products and processes based on what the IoT data indicates	Business Process	3.72	3.35	37
Making large changes in the supply chain processes (production, distribution, and so on)	Business Process	3.69	2.90	79
Changing the business model (for instance, from selling to renting products)	Strategic	3.66	2.52	114
Determining whether and how to sell product usage data to third parties	Strategic	3.60	2.59	101

**Exhibit IV-7: Leaders More Likely to See the Importance of New IoT-Enabled Business Models**



*3. Leaders are more likely to see the breakthrough potential of IoT technologies: to obtain the ultimate truth on how their offerings are performing and being used by customers.*

Before the onset of affordable digital sensors, digital cameras, and low-cost communication networks this decade, it was impossible for companies to feasibly track how customers were actually using their products and services, and the performance of those offerings. Companies had to rely on partial visibility – for example, through complaints to the call center or sales force.

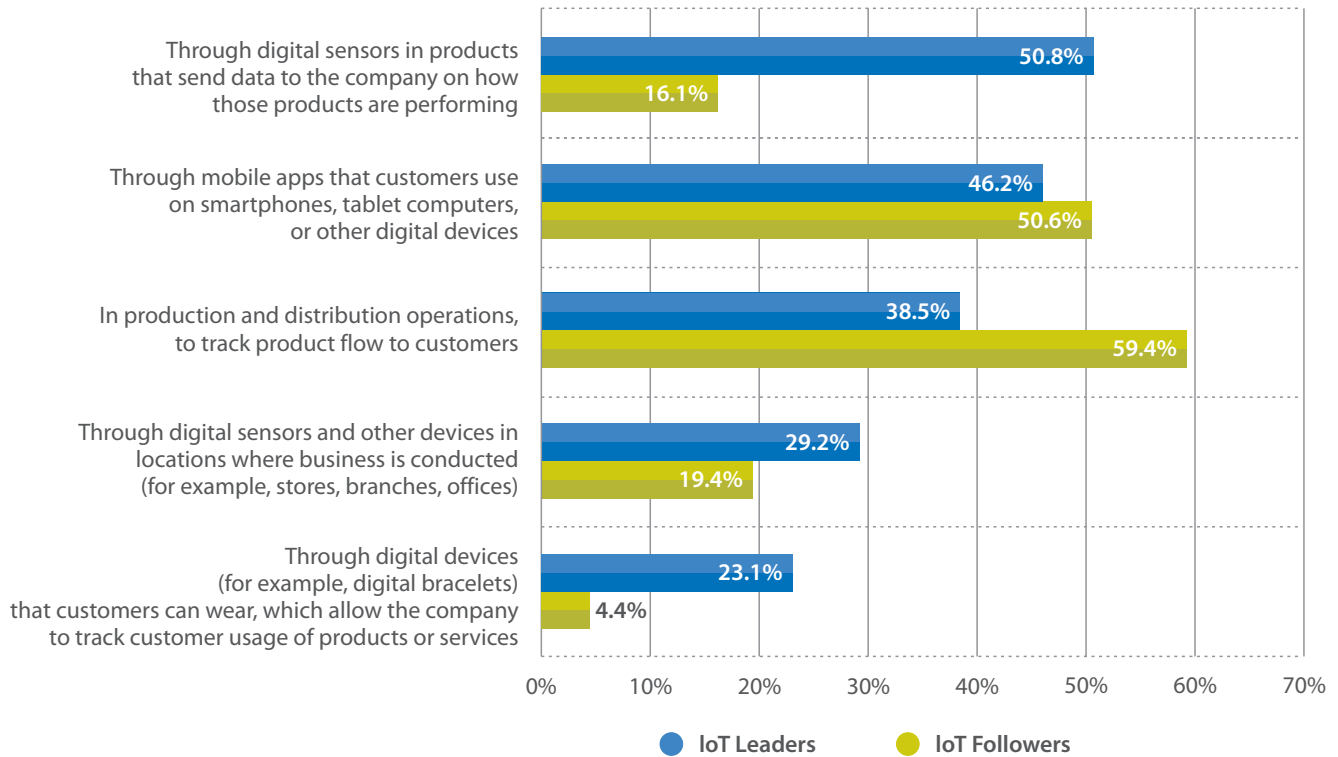
Now the increasing power, affordability, and adoption of IoT and other digital technologies give companies much broader and continuous visibility on how they're performing for customers. (See Exhibit IV-9.) Put another way, companies can get a much deeper understanding of the 'truth' about their standing with customers. In fact, four types of truth become more apparent:

- **Customers' perceptions of the truth** – Via *customer monitoring* technologies such as looking at mobile app behavior, social media comments, and more, companies have unprecedented amounts of data on customers' perceptions of them and their offerings.
- **The truth about the environment companies provide to customers** – Via *premises monitoring* technologies, companies are gaining increasing insights on the truth about the environment they bring to customers – a hotel chain's hotels, a bank's branches, a retail chain's stores, and so on.
- **The truth about their products en route to customers** – Via *supply chain monitoring* technologies, they are getting deeper truths about the products they've made and which are en route to customers.
- **The truth about how their products are actually performing for customers** – Via *product monitoring* technologies, how a company's products are actually performing for customers and how those customers are using them. We refer to this as the 'ultimate truth,' and it's the most recent but biggest piece of the operational metrics pie.





### Q3 (IoT Leaders vs. Followers): Ways in which Companies Use IoT Technologies



### Exhibit IV-10: IoT Leaders Are More Likely to Monitor Their Products than Followers

We believe the collection and analysis of data from product monitoring technologies is a primary reason why Leaders generated far more revenue from their IoT initiatives last year than did Followers. Many more Leaders than Followers see the enormous competitive potential of product usage tracking data.

Even though this data provides companies with the ultimate truth about their offerings, combining it with the other three types of data will be even more powerful.



Imagine the following scenario: An automobile company's onboard telematics systems (i.e., a *product monitoring* technology) begins to signal there's a problem with the radiators of a new car model. Through its social media listening technologies (which is one type of *customer monitoring* technology), the company also begins to notice hundreds of customers complaining to their friends about this car model overheating. This is a PR disaster in the making. In the meantime, digital cameras in dealerships show how angry affected customers are about the issue. In other words, the auto company's *premises monitoring* technology shows its white-hot customer issue. From its *supply chain* monitoring technology, the car company soon traces the defect to one of its factories or a supplier's factory.

All of this can happen in a few days (perhaps even one). The car company knows exactly how many customers are affected, how angry they are (customers' perception of the truth), the source of the problem (the truth about the products en route to customers), the dealership environment this is creating (the truth about the customers' buying environment), and the exact problem in the field (the ultimate truth). The company has the tools it needs to nip a PR disaster in the bud.

While this is a fictitious scenario, it isn't science fiction anymore. In fact, it's one we can see soon becoming possible with the Internet of Things for companies of all types. However, it begins with a new appreciation of product usage tracking data – the unprecedented information available to any company that gets its customers' permission to track how they're using its products or services.

#### *4. Leaders organize and operate themselves to act quickly on 'the truth' about their businesses.*

Despite the power of IoT technologies to help companies rapidly learn the truth about their products, services, premises, and customers, the data is just a means to an end. The end, of course, is fixing a product or other customer problem in the field quickly – or even before the customer knows there's a problem.

This requires a company to be able to handle truly Big Data – enormous volumes of digital information streaming in from thousands of sensors in its products, premises, and supply chains, and digital information from customers who have opted in to mobile apps. It also requires companies to push the ability to act on this data back into the field – ideally to create products and services that can correct themselves.

Companies need Big Data and analytics functions that can deal with the data deluge. One of the biggest differences between Leaders and Followers was the emphasis the Leaders placed on having a group that focused on analyzing IoT data to deeply understand how customers are using the firm's products. They gave it a 3.91 importance rating, while Followers said it was only moderately important (3.00). General Electric has invested \$1 billion to create such a group over the last four years.

It is clear though that the ability to handle and divine insights from Big Data is not nearly enough. Companies must be able to act on it quickly. For large manufacturing companies that have large field service forces, IoT systems should be connected to their enterprise systems – enterprise resource planning software, supply chain management systems, CRM, and more. Field service technicians must be scheduled quickly. Parts must be distributed rapidly as well. Warranty systems need to be available to check whether payment will be owed. Customer call center reps need to know what actions the company has set into motion to fix a problem that an angry customer is describing over the phone. The sales force needs to know what's happening with customers before being called on the carpet.

Leaders place much greater importance on being able to react rapidly in a world in which IoT technologies quickly send back data on the status of their customers, products, services, and premises. They gave it a 4.02 importance rating on our scale of 1-5, while Followers gave it an average 3.03. That was one of the biggest gaps we found between Leaders and Followers about the key success factors of IoT initiatives.

In our work, we find companies using internal analytics teams that focus on 'smart data' from millions of connected devices. These teams are learning from patterns of historical Big Data, often through machine learning techniques and algorithms. For example, some big restaurant companies have put sensors in their stores and cooking equipment to determine how to optimize oil and energy usage in every fryer.

*5. Leaders deal more effectively with major organizational resistance to the truth that IoT technologies uncover regarding product or service performance.*

Of all the technologies that big companies have adopted during the last 50 years, IoT technologies may create the greatest organizational resistance. Such technologies provide data on issues that are highly sensitive in a company: exactly how their products and services are performing – or not performing – for customers. Companies can expect significant resistance to hearing what we referred to earlier as ‘the ultimate truth.’

“Without question, the biggest barrier to the Internet of Things by a large margin is cultural,” says Intel’s Jonathan Ballon, who before moving to Intel last October was heavily involved in GE corporate strategy and the firm’s software and analytics center in San Ramon, Calif. “It’s organizational inertia that gets in the way. People are afraid about what new technologies might reveal about the business.”

It’s one of the reasons that all of the companies we interviewed told us that without strong support and understanding at the very top, their IoT initiatives would not have gone very far. As Intel’s Ballon put it: “The companies I find that are brave are driving this change from the top. The more timid and change-averse companies tend to dig in with their feet, get lost in the weeds, and take too long to make technology decisions.”

At General Electric, CEO Jeffrey Immelt has been front and center publicly about the importance of the company’s ‘Industrial Internet’ strategy. The leaders at the top of Intel, and HP have been similarly supportive. So has the CEO of Walt Disney Company, Robert Iger. A 2014 *Fortune* magazine article<sup>75</sup> about Iger painted a picture of a CEO who was totally comfortable with and immersed in technology decisions:

“Iger surrounds himself with people who are steeped in both worlds, but he has made a deliberate decision not to have a chief technology officer. In fact, he’s the closest thing the company has to a central head of tech. And while there are many lessons to learn from the way he has run Disney over the past decade, this one is right up there: Not only do today’s media companies need to start thinking like technology companies—their CEOs also need to start thinking like CTOs.”

Disney’s openness to new technologies at the very top of the company will be a model that every firm will have to follow in an IoT age.

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75 Michal Lev-Ram, “Disney CEO Bob Iger’s empire of tech,” *Fortune*, Dec. 29, 2014. <http://fortune.com/2014/12/29/disney-ceo-bob-iger-empire-of-tech/>

## *6. Leaders make IoT reliable in the field – especially in providing security against hacking and data leakage.*

Digital sensors, cameras, embedded software, and other IoT technologies considerably increase the technology risks of companies. It's one thing for a large global automotive manufacturer to have its financial or ERP systems down because of a hardware or software glitch or because it was hacked by an insider or outsider; it may have to close its books at the end of a quarter a day later, or send orders to its factories by phone. It's a whole other issue when a firm's embedded product technologies fail because of hacking or a software bug: technology-assisted cars may not be able to help drivers avert crashes, or even worse, a car maneuvered totally by its onboard systems may get into an accident because the consumer placed his trust in his driverless vehicle. (Several automakers and technology companies, including Google, have stated publicly that the driverless car will be possible very soon. The head of Google's self-driving car initiative said earlier this year that the company expects such cars to be on the road in the next two to five years.<sup>76</sup> In fact, the company said in May that its prototype will be operating on California roads this summer – with a driver riding along, as is required by law in the state.<sup>77</sup>)

Making early inroads on the potentially huge security risks of IoT technologies was a key reason why Intel bought a security software firm (McAfee) for \$7.7 billion in 2010. In its press release announcing the acquisition, Intel said it will "ultimately better protect consumers, corporations, and governments as billions of devices – and the servers and cloud networks that manage them – go online."<sup>78</sup> William Ruh, the General Electric vice president who heads the company's Global Software Center, sees new attention in the industrial world being paid to what he calls "operational technology cyber security" (vs. IT security for the data center, PCs, etc.). He believes that operational technology cyber security will be a crucial way for GE to differentiate its offerings.

Despite all these concerns, the Leaders in our study don't appear to be frightened off by the technology risks of the IoT. They collectively assigned its importance to IoT success 3.88 on our rating scale of 1 to 5. (See Exhibit IV-7.) However, they rated 14 other IoT success factors to be more important.

In addition to security risks, IoT technologies also pose big risks around privacy intrusions. B2B companies such as GE have very specific policies on the data they can use as a result of field monitoring products – policies they fully share with their customers. However, many companies that sell to consumers have a ways to go on this front. For example, the U.S. auto insurance industry is wrestling with consumer privacy issues as more usage-based insurance policies take hold. In fact, some states have enacted laws requiring auto insurance firms to fully disclose to consumers what information their telematics devices are collecting.<sup>79</sup>

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76 CBS/AP article quoting Chris Urmson, director of the driverless car initiative at Good, "Google Expects Public to Use Driverless Cars on Public Roads in 2-5 Years," Jan. 15, 2015. <http://sanfrancisco.cbslocal.com/2015/01/15/google-expects-public-to-use-driverless-cars-on-public-roads-in-2-5-years-chris-urmson-detroit/>

77 Alex Davies, "Google's Plan to Eliminate Human Driving in 5 Years," Wired, May 18, 2015. <http://www.wired.com/2015/05/google-wants-eliminate-human-driving-5-years/>

78 Adrian Kingsley-Hughes, "Why did Intel buy McAfee for \$7.7 billion?" ZDNet Insights newsletter, Aug. 19, 2010. <http://www.zdnet.com/article/why-did-intel-buy-mcafee-for-7-7-billion/>

79 2015 National Association of Insurance Commissioners and the Center for Insurance Policy and Research article, "Usage-Based Insurance and Telematics," April 24, 2015. [http://www.naic.org/cipr\\_topics/topic\\_usage\\_based\\_insurance.htm](http://www.naic.org/cipr_topics/topic_usage_based_insurance.htm)

“We see lots of companies trying to do hugely transformational things [with the IoT],” Intel’s Ballon told us. “But they are getting bogged down. Many companies try to boil the ocean.”

### *7. Leaders invest deliberately before writing big checks.*

As we’ve seen in our research, IoT initiatives can involve enormous investments. As our study found, many companies will be making major investments in the IoT this year. In fact, 12% said they’ll spend \$100 million or more this year, with 3% spending at least \$1 billion. However, as we’ve stated, spending big doesn’t at all guarantee benefits.

That leads us to our seventh observation on the primary ways that Leaders differ from Followers: The former are much more deliberative about their IoT spend. They are more likely to test it in one area of their business before triggering wide-scale adoption and big investments. Intel’s investment in IoT to improve its internal operations is a case in point. Its supply chain IoT initiative started with one plant (in Malaysia) rather than every Intel chip-making or assembly plant. Now that the effort has shown itself effective, Intel plans to roll it out more extensively.

The IoT Leaders place greater importance on having clarity on which IoT opportunities to explore first. They rated as most important to IoT success the ability to identify and pursue new business and revenue opportunities (giving it a 4.12 rating on the 1-5 scale). While Followers also rated it to be their most important success factor, they weren’t as strong about its importance to success. They gave it an average score of 3.53, which was more than ‘moderately important’ but less than ‘highly important.’

By starting small in one area of their business – one product, product line, factory, theme park, retail brand, or store region – big companies will be able to learn a tremendous amount about what it takes to deliver exceptional value to customers through IoT technologies, and of course, how to generate value for themselves. Although because, as this study shows, many companies are now investing aggressively in the IoT, they will also have to be ready to rapidly scale up their successful experiments to stay ahead of competitors that also see the vast opportunities of IoT.



# Section V

## Case Studies – GE, HP, Intel, and PTC







## GE Connects Industry to the Internet of Things

General Electric invests big when it comes to the Internet of Things, or what the \$148.6 billion manufacturing giant calls the 'Industrial Internet.'

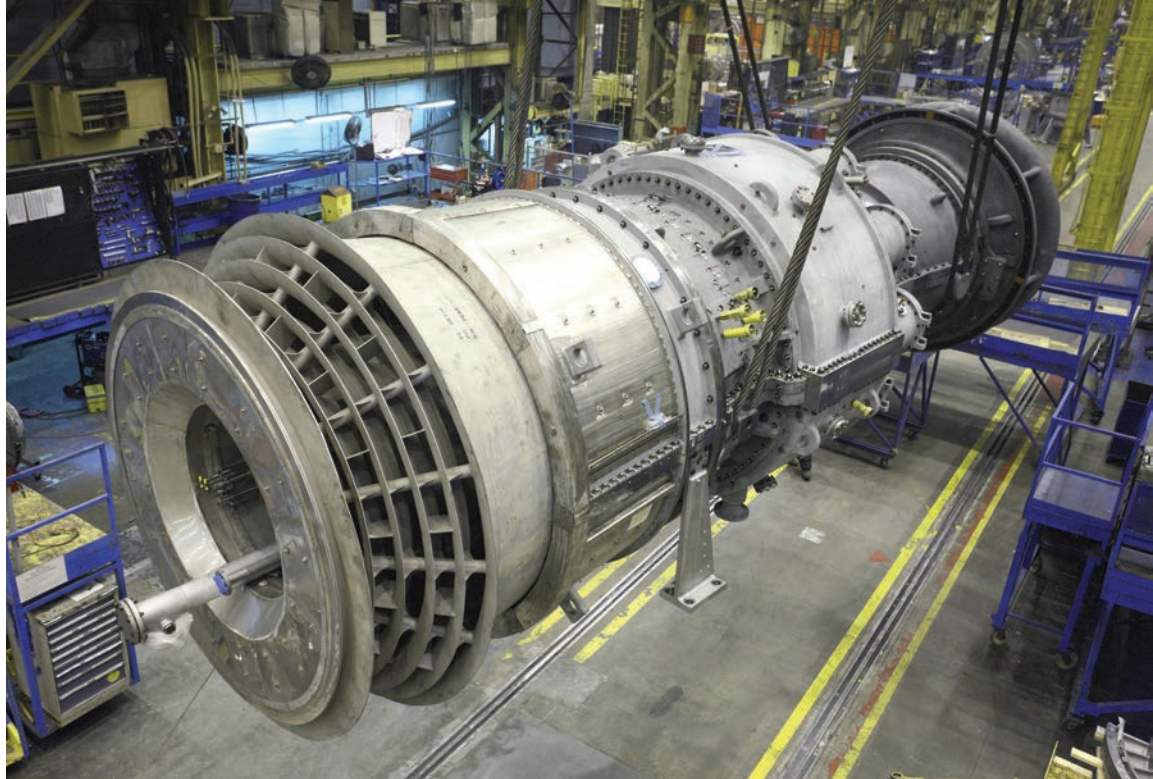
In late 2011, the company announced plans to open a new software center in San Ramon, Calif.,<sup>80</sup> part of a four-year, \$1 billion investment to install sensors and develop software systems to manage the jet engines, locomotives, power turbines, medical equipment, and other machines its customers run. This large stream of new data informs production, maintenance, and innovation at GE. In 2014, GE generated \$1.3 billion in Predictivity revenue from new software and analytics offerings in the market, and that top-line contribution is expected to grow. CEO Jeffrey Immelt says its sales could reach \$4 billion or \$5 billion per year in the next few years.<sup>81</sup> Immelt has become one of the most public evangelists for the power of the Industrial Internet of Things (IIoT) to transform business.

80 "GE to Open New Global Software Headquarters in California," press release, Nov. 17, 2011. <http://www.businesswire.com/news/home/20111117005431/en/GE-Open-Global-Software-Headquarters-California>

81 Richard Clough, "GE Sees Fourfold Rise in Sales from Industrial Internet," Bloomberg Business, Oct. 9, 2014. <http://www.bloomberg.com/news/articles/2014-10-09/ge-sees-1-billion-in-sales-from-industrial-internet>



William Ruh, the GE vice president who heads the Global Software Center, says the company's IIoT investments have led to the launch of approximately 40 applications for predictive maintenance and other functions, and the establishment of Predix, a cloud-based platform for creating industry apps. The cloud platform and applications, Ruh says, help GE provide services that improve operations in four critical areas:



**Resource efficiency.** For example, a service called PowerUp<sup>82</sup> uses analytics to increase the power generated by a wind farm. Another service saves fuel by managing the operations of aircraft engines.

**Machine maintenance.** Predictive analytics determine, based on data from a machine's operations, when it is time for repairs. Through such close monitoring, a customer can schedule machine downtime and maintenance before suffering an outage. Energy pipelines equipped with intelligent sensors provide data that GE analyzes along with other information (on weather, seismology, population centers, health care facilities, and schools, for example) to prioritize repairs and manage risks.

**Operations optimization.** Software applications help the rail industry to reduce energy and increase productivity by supporting daily railroad operations including train and car management, revenue settlement, and car hire accounting. More than 450 railroads across North America rely on software to eliminate manual processing. By calculating optimal speeds using train make-up and route topography, predictive analytics are also able to automatically optimize fuel consumption through features like automatic throttle and dynamic brake control.

**Intelligent environments.** By combining LEDs with sensors, GE can turn existing lighting systems into information networks. Imagine the possibilities: every lamppost becomes an active node in the network, capturing and relaying data in real-time about what's going on around it. Imagine the potential benefits: cities and towns could do a better job of monitoring traffic, managing parking, and keeping track of roadwork and needed repairs.

Developing systems that provide these benefits means GE has installed millions of sensors in its products, at customer locations, and in its supply chain. GE first uses these systems internally, Ruh says, and the experience helps the company communicate the technology's value to customers. "I'd say those are the two primary things we look at as success: enabling a change in the services business at GE and enabling the outcomes we see with our customers. Everything is based on an outcome. Do we make pipelines safer? Do we save fuel for a customer?" he says.

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82 "Increasing Wind Energy Production with GE's PowerUp," GE website, accessed May 7, 2015. <https://www.gepower.com/business-info/initiatives-collaboration/increasing-wind-energy-production-with-ge-powerup.html>

## Creating a New Business Model

The Industrial Internet of Things lets GE develop a new service-oriented business model, as Marco Iansiti and Karim R. Lakhani noted in a recent *Harvard Business Review* article.<sup>63</sup> In the example of a wind farm operator, GE analyzes sensor data from energy equipment “to optimize equipment performance and maintenance. It captures that value by charging a percentage of the customer’s incremental revenue from improved performance,” the authors write.

That mutually beneficial partnership requires both data sharing and security, Ruh says. GE's systems are working in the customer's environment – a shop floor, a power plant, an aircraft, a hospital. To get customers to work with GE's Industrial Internet systems, those customers have to gain significant value from GE in return. The company spells out specific policies on data usage and sharing that go well beyond typical end-user agreements. "If you're giving your customers something of value and they know how much it impacts their bottom line, then they're going to feel much more confident in working with you," Ruh says.

GE also invests in the security of the IIoT systems. Predix has a two-key security system that gives customers the right to configure how their data is used. Complying with government regulations, country by country, adds another element of complexity to GE's industrial Internet. Ruh says every nation's regulatory agencies have rules about data sovereignty, such as where data resides. There are close to 70 countries that require data to stay on domestic soil, Ruh estimates.

## What Makes GE's Industrial Internet Initiative Successful

The IIoT unquestionably represented a strategic opportunity for GE. The Global Software Center now employs 1,200 people, with another 10,000 employees working in software applications in GE's various divisions, Ruh says. The company also is building a network of partners who will develop applications on Predix and deliver services to customers in the cloud.

The partnerships that GE has forged with customers – on data-sharing procedures as well as the service business model – are key elements of GE's ability to generate revenue. Ruh identifies four additional factors that make the initiative successful:

**1. Locating in a development talent hub.** Establishing the Center in the San Francisco Bay area was an important decision for GE because of the number of people with technical savvy and entrepreneurial experience, Ruh says. “There’s a certain architectural transformation under way and new business models on the cloud being formed. And so having access to talent who can help you build out these new cloud-based solutions has been an extraordinarily important part of our success,” Ruh says.

83 Marco Iansiti and Karim R. Lakhani, "Digital Ubiquity: How Connections, Sensors and Data Are Revolutionizing Business," Harvard Business Review, November 2014. <https://hbr.org/2014/11/digital-ubiquity-how-connections-sensors-and-data-are-revolutionizing-business>

**2. Boardroom backing.** Senior executive support “is baked into our strategy,” Ruh says. The Industrial Internet, he adds, “is not an IT project. It’s a strategic business initiative that requires IT and OT to converge. And that’s a big difference in what makes it successful for us.”

**3. Eating their own dog food.** GE executives made a conscious decision to learn about IIoT technologies and how to implement them in-house before offering capabilities to customers. The approach was “do it for ourselves internally, do it for our customers, then help our customers do it for themselves,” Ruh says. “You’re much better off learning through this process. For us, we were able to crawl, walk, run over the years. And I think every organization in this Industrial Internet of Things is going to go through that.”

**4. Commitment to invest.** Ruh notes that not every company will invest as much as GE. But any successful IIoT initiative requires devoting enough resources to achieve business results.

The truth is that every industry can improve efficiency – making every industry a candidate for IoT investment, Ruh says. “This is sort of low-hanging fruit to go after inefficiencies where you can help your people do their jobs better. That’s really what this is about. And for most people, it’s about focusing on things where small changes can lead to big numbers.”



## HP Turns Printers into IoT Hubs in the Home

Printers, and especially the ink that goes into them, represent a huge business for Hewlett-Packard: \$23 billion last year. (HP's Printing and Personal Systems Group, which will be separated from the enterprise division of the Palo Alto, California company in November 2015, had overall 2014 revenues of \$57.3 billion.) However, the current ubiquity of mobile devices and transformation of workers on-the-go means that consumers' print appetites have changed at home and in the home office.

Given this challenge and the rise of competition on the ink supply side, HP is moving boldly with the Internet of Things to keep its printers and ink household mainstays. But the company has even greater ambitions for the machines: making them a beachhead for other IoT-enabled services in the home. As a result, its 'razorblade' strategy of the past – where the majority of the profit comes from selling ink, not printers – is getting an update in the IoT age.



## Printer as a Service

IoT technologies create the opportunity to turn almost any digital device into a service. “Hyper integration offers endless possibilities of connections and use models,” says Naresh Shanker, the named Chief Information Officer for HP Inc., the future printing and personal systems company after the Hewlett-Packard separation on November 1. “With IoT printers integrated with other IoT services, there are now millions of HP printers that can provide services in homes.”



The HP Print Channel is a prime example. The company launched the service in 2014 with the goal of making printers an IoT hub in homes similar to climate monitoring devices such as the Nest thermostat. The HP Print Channel is offered through a website called IFTTT, which aggregates apps for consumers and allows them to combine apps to do what they want, when and where they desire.

For instance, with the HP Print Channel service and one of the company's IoT-enabled printers, consumers can automatically send any picture they post on Instagram to their home printer simply by adding the hashtag #print to their post. If a consumer is reading a good wine article on a smartphone, he or she can also send that immediately to the printer. Through IFTTT, HP Print customers can easily connect their printers to more than 150 websites including Facebook, The New York Times, Dropbox, Fitbit, and Digg.

## Turning Ink into a Service

HP is also using the Internet of Things to transform the razorblade side of its printer business—ink cartridges—into a service. Running out of ink has long been a pain point for customers, but it is also a challenge for manufacturers. When customers run out of ink, they may turn to generic brands, or even worse, may decide to print less.

HP is tackling those challenges through HP Instant Ink, a service it launched in 2013 that offers users streamlined services paired with extreme cost savings. Sensors in eligible HP printers predict when a customer will run out of ink – and HP then automatically ships replenishment cartridges before the printer runs out. HP Instant Ink also offers ink on a subscription basis to reduce customers' costs and build an installed base of HP-branded ink cartridge buyers. For \$2.99 per month, for example, customers can print up to 50 pages, which HP estimates will generate annual savings of \$96. For \$9.99 they can print up to 300 pages (which saves consumers around \$672 a year). Subscribers can use as much ink as they need, and all unused pages roll over into the next month.

Such services disrupt traditional channel models, but HP isn't trying to go it alone. It offers HP Instant Ink directly and through its channel partners including retailers such as Staples and Best Buy. According to Shanker, HP Instant Ink has been a huge success.



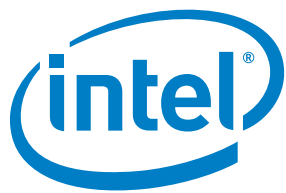
## Emulating the Founders' Innovative Spirit

Shanker stresses that HP's ability to secure its fortunes and keep pace with IoT developments is anchored on its culture of innovation. "Testing aggressively and moving fast is part of our DNA," he explains. "We have a value system that reflects the beliefs of our founders, and we drive those beliefs through the organization."

Startup-like entities within the company act as incubators for new ideas and quickly test hypotheses and prototypes. Their success has been recently demonstrated in announcements including 3D printing's Multi Jet Fusion and HP Sprout, a first-of-its-kind Immersive Computing PC with 3D scanning allowing users to transform physical items into a digital workspace.

## Assuring Relevance in the Future

Through its ability to innovate, HP has carved out an important role at the fulcrum of printers and new customer experiences that the IoT is creating. As Shanker points out, no one company can own all the possible connections between devices, customers, and experiences. The key is to find points in the system where a company's products play a potent role. With HP Print Channel and HP Instant Ink, the company has found one of those points and is transforming what people can do with a printer and the economics of the printer business. As printing habits change, HP is successfully revamping the razorblade strategy and using innovation as a stepping stone to ensure it remains on the forefront of the printing and ink businesses.



## Intel's Vision for the Internet of Things

It's understandable that Intel Corp., the world's largest semiconductor manufacturer (2014 revenue of \$56 billion), has been a major proponent of the Internet of Things. The company makes many of the technologies – chips, security software, and operating systems, to name a few – found in IoT devices such as cars, digital signs, and manufacturing equipment.

But Intel's vision of a world of billions of intelligent, connected devices doesn't end with the \$2.2 billion worth of embedded silicon and software the company sold last year to its customers. Intel is investing in IoT technologies to solve customers' business problems and improve people's lives. In addition, Jonathan Ballon, a vice president in the company's Internet of Things Group, feels IoT technologies could be a game-changer in how the company operates its supply chains and improves its products, both those in its R&D labs and those in the digital devices that customers use.

"We're deploying IoT solutions across the company, in our manufacturing capabilities, in building automation, to optimize our supply chain, and in other areas," Ballon says. "We're a first adopter."

Ballon sees very big things for the Internet of Things, and for Intel's role in that market. The company underscored its seriousness early last year when it formed a new IoT business group to focus on IoT strategy and initiatives.





## The Internet of Things Meets Intel Production Lines

That connected device vision drives the company's IoT business. But that's not the only IoT challenge. To borrow from the company's famous advertising campaign "Intel Inside," you might say the company is busy figuring out how to put the IoT inside Intel and create new business opportunities and experiences for people around the world.

Intel already has wins to show. An Intel semiconductor manufacturing plant in Penang, Malaysia last year became a case study on using IoT technologies in supply chain monitoring. The factory installed sensors on equipment known as CPU assembly modules, which complete the final steps of manufacturing. Using analytics software, sensors, and gateways, Intel reduced the number of machine failures and boosted assembly line uptime and productivity. Yields are higher and the equipment operates with reduced downtime.

The assembly line and preventive maintenance efficiencies are stunning, Intel says. "We are also using image analytics to detect defects in about a tenth of the time that it takes through manual inspection," Ballon says. "It has paid for itself many times over." Intel now plans to roll out these technologies to additional plants worldwide. Customers have noticed, and they want to learn from Intel and its manufacturing plants.

## Enabling IoT Data Services

There may be much bigger IoT game for Intel to hunt – namely, monitoring the performance of customers' IoT devices in the field. That marks a huge departure in the history of the 47-year-old company, which largely hasn't collected digital data from the computers and other digital devices using its electronic components. Says Ballon: "Today we don't do that. In the future, I feel it's imperative we enable that to happen securely and by opt-in. We deploy sensors on almost every product we ship and we want to ensure our customers and partners can create and receive value from that data."

A system running on an Intel chip does, in fact, have sensors that can deliver data about the performance of the machine's hardware. For example, an industrial manufacturing company could create a service that aggregates data from a plant's sensors and other devices. "By analyzing what software is running on the gateway and whether it is secure, you can manage the data communications stream to ensure it is functioning at its highest level of productivity."

That, of course, requires an end user to allow service providers to use data that comes from its factories. In Ballon's view, that requires a substantial 'value exchange' – where in return for letting someone monitor its factory data, the customer gains something substantial. This will be true for companies and individuals.

"The benefit has to be to customers," he says. This will be especially true when IoT technologies are generating sensitive customer data, he adds. Case in point: medical data from patient monitoring. "Suppose I've been diagnosed with type A diabetes and my doctor gives me a glucometer and with it a home gateway for remote patient monitoring. I have a choice: I can monitor my glucose level myself and hope I'm doing a good job. Or I can plug in that gateway and let that data get back to my physician securely. In exchange, I'll get a higher level of service from the doctor, and potentially it could allow me to live longer. That's a personal choice. But I think [IoT information from product usage tracking] is about choice and that value exchange."

## Corporate Culture Change: Key to Success

When asked to rank the biggest success factors for IoT projects, for customers and for the technology organizations where he's worked (Intel, GE, and Cisco), Ballon's answer is quick. "Without question, the biggest success factor by a large margin is cultural," he says. "I've experienced this at every company I've worked at that's trying to adopt new technologies."

"Organizational inertia," as he puts it – more specifically, the fear that new technologies will expose unproductive practices and processes – is the biggest barrier. This is especially the case in big companies, he believes. "People are afraid of what the new technologies might reveal about inefficiencies that they may be held accountable for," Ballon explains.

The companies in the lead on IoT technologies – firms like GE, Cisco, and Intel – reduce this inertia in part by having CEOs who embrace organizational change. "It's the companies that are brave and leading and have leadership at the top that are driving these solutions. They're the ones that have been quickest to adopt IoT and get benefits," Ballon says. In contrast, he adds, "depending on the market, some companies are understandably more change-averse and we have to prove the benefits are real while mitigating risk factors, like security."

That's why companies need to start small, doing pilots and then iterating them before trying to unleash IoT technologies across the organization. Early wins create internal advocates who can convince doubters to give change a try. "Major transformations like IoT are challenging and we help enable quick wins that prove the value and lead to larger-scale rollouts."

# PTC®



## Five IoT Issues That Companies Underestimate: The View of an IoT Veteran at PTC

The Internet of Things may appear to be a very new concept, but its roots actually go back decades to the early days of products with embedded software. Thus, there is much to be learned from the pioneers of connected embedded systems, one of whom is John Canosa.

Canosa today works for PTC, a \$1.4 billion company based outside Boston which has its roots as a leader in the field of computer-aided design (CAD) and product lifecycle management systems. Today, the company is a global provider of technology platforms and enterprise applications for smart and connected products, operations, and systems in the IoT market. The IoT is a big deal for PTC and its customers, which include global manufacturers such as 3M, Philips, Volvo, Ingersoll Rand, Honeywell, Adidas, and Trane. In fact, PTC's CEO, Jim Heppelmann, co-authored a cover article in *Harvard Business Review* on the Internet of Things last November with Michael Porter, the world-renowned Harvard Business School professor of strategy.<sup>85</sup>

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<sup>85</sup> Porter and Heppelmann, "How Smart, Connected Products Are Transforming Competition," *Harvard Business Review*, Nov. 2014. <https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition>





### 3. Growing Number of IoT Apps Target Micro Verticals

IoT hardware and software offerings continue to evolve to suit the needs of industries such as healthcare and manufacturing. However, IoT software application developers are increasingly finding success targeting ‘micro verticals,’ Canosa says.

He gives the example of software companies focusing on specific types of ‘smart farming.’ One PTC customer, OnFarm,<sup>87</sup> makes an application that helps produce farmers reduce water usage. Another, Dirt Road Data, makes an app that guides chicken farmers to maximize profits by tweaking factors such as environment temperature and grain usage.<sup>88</sup> A third customer, Vital Herd, makes applications to track and improve cattle health, using IoT data from RFID ear tags and even smart pills that cows swallow.<sup>89</sup>

These three software makers target not just the agriculture industry, but very specific niches within it. The ability to create highly targeted applications very rapidly is essential in today’s economy, says Canosa.

### 4. For IoT Devices, Smarts Matter as Much as Connections

Many executives today envision the Internet of Things as a bunch of sensors, pushing data to the cloud, followed by rounds of Big Data analytics software, Canosa says. But smart, connected devices offer other options, he points out.

Companies should write applications to make their products ‘smart’ and not always be reliant on Big Data analysts at headquarters to respond to something that is happening in the field. “These products have intelligence that we can harness to create a much larger, more effective system,” Canosa explains. “A lot of times people forget about the word ‘smart’ and they focus on the word ‘connected.’”

Not all data has to go to a company’s online data storage, raising costs and creating management and privacy concerns, he says. “The lowest-cost way to collect data is to not collect it, but take advantage in situ,” Canosa says. Data doesn’t have to be big to be useful. For more on this topic, see Canosa’s blog post, “[How Small Data Can Bring You Big Value](#).”<sup>90</sup>

### 5. IoT Apps Must Connect to Enterprise Systems Such as ERP

Early IoT programs were largely about remote servicing of equipment and were built as islands of automation – as ways for machines to ‘talk’ to other machines. They weren’t designed to transmit their data to business systems such as ERP software, Canosa notes. That isolation doesn’t fly in the age of digital business transformation.

Companies need to integrate IoT device data with information from traditional ERP and CRM apps, analytics tools, collaboration apps, and online data sets such as weather reports, Canosa says.

“Part of transforming your business isn’t throwing away an installed base of enterprise apps that you’ve spent millions of dollars on. That’s not the transformation people are looking for,” Canosa says.

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87 OnFarm web page, <http://www.onfarm.com>

88 ThingWorx web page, “ThingWorx Powers First Cloud-Based Smart Agriculture Solution,” <http://www.thingworx.com/thingworx-powers-first-cloud-based-smart-agriculture-solution/>

89 Vital Herd web page, <http://www.vitalherd.com>

90 John Canosa, PTC blog, “How Small Data Can Bring You Big Value,” March 15, 2015. <http://blogs.ptc.com/2015/03/23/how-small-data-can-bring-you-big-value/>

# Annexure

## Research Approach and Survey Demographics



The design of this study began in December 2014 when we looked at the ‘white space’ in the market on the topic of the Internet of Things. Quite a bit had already been published on the topic. That content ranged from articles by authors such as the eminent Harvard Business School strategy professor Michael Porter (who co-authored a cover *Harvard Business Review* article with PTC CEO Jim Heppelmann on the IoT),<sup>91</sup> to studies conducted by McKinsey & Co., IBM, Capgemini, Accenture, and other consulting and IT services firms.

That required us to explore aspects of IoT that had not been explored or were underexplored. Thus, we designed this study to look at four areas where most businesses have been investigating or using IoT technologies to date:

- Tracking their customers
- Tracking their products
- Tracking their premises
- Tracking their supply chains

We weren’t exploring the topic from scratch. A study that we released in the summer of 2014 on digital initiatives at more than 800 companies around the world (‘Digital Reimagination’) looked at a few aspects of the Internet of Things, including the number of companies that had sensors in their products and provided wearable technologies.<sup>92</sup> That study also looked at many other types of digital initiatives but this one goes deeper into the IoT initiatives that covered the four areas mentioned above.

Because a study delving deeply in all four areas could take a substantial amount of time, we focused on the first three areas, particularly the ways that companies were tracking their products. However, we did collect survey data on how companies are using the IoT in production and distribution, as well as conducting interviews and secondary research.

We further focused our inquiry with six overarching questions:

1. How are large global companies around the world using the smart, connected products that they sell to customers (businesses and consumers) to create new businesses and revenue sources?
2. How much are their organizations spending on IoT initiatives today and what are their spending plans for the next three years? Where are they spending that money?
3. How are they improving the ways they service, create demand for, and supply their current offerings?
4. How are they improving their products and services as a result of having IoT embedded in them, as well as from tracking customers, the locations in which they do business with those customers, and their supply chains?
5. What do they plan to do on these fronts during the next five years (to 2020)?
6. What are the key success factors in getting business benefits from IoT initiatives?

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91 Porter and Heppelmann, “How Smart, Connected Products Are Transforming Competition,” *Harvard Business Review*, November 2014. <https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition>

92 TCS Global Trend Study – July 2014, “The Road to Reimagination: The State and High Stakes of Digital Initiatives.” <http://sites.tcs.com/stateofdigital/>



We therefore look at two time periods: from the present to 2018, and to 2020. With respect to budgets, we felt that projections beyond three years may not be accurate. But for the reach and impact of IoT, a longer time horizon gave our respondents more room to expand on their vision.

As with our past five global trend studies since 2011, we focused on 13 global industries in four areas of the world (North America, Europe, Asia-Pacific, and Latin America). We collected data from a wide range of executives in those industries: IT, marketing, sales, manufacturing, R&D, finance, and others. We also collected data from large companies (at least \$1 billion in revenue), although to generate representative samples in Latin America, we needed to somewhat lower that revenue threshold.

## Research Approach

With our research topic and key questions in hand, we then created an initial set of hypotheses to further guide the inquiry – specifically the data collection tools we would use in conducting quantitative, qualitative, and secondary research. We designed these instruments to be used in three research streams:

### *Quantitative Research*

Our research designers provided a major research survey panel company, Research Now, with a 17-question survey that it conducted online. Research Now fielded the survey to its panelists from late March to mid-April 2015. The survey took participants an average 20 minutes to complete. All questions were close-ended with a mix of multiple choice, Likert scales, or numerical responses.

More than 5,000 executives attempted the survey, and many of those were screened out because their company was too small, they didn't know enough about their companies' IoT initiatives, they weren't at a high-enough level in the organization, or they worked in an industry outside the 13 that we focused on. Some 3,764 executives of the right profile completed some or all of the survey, including many whose companies didn't have and didn't plan to stage IoT initiatives by the year 2020.

From this sample, we derived data on the percentage of companies that are already doing something with IoT technologies: 79%. Ultimately, after screening out survey participants who didn't complete the entire survey, we had 795 participants, of which 715 had IoT initiatives under way and 80 of which planned to have them by 2020.

### *Qualitative Research*

We interviewed executives in-depth at General Electric, HP, Intel, and PTC. We conducted these interviews using questions from a structured interview guide that we designed, using a third party to conduct them (Bloom Group LLC).

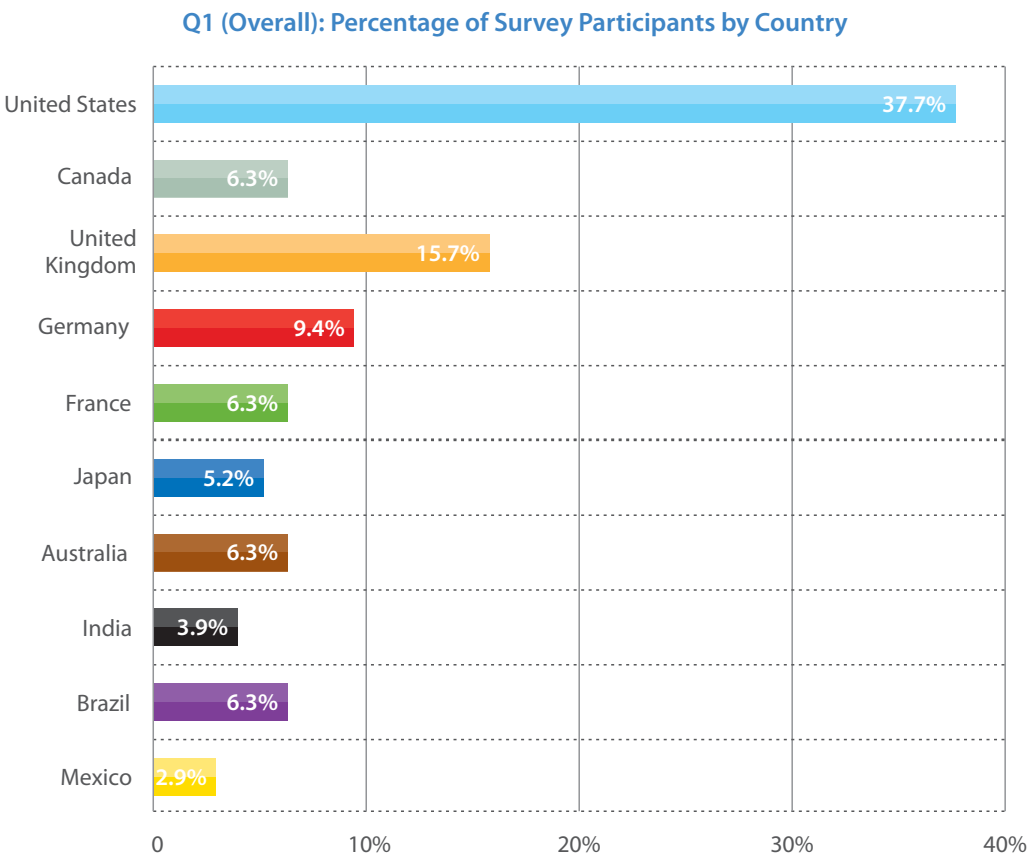
### *Secondary Research*

We also conducted extensive secondary research, looking for publicly available information from the press, companies' websites and investor documents, conference presentations, and other sources on IoT initiatives at major global companies. We found dozens of examples from this research stream, with many companies disclosing quite a bit of information about their IoT programs.

We analyzed our survey data between late April and early May. The interviews with executives at the six companies were conducted between mid-April and mid-May. The TCS research analysis team pored through all the data in April and May, going through several rounds of analysis to arrive at the findings in this report.

Survey Demographics

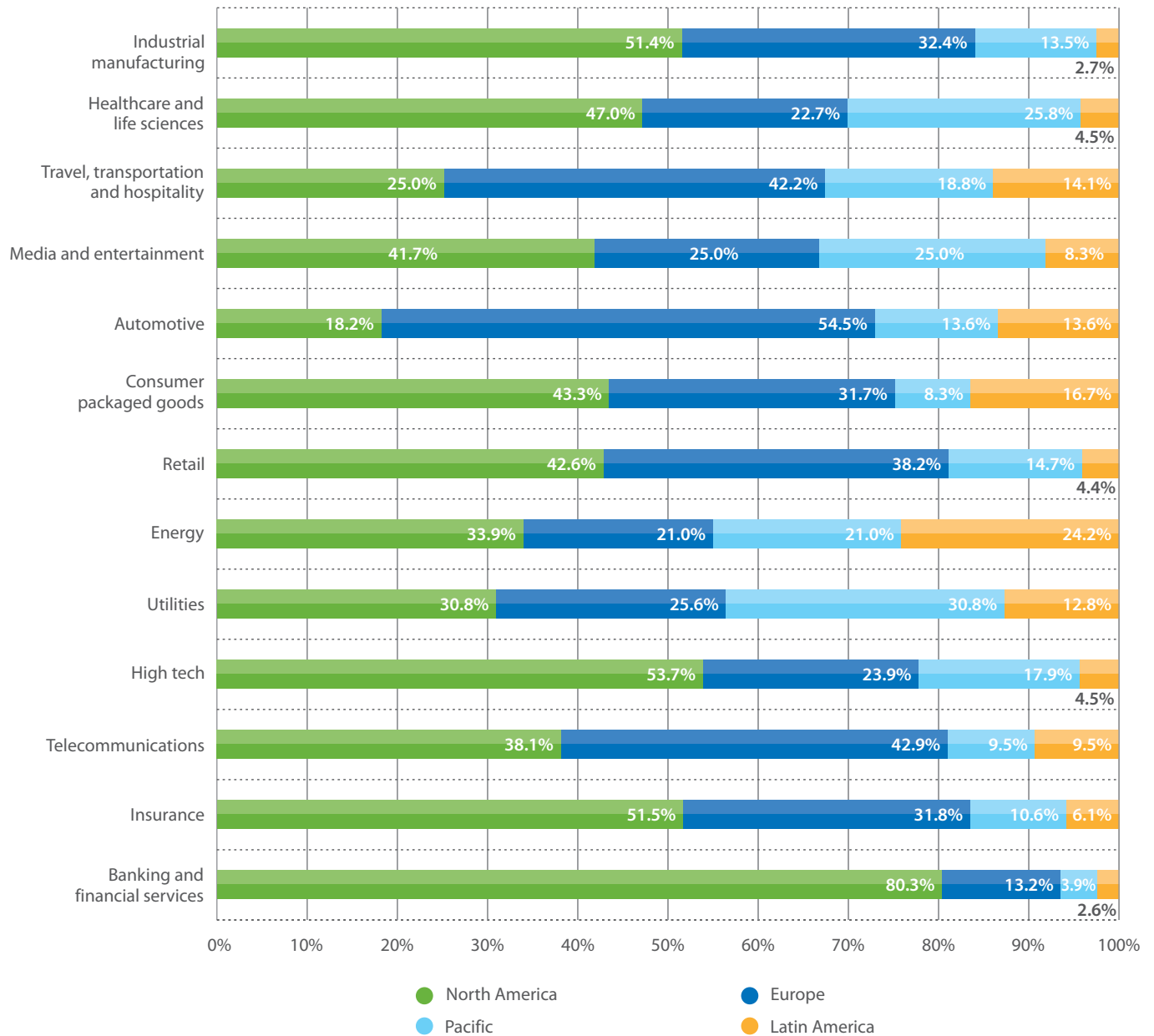
Of the 795 survey participants, the majority were in North America (44% of total) and Europe (31%). Some 15% were in Asia-Pacific and 9% were in Latin America. Here is the country breakdown.





In each industry, survey participants came from all four regions of the world that we studied.

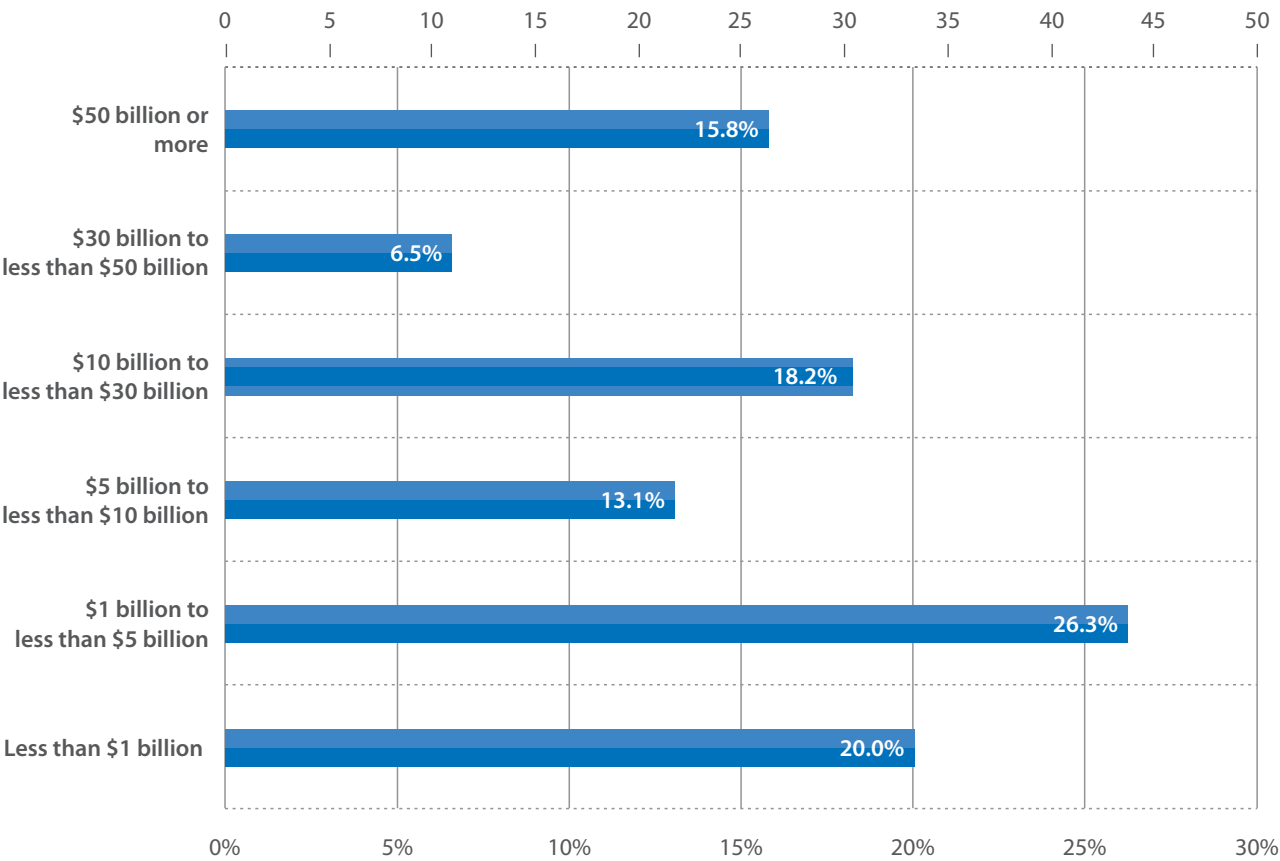
Q1 (Industries): Percentage of Survey Respondents by Industry and Region





In all, 20% of the 795 respondents were less than \$1 billion companies. However, the number of survey participants from companies of at least \$50 billion in revenue pulled up the average revenue of participants across the world. A slight majority of companies (58%) were between \$1 billion and \$30 billion in revenue.

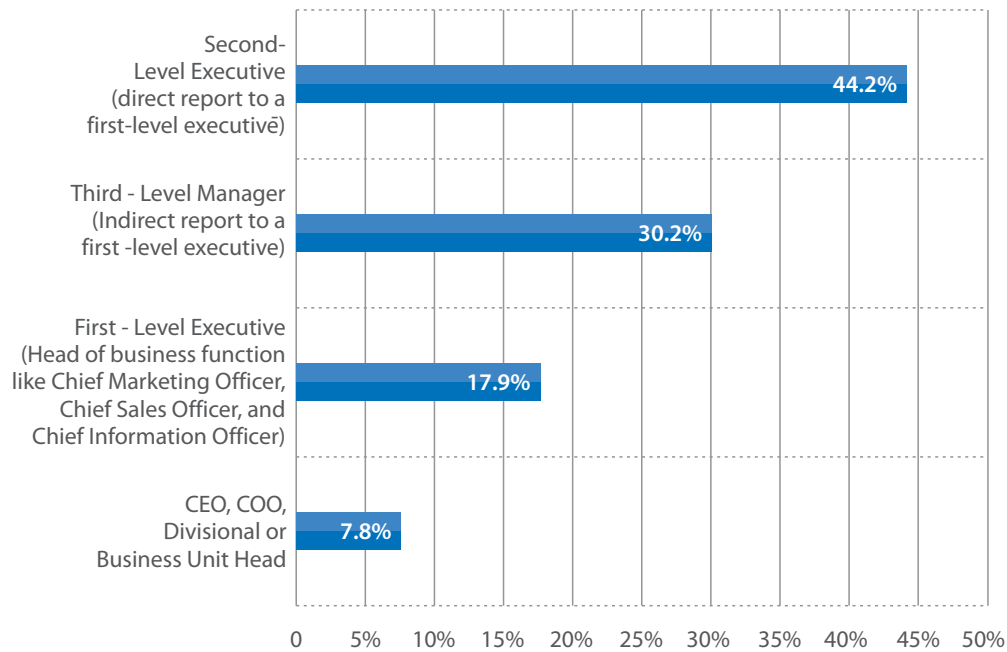
Q2A (Overall): Percentage of Companies by Average Revenue





We also generated responses from high places all around – meaning from senior-ranking executives. Some 70% were either at the highest level (CEOs, COOs, and GMs), the C-suite, or a direct report to the C-suite.

**Q6 (Overall): Respondents by Organizational Role**





## About the TCS Global Trend Study Research Team

This is the sixth in a series of major global studies that TCS has conducted since 2011, exploring how large companies in 13 industries and four regions of the world (North America, Europe, Asia-Pacific, and Latin America) are capitalizing on digital technologies. The following people played key roles in executing and publishing this study.

**Executive Sponsor:** John Lenzen, Chief Marketing Officer, TCS

**Business Sponsor:** Study conceptualization, research design, trends analysis, best practice interview facilitation: Dr. Satya Ramaswamy, Global Head of TCS' Digital Enterprise Unit

**Program Manager:** Serge Perignon, Head of Marketing, Global Consulting Practice at TCS

### Lead Research Analysts:

- Industry findings:
  - Rajashree R., Global Head – TCS' Retail Solutions Group
  - Sreenivasa Chakravarti, Head, Innovation & Transformation Group – TCS' Manufacturing Business Unit
  - Regu Ayyaswamy, Global Head – TCS' Engineering & Industrial Services Unit
  - Thanga Jawahar, Global Head, Functional Unit – TCS' Engineering & Industrial Services Unit
  - Sukriti Jalali, Leader of IoT initiatives and solutions – TCS' High Tech Business Unit
  - Frank Diana, Principal – TCS' Global Consulting Practice
  - Kamal Badada, Global Head – TCS' Telecom, Media and Entertainment Business Units
  - Shrikant Pathak, Head, Industry Advisory Group – TCS' Media and Entertainment Business Unit
  - Mukil Kavungal, Head, Digital Transformation – TCS' Media and Entertainment Business Unit
  - Sanjeev Goyal, Senior Industry Consultant – TCS' Media and Entertainment Business Unit
- Emerging technology trends:
  - Anita Nanadikar, Head of the Corporate Technology Office's Incubation function at TCS.
  - Prateep Misra, IoT Research Area Manager at TCS
  - Seeta Hariharan, Group Head, TCS' Digital Software & Solutions Group

**Best-Practice Interview Participants:**

- Intel Corp.: Jonathan Ballon, Vice President of Intel's Internet of Things Group
- HP Inc.: Naresh Shanker, Chief Information Officer
- General Electric (GE): William Ruh, Vice President and Global Technology Director at GE's Global Software Center
- PTC Inc.: John Canosa, Chief Strategist, Connected Products at the ThingWorx unit of PTC

**Research Design and Data Collection:**

- Bloom Group LLC

**Research Report Production and Publishing:**

- Editing: Jyothi Nair, Ami Malik, Unmana Datta, Sonalika Sharma, Shona Dias, Reema Pawa, Meirah Bhastekar
- Branding and Graphic Design: Vishal Jhunjhunwala, Chandrahas Barde, Rahul Wakade
- Microsite: Shilpa Hejmadi, Akshay Mujumdar, Rukmini Kunjithai, Manish Khemani, Priya Raut

**Previous TCS Global Trend Studies on Digital Technologies**

Since 2011, TCS has been conducting in-depth primary research on how large companies around the world are using and benefiting from digital technologies such as mobile devices, social media, Internet of Things, cloud computing, and Big Data and analytics.

Each of our five previous studies has an extensive microsite devoted to its findings:

- [The Road to Reimagination: The State and High Stakes of Digital Initiatives \(2014\)](#)
- [Mastering Digital Feedback: How the Best Consumer Companies Use Social Media \(2013\)](#)
- [The Emerging Big Returns on Big Data \(2013\)](#)
- [The New Digital Mobile Consumer: How Large Companies are Responding \(2012\)](#)
- [The State of Cloud Application Adoption in Large Enterprises \(2011\)](#)

For more information about TCS' Global Trend Studies, please contact Serge Perignon at [s.perignon@tcs.com](mailto:s.perignon@tcs.com).



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