The Internet of Things: A New Path to European Prosperity

With the right focus, Europe can capitalize on the rise of the Internet of Things and the €1 trillion opportunity that it brings.
# Table of Contents

The Internet of Things and European Competitiveness  
1

IoT’s Impact on European Industries  
3

The €80 Billion Opportunity  
6

Ready or Not: Preparing Europe for Capturing the IoT Market  
10

Key Success Factors for European High-Tech Players  
16

Policies for a Level Playing Field  
22
The Internet of Things and European Competitiveness

The Internet of Things. It is a phrase that is equally applied to our using a cell phone to control a home’s temperature from hundreds of miles away, or an airline’s using sensors on its fleet’s engines to save money in fuel consumption. Even more profound, for Europe and its 28 member countries (EU28), IoT means the opportunity to unlock 7 percentage points of GDP growth by 2025 through productivity improvement and value redistributed to end customers.

A.T. Kearney recently conducted unique, in-depth research and analysis of IoT to more thoroughly understand the value it offers the EU28 and the ways that member countries can best address the hurdles that will keep them from realizing its fullest benefits (see sidebar: About A.T. Kearney’s Analysis of IoT in the EU28). Our overarching finding: Within the next 10 years the market for IoT solutions will be worth €80 billion, and its potential value for the EU28 economy could reach nearly €1 trillion (see figure 1 on page 2).

We believe that value will come from three sources:

**Increased productivity (€430 billion).** Analysis of real-time and historical data and remotely controlling objects will help companies make better, more informed decisions. They will act earlier and at a lower cost to optimize and automate objects in ways that have not been possible before. These capabilities will increase exponentially when connected objects are coordinated.

---

**About A.T. Kearney’s Analysis of IoT in the EU28**

The economic impact presented in this report is an original and proprietary assessment conducted by A.T. Kearney from March to June 2015.

The A.T. Kearney model determines:

- The value-creation potential (increased productivity, increased purchasing power, and freed-up time for individuals) of IoT of the EU28 GDP during a 10-year horizon
- The market for IoT solutions (consumption and investment in smart objects and associated services)

We developed our GDP model using the expenditure approach, similar to what is done for national accounts. It assesses the impact of IoT on household consumption, enterprise consumption, investments, government spending, and trade balance.

Across the main sectors of the economy, the valuation is based on 40 use cases, selected for their impact on GDP. Only use cases that involve smart objects (including those with at least one sensor and communication connectivity) were considered. E-commerce, or mobile and fixed telecoms when they are not used to connect a smart object, were excluded from the scope. Based on these use cases, we also developed estimates for the number and types of smart objects, as well as the corresponding market for IoT solutions, that encompass component modules, connectivity services, enabling capabilities such as cloud or security, system integration services, and service platforms. We did not include the value of the objects themselves, such as cars, pacemakers, or watches, since they would exist without IoT.

Data presented in the report is derived from publicly available sources regarding the size of the European economic sectors, and from our own research on the impact of IoT on the drivers of consumption. We were able to confront many of our use cases with industry experts as part of our collaboration with French think tank Institut Montaigne, with whom we assessed the impact of IoT on the French economy.

By definition, this assessment is incomplete—for a comparison, who could have predicted the many uses of plastic when it was first introduced?—and will evolve as technology matures and as industries discover all its possibilities. Hence, our intention by writing this report is not to forecast a precise value for IoT in Europe in 2025, but to inform business leaders and policy makers on the magnitude and drivers of the impact and on the importance to act soon in order to grasp this unique opportunity.
The Internet of Things: A New Path to European Prosperity

Increased consumer purchasing power (€300 billion). IoT-enabled objects will trigger significant energy savings for consumers and increase products’ durability.

Freed-up time for individuals (€210 billion). Connected objects will improve individuals’ health and decrease their risk factors. Combined with productivity gains, this will provide people with more free time, a share of which will be spent on productive tasks, delivering economic value on top of personal value (see sidebar: IoT Benefits Society).

Hence the Internet of Things can have a sizable “multiplier” effect. Based on our estimates, every euro spent on IoT solutions could produce up to 12 euros in productivity gains, purchasing power, and savings from economies of time.

**IoT Benefits Society**

While our research found that IoT can generate annual per capita savings of €1,100 by 2025, the non-economic advantages of this unifying technology could be even better:

- **More free time and reduction of arduous tasks.** Individuals could save more than 10 days a year due to fewer traffic jams and less housework.
- **Longer, healthier lives.** A greater focus on preventive healthcare and more efficient medical treatments will lead to longer, healthier lives.
- **Greater sustainable development.** More efficient use of resources such as energy and water should reduce supply scarcity. Asset utilization should rise, further reducing the carbon footprint and waste.
Realizing these benefits could transform Europe’s competitiveness, but not without the EU28 surmounting some significant hurdles. In this paper, we look at what IoT really is, how it can transform major industry verticals across the continent, and what it will take for companies, governments, and the high-tech industry to attain the ultimate connectivity—bringing together the tremendous potential of this unifying phenomenon with Europe’s competitive advancement in the world.

**The Growing Scope of IoT**

IoT is the expanding network of physical objects embedded with sensors, electronic chips, software, and connectivity to the Internet. This combination allows things to be monitored and controlled remotely, with a massive amount of data generated about their performance and the environment in which they operate. We see IoT as the seamless combination of embedded intelligence, ubiquitous connectivity, and deep analytical insights that creates unique and disruptive value for companies, individuals, and societies.

Within the next decade, the number of connected devices will increase dramatically. Innovations are converging, including:

- Breakthroughs in the performance, miniaturization, and energy efficiency of sensors and actuators, and falling prices of micro-electrical-mechanical systems
- Highly compact, low-cost processing power and data storage
- The introduction of IPv6, the most recent version of the Internet Protocol, which allows up to 340 trillion potential Internet addresses
- An extending range of connectivity solutions allowing both higher-speed applications (5G) and low-throughput, low-energy-consumption applications (LPWA)

Combined with cloud architectures and big data algorithms, IoT provides an unprecedented source of value creation. In fact, all of the fuss about IoT—in addition to the pleasure of being able to preheat your dinner before you get home—is the sheer disruptive value it poses for companies, individuals, and societies, including all of Europe.

**IoT’s Impact on European Industries**

IoT can boost Europe’s competitiveness in most industry sectors. In our research, we looked at the impact of more than 40 main IoT applications in eight vertical segments (see figure 2 on page 4).

Then we identified segments with the highest potential through 2025. Our calculations were based on contributions from the three value-creation sources mentioned above, but do not include investments made by individuals, enterprises, or governments (see figure 3 on page 4).

While the sizable impact of these use cases may indicate that IoT is a panacea, we must insist it is not; much effort is needed to achieve the benefits outlined here, and some of them may never be realized. Besides technology, new business models will need to be imagined and risks taken to invest in smart objects. In addition, common standards agreements will be needed across ecosystems for solutions to interoperate; processes will have to be reengineered to generate efficiency gains. Later in this paper we look more closely at the specific success factors required from high-tech players and policy makers.
The Internet of Things: A New Path to European Prosperity

Figure 2
Eight vertical segments and more than 40 applications of IoT

<table>
<thead>
<tr>
<th>Transportation</th>
<th>Healthcare</th>
<th>Housing and hospitality</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accident avoidance</td>
<td>At-home recovery and rehabilitation</td>
<td>Energy savings</td>
<td>Express and parcel delivery</td>
</tr>
<tr>
<td>Car sharing</td>
<td>Chronic disease monitoring</td>
<td>Fire alarm</td>
<td>Smart construction</td>
</tr>
<tr>
<td>Private hire and taxi platforms</td>
<td>Medicine consumption optimization</td>
<td>House automation</td>
<td>Smart logistics: Container tracking</td>
</tr>
<tr>
<td>Driverless cars</td>
<td>Non-observance reduction</td>
<td>Remote burglar alarms</td>
<td>Smart logistics: Rail car tracking</td>
</tr>
<tr>
<td>Public transport fleet and route management</td>
<td>Early identification of diseases or risk factors</td>
<td>White and brown goods</td>
<td>Smart logistics: Fleet management</td>
</tr>
<tr>
<td>Telematics</td>
<td>Smart pharmaceutical R&amp;D</td>
<td>Telematics</td>
<td>Smart manufacturing</td>
</tr>
<tr>
<td>Traffic jam reduction</td>
<td>Time savings from better treatment</td>
<td>Smart kitchen in restaurants</td>
<td>-</td>
</tr>
</tbody>
</table>

Retail and wholesale
- Stockout and theft reduction
- Smart logistics fleet management
- Automatic checkout
- Express and parcel delivery
- Sports articles

Utilities
- Smart grid
- Smart water
- Smart gas

Primary sectors
- Precision farming: Crop management
- Precision farming: Livestock management
- Smart extraction (oil and gas, mining)

Public administration
- Public administration efficiency
- Street light control
- Waste management
- Education classroom management

Source: A.T. Kearney analysis

Figure 3
IoT’s GDP impact by sector

€ (2025), EU28

Source: A.T. Kearney analysis
Below, we list the top five segments:

**Transportation (€245 billion).** A key component of our daily lives, transportation by car is rife with negative externalities affecting time and money spent (approximately €25 billion in time and gas lost in traffic, and approximately €25 billion invested in new road capacity), accidents (approximately €120 billion in human and material costs), energy, and vehicle utilization. The proliferation of sensors and driving assistants, coordination between vehicles and road sensors, and connection of vehicles to Internet marketplaces should dramatically reduce these externalities. We estimate that improvements will reduce accidents by 30 percent through the use of telematics (€38 billion); reduce the number of cars in circulation by as much as 10 percent due to car sharing, private hire platforms, and self-driving cars (€130 billion in savings and new revenues); and create energy savings of 10 percent (around €24 billion). Those steps will also significantly reduce greenhouse gas emissions.

Public transport operators and users should also benefit. For example, dynamically matching public transport routes and frequency with demand could cut passengers’ transportation time by 10 percent.

**Healthcare (€235 billion).** IoT will strongly impact healthcare, which consumes about 10 percent of Europe’s GDP (about €1.4 trillion). It should improve monitoring of chronic diseases such as diabetes, asthma, and high blood pressure and support better patient compliance with medication regimens. Out of the €470 billion cost of chronic disease, according to the French Haute Autorité de Santé, we believe that 10 percent (€47 billion) could be saved through better monitoring of vital signs and better coordination of patient visits. Non-medication compliance, which costs €66 billion, according to IMS Health-France, could be reduced by up to 80 percent (€53 billion) through use of devices such as ingested sensors connected pillboxes. The proliferation and sophistication of low-cost consumer biometrics, by continuously measuring activity, vital signs, and motion, should dramatically improve the early detection of diseases (for example, the early onset of Parkinson’s through gait analysis motion detection). Remote hospitalization, enabled by connected medical devices, could reduce the cost for rehabilitative care by 40 percent (€17 billion out of a total of €42 billion). Finally, opening up IoT-derived medical data to pharmaceutical research companies could help understand disease progression and factors and speed up the development of more individualized therapies.

**Housing and hospitality (€165 billion).** One of the biggest spending items for European households, housing is an important battleground for efficiency gains. The main source of value creation will be energy savings: Of the €450 billion GDP spent, we estimate that 35 percent of households could save 15 percent (€25 billion) on energy costs through better monitoring and the dynamic control of consumption of heating, cooling, and energy-hungry appliances (such as smart thermostat) that IoT will enable. Development of more autonomous and service-oriented white and brown goods should free up to 20 percent of the 20 hours per week spent by individuals on housekeeping tasks and generate up to €120 billion. This category also includes private security and accident prevention (for risk of fire and water leakage).

---

2 François de Brantes, Amita Rastogi, and Michael Painter, “Reducing Potentially Avoidable Complications in Patients with Chronic Diseases,” *Health Services Research*, July 2010. The study showed that 30 percent of chronic disease costs were attributable to avoidable complications that could be improved by better monitoring of patients. We estimate prudently that IoT could reduce these complications by one-third, hence reducing total costs by 10 percent.
4 Institute for Research and Information in Health Economics, which estimated that 60 percent of rehabilitative care could be transferred from special rehabilitative care homes to home hospitalization.
Hospitality is one of the most energy-hungry industries, and adopting smart energy solutions would help hotels and restaurants achieve up to 10 percent savings (roughly €5 billion).

**Industry (€160 billion).** Europe has more than 230,000 factories and 2.6 million industrial machines, for a total production cost of nearly €3 trillion. We estimate that equipping a large part of these production assets with smart capabilities should deliver 5 percent (approximately €130 billion) in productivity gains, thanks to better tracking of inventory, preventive machinery maintenance, and improved positioning of objects in machines. Better tracking and management of transportation fleets, pallets, and items transported through tags and localization devices should trigger up to €11 billion in savings on transport and handling.

**Retail and wholesale (€60 billion).** IoT should have a profound impact on logistics, inventory management, and the shopping experience. As is the case with the industry sector, logistics costs could be reduced by 10 percent or €10 billion. Goods tagging and connected store shelves will enable yet another level of transparency in inventory tracking, driving sizable benefits in terms of availability (increasing sales at least 2 percent), shrinkage reduction (savings estimated at about 70 percent for tagged goods), and write-offs, totaling approximately €30 billion in cost avoidance and new revenues. This would also allow retailers with wide inventories, such as pharmacies, mail-order companies, and cultural goods retailers, to dramatically simplify their operations by allowing them to more easily search for and find a particular SKU. Finally, equipping stores with new sensing devices, such as low-power Bluetooth, will enable a new shopping experience that includes self-service and automatic checkout—worth €9 billion in savings from lower cashier costs and increased sales.

### The €80 Billion Opportunity

Europe’s IoT environment can be analyzed by organizing its manufacturers, suppliers, and functions in several ways. First, the spread of IoT applications across industry verticals will require a well-evolved IoT solutions market (see figure 4 on page 7).

Realizing the kinds of industry opportunities posed by IoT requires the connection of more than 25 billion objects in the EU28 alone. This is no small task, but it would represent an annual opportunity worth €80 billion for six categories of IoT solutions providers (see figure 5 on page 8):

- **Component and module makers (€10 billion).** Produce the smart modules (sensors, actuators, connectivity) that are embedded in objects to connect, monitor, and control them in the network. Players include Sierra Network, Telit, and Gemalto.

- **Object manufacturers.** Design and manufacture smart products and tend to be specialized by vertical industry. They can be incumbent players such as Bosch Siemens Hausgeräte (BSH) for home appliances or new entrants such as Withings for connected health appliances.

- **Connectivity providers (€15 billion).** Operate the fixed or mobile service for connecting objects to the Internet. These can be typical telecom operators such as Deutsche Telekom, Orange, or Telefónica, or a new breed of low-cost network operators dedicated to IoT such as Sigfox.

- **Enabling solutions providers: cloud (€9 billion), analytics (€6 billion), automation, and security.** Deliver the key building blocks to develop services from IoT data and to provide

---

5 National Institute of Statistics and Economic Studies (France), *Domestic Work: 60 Billion Hours in 2010*, November 2012. We assume that the working population would spend 5 percent of their freed-up time on economic activities, generating €37 of GDP per hour.

6 We have not estimated the value of objects because the non-IoT portion of a car is much greater than the IoT portion.
intelligence to smart objects. Some of the most important include cloud-service providers, which store massive amounts of data and applications (including Amazon AWS, Microsoft Azure, and Google), and data analytics specialists, which make sense of the data (including Accenture, Intel, IBM, ThingWorx, SAP, and Capgemini).

- **System and management software makers (€1 billion).** Provides advanced communication platforms and middleware to facilitate the seamless integration of devices, networks, and applications. The intent is to enable rapid development and lower costs by offering standardized components that can be shared across multiple solutions in many industry verticals. Players include Bosch Software Innovations, Telenor Connexion, and Device Insight GmbH.

- **Systems integrators (€22 billion).** Ensure the seamless integration of modules within objects, as well as integration of the various operations, processes, and solutions used to build IoT services. This service can be offered by large integration players such as IBM or Accenture.

- **Services and platform aggregators (€18 billion).** Operate the solution for the customer, including bundling together objects and services, setting the price, billing, and overseeing customer care. These services can be provided by the object manufacturer (for example, car manufacturers or home appliances manufacturers) via an extension of the object itself, or separately by specialized players or telecom operators (for example, Deutsche Telekom Qivicon or Smart Home by Orange).

---

**Figure 4**

*A framework for IoT*

---

1 This list does not include other applications of IoT that are not specific to the verticals named in this figure.

Source: A.T. Kearney analysis
Not all objects will require the same level of smartness and connectivity. They will range from a very simple tracking tag stamped on a bottle of milk to autonomous cars with an enormous range of component modules, each requiring connectivity solutions to ensure high reliability.

With that range in mind, we have identified five categories of IoT component modules that we estimate will be worth €10 billion by 2025 for the EU28 (see figure 6 on page 9):

- **Tag.** The bulk of objects (21 billion units valued at €1.6 billion) will be equipped with tags, the simplest form of module. They will be used primarily on merchandise for tracking, inventory, or localization purposes.

- **Basic.** These modules (4.6 billion units valued at €6.6 billion) will provide low-frequency data collection and limited control. They will have a broad range of uses including pillboxes, street light control, and utility network monitoring.

- **Active.** Objects requiring a combination of sensors and continuous control, such as white goods automation, use active components (520 million units valued at €0.8 billion).

- **Real-time.** This includes time-sensitive applications, such as precision farming drones or fire and burglar alarm (300 million units at €0.6 billion).

- **High-performance.** These modules (4 million units at €0.4 billion) support the most demanding applications, requiring the synchronization of a large number of sensors and actuators, in a time-sensitive manner. It includes components embarked in autonomous cars or for the control of plane engines.
Within the IoT connectivity market (valued at €16 billion), the focus should be on low-power, wide-area (LPWA) connectivity and more traditional 3rd Generation Partnership Project (3GPP) mobile solutions (see figure 7).

**Figure 6**

**The size of the EU28 module market**

<table>
<thead>
<tr>
<th>Type of module</th>
<th>Description</th>
<th>Installed base of modules, 2025</th>
<th>Value of modules sold in 2025 (€ billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tag</td>
<td>• Passive or semi-passive tag, some data-transfer capability</td>
<td>20.8 billion</td>
<td>6.6</td>
</tr>
<tr>
<td>2. Basic</td>
<td>• Low-frequency data collection, some control</td>
<td>4.6 billion</td>
<td>1.6</td>
</tr>
<tr>
<td>3. Active</td>
<td>• One or few sensors, input/output, continuous monitoring, and control</td>
<td>520 million</td>
<td>0.8</td>
</tr>
<tr>
<td>4. Real-time</td>
<td>• Multi-sensor, multi-input/output, advanced real-time control</td>
<td>300 million</td>
<td>0.6</td>
</tr>
<tr>
<td>5. High-performance</td>
<td>• Highly advanced control</td>
<td>4 million</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>&gt;26 billion</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Source: A.T. Kearney analysis

**Figure 7**

**IoT connectivity service market in 2025**

<table>
<thead>
<tr>
<th>Type of connectivity</th>
<th>Description</th>
<th>Installed base of modules, 2025</th>
<th>Value in 2025 (€ billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Local</td>
<td>• Local connectivity (WiFi, low-power Bluetooth, Zigbee)</td>
<td>4.8 billion</td>
<td>Assumed to leverage existing connectivity</td>
</tr>
<tr>
<td>2. Tag readers</td>
<td>• Tag-reading equipment</td>
<td>20.6 billion</td>
<td></td>
</tr>
<tr>
<td>3. LPWA</td>
<td>• Low-power Wide-area (3GPP NB-IoT, LoRa, SigFox, etc.)</td>
<td>620 million</td>
<td>11.5</td>
</tr>
<tr>
<td>4. Cellular (old generation)</td>
<td>• 3GPP connectivity, narrowband</td>
<td>150 million</td>
<td>3.6</td>
</tr>
<tr>
<td>5. Cellular (new generation)</td>
<td>• 3GPP connectivity, broadband</td>
<td>4 million</td>
<td>1.0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>&gt;26 billion</td>
<td>16.1</td>
</tr>
</tbody>
</table>

Source: A.T. Kearney analysis
• **LPWA.** The main opportunity for connectivity providers (600 million objects to connect for approximately €11.5 billion in service revenues) will come from LPWA, a new breed of connectivity that offers low-throughput, low-energy consumption and low-cost solutions for non-moving objects (or objects that do not require a seamless handover of connectivity). LPWA will meet the needs of many IoT applications in the utilities industry, as well as infrastructure monitoring and fleet management applications. New players have been emerging (for example, SigFox and Arquiva) to address this opportunity with dedicated infrastructure. Telecom operators can address this relatively cost-effectively, however, through upgrades of their existing infrastructure when software supporting evolving 3GPP standards (called NarrowBand IoT or NB-IoT, or EC-GSM-IoT) is available (within a couple of years), and it remains to be seen how the market will be divided.

• **Cellular (old generation).** More traditional 3GPP-type connectivity (150 million objects to connect for €4.5 billion in service revenues) will continue to be necessary for applications requiring permanent connectivity and handover that have fewer energy constraints such as drone operations or control of fire and burglar alarms or vehicles.

• **Cellular (new generation).** For more demanding applications that need higher data throughput, the most recent 3GPP-type connectivity (4 million, with €1.0 billion in service revenues) will be required, such as for drones, autonomous cars, and home hospitalization.

• **Local and tag readers.** A vast majority of objects (more than 25 billion) will connect to the network through existing local area networks and generate only marginal revenues for connectivity providers. This will be the case for objects equipped with tags, and all non-moving objects covered by a local area network (through a home or company router) or a personal area network (through smartphones) that do not have energy alimentation issues (for example, white goods, smart machinery, and wearables).

---

**Ready or Not: Preparing Europe for Capturing the IoT Market**

Europe is in a challenging position compared with the United States and Asia when it comes to the component and object sides of IoT. For example, Europe has been losing ground in production of semiconductors, software, and consumer electronics devices, as we found in our recent study of high tech in Europe, *Rebooting Europe’s High-Tech Industry*. Despite this, the continent has many of the key qualities to become an IoT leader.

Success requires strength in many of the areas already discussed in our IoT framework in figure 4 on page 6. The components are mutually reinforcing, creating a positive feedback loop that can strengthen Europe’s overall competitiveness. Providers of IoT solutions are dependent on consumers and businesses that use IoT applications to jointly drive innovation and co-create new business models. Society enables IoT (or hampers it) through IoT-friendly regulation, and individuals drive adoption and use, as both consumers and workers.

Europe already is a leader in many of these areas.

**Strength in industry verticals**

Europe leads in both productivity and innovation in a number of industries. They could form the hub of a future, thriving IoT ecosystem.
Figure 8 plots the competitiveness of various European industries against IoT’s importance for each industry. The positioning of the industries on the Y-axis is based on the financial-impact assessment described earlier. That is combined with a qualitative assessment of the importance of IoT to an industry’s efficiency, product and service innovation, customer interaction, and value chain. We also looked at the extent to which IoT will bring disruptive models to each industry.

The positioning of industries on the X-axis is based on assessments of the EU28 versus North America, Latin America, Southeast Asia and Oceania, Eastern Europe and Western Asia, the Middle East and Africa, and Northeast and Central Asia. These assessments considered the following factors for each industry:

- What is its market share relative to the region’s size? Is that share growing?
- How strong is efficiency and productivity?
- Does it drive innovation?
- How well does it achieve customer intimacy?
- Does it adapt to disruptive changes?
- How influential are societal factors (such as the supply of skilled labor and universities, and extent of regulation) in driving competitiveness?

For some industries that are local by nature, the measure of competitiveness is less about how regions can fight for global market share and more about how well the industry performs in the region relative to other regions.

Figure 8

Many industries could form the hub of an IoT ecosystem

Source: A.T. Kearney analysis
Determining the competitive agenda for Europe for all of the industries is beyond the scope of this paper. However, the industry’s position in the matrix can help determine if it can be part of building a strong IoT ecosystem in Europe.

The upper right-hand quadrant comprises industries where Europe has a stronghold and business shifts driven by IoT are expected to be substantial. These industries would likely serve as the cornerstones of a European IoT ecosystem:

**Healthcare.** Europe has a well-developed healthcare system. It stands up well to North America on quality, but has a substantially lower cost position. Europe is also home to Philips and Siemens, which have strong presences in the medical device market. IoT promises to deliver significant quality and cost benefits. For example, monitoring and management systems can help detect health problems early, improve accuracy of diagnoses, and improve recovery.

**Automotive.** Europe is home to many leading car brands. A number of them, such as Mercedes and BMW, are using IoT innovations in their commercial trucks and passenger cars. Telematics supports communications in vehicles and quite soon will be the cornerstone of autonomous driving, which will transform the entire industry. Leadership in IoT will help European automakers come out ahead in this new era.

**Telecommunication operators.** Overall, Europe has a sophisticated communication infrastructure that can accommodate increased capacity and performance. Orange, T-Mobile, Telefónica, and others have all been early adopters for LTE and LTE-A features and are likely to continue to drive the evolution, provided they improve their financial power to sustain the pace of investment required for these new networks. Communication is the backbone of IoT and is a strong enabler for IoT penetration and use within other sectors, placing Europe in a leadership position.

**Financial institutions.** European banks and other financial institutions are well ahead globally in innovation and efficiency. For example, payment solutions with chip+PIN are more prevalent in Europe than any other region, and organizations such as Visa continue to drive this development. Insurers are already quite public about the impact IoT could have on their business, as it pertains to insurance pricing and follow-up. With more and more mobility, and a move to connected and cashless payment systems, Europe is well placed to maintain its leadership position.

**Industrial machinery.** Europe has a strong position in industrial machinery and automation, and IoT will be key for Europe to maintain its strong position in the sector. Companies such as ABB, Siemens, and Schneider Electric are world leaders in industrial equipment. IoT will bring a new wave of productivity in manufacturing and other sectors enabled by these industries, and automation is the chance for developed regions to compete against low-cost countries.

**Private security.** While many other regions in the world may be more focused on private security than Europe, the region is quite advanced in its use of security automation (such as alarms and monitoring). IoT will further enable these types of solutions, and Europe could continue its prominence in this area. Europe also boasts such leading companies as G4S and Securitas, in an otherwise fragmented industry.

The upper left quadrant in figure 8 contains industries where Europe likely would need to make major advancements to increase its competitiveness. IoT can be a key part of this, giving Europe the opportunity to be a first mover or fast follower for new IoT-driven business models (but in most cases work would be needed on numerous other dimensions as well):
**High tech.** As seen in “Rebooting Europe’s High-Tech Industry,” Europe is struggling to keep up with the developments in North America and East Asia. As IoT and high tech become virtually synonymous, a strong IoT ecosystem is vital for achieving high tech’s comeback.

**Transportation.** Europe’s competitive position in the transportation industry is primarily driven by labor inefficiencies. IoT promises to become a major productivity driver—from ticketing to tracking, and eventually to autonomous driving—so embracing IoT within this sector would advance it considerably.

**Retail and wholesale.** Efficiency within retail and wholesale in Europe is hampered by the demand for heterogeneous, culturally diverse stores that are both small and local. IoT could help increase the competitiveness of this industry, but it would require a transformation in retailer formats to catch up with other regions (primarily North America).

The lower half of the matrix contains industries where applications of IoT can still be important, but perhaps less so than other industries. As these are of less interest for the purposes of this paper, we do not cover them here.

IoT promises to become a major productivity driver, so **embracing IoT within the transportation sector** would advance it considerably.

The industries in the upper right-hand corner are of vital importance for IoT and vice versa. By leveraging IoT, these industries will be even more innovative and cost competitive, resulting in a strong export opportunity. In addition, given their strong global positions, these industries can serve as the foundation for a European IoT ecosystem. By leveraging their use cases and solutions, they can capture a globally leading position.

**Europe’s emerging IoT solution providers**

There are a number of industries focused on providing products, services, and solutions for IoT. Europe is strong in several of these sectors, including communications technology and telecommunications but more challenged when it comes to components and IoT products.

**Component and module makers.** Europe is furthest behind in the IoT components arena, where electronics companies in Asia and the United States lead the way. There are bright spots, such as processor designer ARM, which serves as IP base for 95 percent of all smartphones, and ST Microelectronics, which is among the 10 largest semiconductor makers, with a strong portfolio of sensors and similar components. On the other hand, numerous companies have had to close shop within the past five years due to heavy competition from North America and East Asia—for example, the joint venture between ST Microelectronics and Ericsson for communication platforms. Despite this, there are exciting new start-ups, such as Riot OS, a Germany-based company that has developed an operating system for IoT; Ardunio, with a strong presence in Spain for an IoT platform; and Raspberry Pi, based in the United Kingdom, with a small-board computer.
Object manufacturers. Europe’s position in this area is largely dependent on the industry sector, as we noted earlier. For some industries, such as automotive, Europe is in an excellent competitive position. Similarly, in the area of building and industrial energy management and automation, a company like Schneider Electric is well placed. Europe is strong in machinery equipment as well, with ABB and Siemens two strong players. And smaller, innovative companies also pop up, like Netatmo for weather station applications and Withings for home and personal sensor devices. For other areas, such as handheld devices, Europe has gone from a position of strength to one of relative weakness (with Microsoft acquiring Nokia, and Ericsson exiting its joint venture with Sony).

Connectivity providers. Europe has traditionally been strong in communications technology. While it has been losing ground during the past 10 years, companies like Ericsson, NSN, and Alcatel-Lucent (and the potential merger between the latter two) are still major players. Because 5G will be a key component of IoT, the strength of these companies is likely to continue. The telecommunication sector in Europe remains robust, and the region has long been the frontrunner in terms of mobile penetration and use of mobile data. Although they are losing some ground to the United States, European networks and services are still among the leaders in the world. For example, T-Mobile, Orange, and Telefónica are driving the build-out of LTE and LTE-A. Europe also has some exciting new companies, such as France-based Sigfox, which is aiming to provide global low-power IoT network access, and United Kingdom-based Aeris, with a similar mission.

Enabling solutions providers (cloud, analytics, and automation). Europe is in a weak position in this sector, with most of the leaders, including Google, Amazon, and Microsoft, based in the United States. Even Facebook has announced major investments in artificial intelligence. One notable European exception is SAP, which ranks in the top five globally when measuring revenues for software-as-a-service (SaaS) and platform-as-a-service (PaaS) solutions. SAP has embedded IoT capabilities in many of its enterprise solutions and recently launched HANA cloud solutions for IoT. On the start-up side, there are a number of European players, including Carriots in Spain with an open platform for IoT application development; UK-based Intellisense, with an IoT application platform; and Italy-based Solair, also with an IoT application platform.

System and management software makers. The market for management software is emerging, and while most companies in this industry are based in the United States, there are some European providers such as Bosch Software Innovation, Ericsson, and ARM/Sensinode.

Systems integrators. Traditional systems integrators use IoT throughout their operations. Many of these services are local in nature, so the bulk of those used in Europe are based there. Europe is relatively weak in this sector, with Capgemini the largest European provider. T-Systems, a subsidiary of Deutsche Telekom, is also large, and has a significant IoT focus. Beyond that, multiple smaller system integrators work with IoT, and these services are bundled with a hardware or software product. Italy-based Eurotech, for example, offers management software and hardware.

Services and platform aggregators. This includes telecom players such as Deutsche Telekom Qivicon and Orange Homelive as well as Securitas Direct in home automation; WirelessCar, Tomtom, and BMW ConnectedDrive in automotive; and Engie, British Gas, EDF, and E.ON in energy.
IoT adoption in Europe

Society’s embrace of IoT, including supportive governments and regulations, will be important to its success. For example, for remote health monitoring to work, legislation must allow for an IoT-enabled collection of patient health data, and individuals should feel comfortable with the concept. This can only happen if there is trust among citizens, governments, and companies.

While Europe’s IoT standardization and investment in the telecom infrastructure will be important (please see the next section, “Key Success Factors for European High-Tech Players”), we believe that the continent is a leader in data privacy. The EU recognized early that such measures would be critical to the digital economy, so it has developed a framework for data protection that will provide consumers with more transparency and control over their data, and eventually will generate more trust.

Europe’s strengths include leadership in key industries, a regulatory framework that can be adapted to support IoT, and digitally fluent citizens.

Overall, EU legislation for data privacy is based on two important concepts: “Privacy by default” and “right to be forgotten,” which will require companies to apply a new technological approach called “privacy by design” and “silent chip.”

While some may believe that these rules will be cumbersome for EU companies to implement, we believe that they will provide them with two important advantages on a global scale:

- A technological capability to design and provide services that correspond to consumer privacy requirements
- Trust as an asset, ensuring a sound foundation for the development of a digital economy

Striking the right balance between this pro-privacy approach and regulatory levels that minimize bureaucracy while promoting innovation will be important for the EU, however.

Successful adoption of IoT also requires a digitally fluent citizenry. This holds true for consumers of IoT-enabled objects (such as wearables, home monitoring devices, and connected white goods), consumers of services built on IoT, and employees working for companies that are applying IoT.

Digital fluency in Europe is high compared with other regions, but it varies considerably across member states. Nevertheless, a large number of countries, including Denmark and Sweden, rank very high. In the International Telecommunication Union’s Information and Communication Technology (ICT) Development Index, eight out of the top 10 positions belong to Europe (see figure 9 on page 16). This digital fluency is an important indicator of how well European companies can leverage IoT for competitiveness.

All in all, Europe is a heterogeneous region. Compared with the United States and parts of Asia, Europe is behind in critical IoT technologies. Despite this, it has a sufficient number
of advantages to drive IoT and emerge as a global frontrunner. These strengths include leadership in key industries, a regulatory framework that can be adapted to support IoT, and some of the most digitally fluent citizens in the world. If European companies can leverage these strong points, the European IoT ecosystem can be a major competitive force.

Key Success Factors for European High-Tech Players

Despite its current advantages, Europe’s biggest stumbling block is its weak position in the IoT industry itself. Companies making the components, objects, software, and enabling solutions, as well as the providers of systems integration and connectivity, will build their position only through dedicated work to reach this goal. We discuss the key success factors for some of the sub-industries below.

Component and module makers

Components is a relatively mature, extremely scale- and standards-driven industry with high barriers to entry. It has long been dominated by the United States and Asia, but there are some outstanding European examples, such as ARM. ARM processors dominate the smartphone world and have made strong inroads into many other applications. ARM’s strength is due to a combination of factors. It was one of the first companies to focus on power consumption in performance processors and continues to excel in this area. It has fostered a cadre of chipmakers that use the ARM IP and have converted to chipsets. ARM has no semiconductor factories; it provides the processor design to more than 1,000 partners that turn it into chipsets. Both Apple and Android platforms use ARM. The company is in an excellent position to ride the IoT wave, since many IoT applications demand low power usage and a standard
application development platform. ARM is also positioning itself through the recent acquisition of IoT platform company Sensinode. Learning from ARM could provide guidance for other companies in the component industry:

**Build components with integrated functionality based on open standards, suitable for low-cost deployment in a wide range of IoT applications.** For wide use, IoT components need to be affordable. To achieve this, functionality must be integrated into a single chip and the component design must be basic enough to achieve economies of scale during manufacturing. For many aspects of component building—communications networks, embedded logic, or the input/output (I/O) interface to sensors and actuators—open standards will be critical to development and adoption. Not every IoT application has sufficient scale to justify creating proprietary standards, so it is important for component makers to be active participants in developing a broader set of standards.

There are also significant advantages to conforming to an existing set of standards. It supports communications, because IoT is about networking, and it is very challenging to drive a proprietary standard. It’s also about embedded logic, because each IoT application does not have sufficient scale to drive its own standards. And it also supports I/O interfaces to sensors and actuators. Conforming to open standards enables scale. Sensors and actuators are more specific than embedded logic, however, so there is room for a balanced strategy.

ARM provides a suite of designs for a wide range of applications, from smartphones to embedded logic, and it embraces openness to surrounding components for easier integration.

**Use global niches to break in to new markets.** Due to scale economics in component making, emerging niches will be the way that aspiring players break in. ARM did this through its focus on low-power smartphone devices, while the incumbent Intel was busy focusing on high-performance personal-computer and server applications. Success in one niche can then be parlayed into another niche and so on.

**Ensure that the components are embedded with the right level of security.** With so much connected in an IoT world, guaranteeing solutions’ security is paramount. Objects that are always on, collecting data and controlling things, become a risk to hackers, who can now not only steal your credit card but potentially turn your connected house, factory, or car against you. ARM has a strong focus on providing security within its hardware’s core.

**Allow other players to build complementary solutions for greater, healthier competition.** Usually a company is best suited to dominate a specific part of the market, but it can leverage other parts to achieve its objectives. Trying to succeed in all IoT areas will actually weaken a company’s ability to dominate a niche. Hence, it is important to make effective use of existing, supportive partners, as ARM did in working with many other companies that can convert its designs into chipsets.

**Object makers**

Traditional products acquire added functionality and become “smarter” when they are Internet-enabled. For example, a stove that can be controlled remotely can preheat your dinner, or a fork that can measure the amount of food an older person eats through data analysis can help him avoid obesity.

One successful European company in this category is home-appliance maker BSH, which has focused much of its innovation capacity on IoT (in addition to sensor technology and
automation). Staying close to customers and markets is central to BSH’s strategy. It also recognizes that its current core skills are in white-goods applications and that it needs to leverage the IoT world to embed intelligence and connectivity in its products. To build the right solutions, BSH runs “hackathons” for rapid prototyping and experimentation. It also is closely involved with a series of innovation partners. The company recognizes that it cannot build a BSH-only solution because most homes contain different brands of appliances. So it has launched Home Connect, which integrates with other appliance makers.

We can learn several valuable points from BSH:

**Develop IoT objects and use cases in close cooperation with the customer and a firm understanding of the value chain.** First and foremost, the non-IoT parts of the object need to be a good and competitive product (the oven had better be of a quality that stands up to its competitors). Regarding IoT, customers will typically adopt new technology if it provides a solution that addresses a specific need. Yet, customers may not always be able to envision how a product can solve their needs. Take Henry Ford’s classic quote: “If I had asked what people wanted, they would have said faster horses.” Success in building the right solutions will hinge upon IoT object makers striking a fine balance between listening to and co-creating solutions with their existing and potential customers, while also being prepared to lead the way. Understanding of the value chain will also be important, for it will indicate where profits lie and what complementary solutions should be in place to drive customer adoption. To achieve all this, BSH works with partners and other external parties through venture forums and the aforementioned hackathons to rapidly develop testable new concepts.

**Bring IoT solutions to market in a way that maximizes their chance for adoption.** While an object maker that simply adds IoT functionality to its existing products could go to market as it has many times before, it would be much more effective to think through how to communicate, sell, and work with the added functionality throughout the product’s life cycle. For example, software function upgrading could become a part of the business model. For new types of products that are made possible through IoT, a go-to-market approach and strategy developed from scratch would be important for each industry and use case that the products are intended to address.

**Extend the customer relationship throughout the life cycle.** As mentioned earlier, IoT can build a longer relationship with customers than ever before. Through constant remote connection with a product, the object maker can bring new functionality (through upgrades), monitor performance, get feedback to improve future iterations, suggest service intervals, and provide new value-added services.

**Navigate the regulatory environment and public perceptions to avoid IoT being viewed as an intruder of privacy.** Data-protection, exchange, privacy, and security regulations greatly affect IoT. For solutions to be successful, regulations cannot impede innovation and adoption. So aligning with regulations and customer perceptions will be crucial for object makers before security becomes a pressing concern.

**Contribute to powerful industry relationships to ensure openness.** If an IoT object maker incorporates standard components and communication, as discussed above, it will be better able to benefit from related upgrades in functionality and performance. This thinking expands even more to the environment surrounding the objects it makes. BSH’s inclusion of other appliance makers in its Home Connect product is a case in point. Adhering to the same principles of openness and integration that the components do will encourage other companies to participate.
Connectivity providers

Even though some parallel networks focus solely on handling low-data-rate IoT applications, the existing communication infrastructure will be a major carrier of these connections. However, connectivity providers may need to adjust their offerings to support IoT applications and avoid the risk that they turn to an alternative infrastructure, or use only local connectivity.

Major operators such as Orange and T-Mobile are gearing up to capture growing IoT opportunities by ensuring their networks feature the most advanced technology now. They also are adjusting their business models to enable IoT penetration. Nevertheless, more remains to be done.

Trying to succeed in all IoT areas will weaken a company’s ability to dominate a niche; it is important to make effective use of existing, supportive partners.

Operators are pushing the IoT market as well. For example, Orange is supporting new IoT applications by assisting with the physical distribution of products and consulting in areas such as communication module integration, access to sourcing, and the manufacture of objects. Other items that operators can provide include:

**Connectivity solutions that match the needs of IoT use cases.** Network coverage is critical for connection-dependent IoT, with the connection's performance appropriate to the application. Some will require high-performance connections, such as video surveillance. Many also need extremely low-power connections and a network infrastructure that can support them. For example, Sigfox is building a global network for ultra-low-power connectivity, and 3GPP is standardizing low-power connections for this purpose. Orange and T-Mobile are rolling out new advanced standards. Other important issues are indoor solutions for coverage and low power, and LTE/LTE-A/5G.

**Pricing plans that match the value for having an object connected.** The recurring cost of wide-area connectivity, including administration of subscriptions, can be a major obstacle for achieving IoT penetration. This is especially true for “things” that are moving cross-border and incurring roaming fees. Hence, it will be important for connectivity providers to provide efficient, cost-effective, and fair plans that include:

- Device and connectivity management solutions, such as soft SIM and automated provisioning
- Pricing to match applications, such as low-data-rate and infrequent for sensory applications or high-data-rate, low-latency, and high-reliability for 5G-type applications
- Pricing to match uses, such as group plans that allow many connections on the same subscription
- Pricing that accommodates roaming situations at affordable rates

**IoT solutions promoted and co-developed with partners.** Beyond mere connectivity services, IoT is a business opportunity for these providers. Yet, operators’ track records for
developing their in-house solutions has been spotty because they often become sub-scale. Instead, an operator could act as a channel and provide off-the-shelf solutions. A more forward-looking strategy would be to work with other IoT solutions providers to achieve joint differentiation and new business models. Allowing them to sell the solutions more broadly would ensure their long-term viability while the leading operator would be able to capture first-mover benefits.

**Enabling solutions providers**

These companies provide items including analytics, cloud services, and payment solutions. They rely on economies of scale, and their offerings can often be used in applications beyond IoT.

For example, the UK company Tridium provides analytics and security frameworks for IoT. In effect, it aspires to provide IoT’s operating system by connecting and translating data from nearly any device or system. Through its open platform, it has fostered a broad community of people, machines, and companies, and thousands of applications utilize its capabilities. During the past 15 years, it has built an extensive network of partners, including original equipment manufacturers, developers, systems integrators, and IoT technology companies. Tridium’s platform extends into areas such as data centers, ensuring the scale necessary to its solution.

**Extend enabling solutions to be relevant and powerful for IoT applications.** They can be leveraged across applications and beyond IoT, while their use within IoT will be only a niche application. Thus, most enabling solutions will be inherited from other parts of ICT. To determine these solutions’ added value, it is important for companies to understand the needs of IoT across the applications (for example, knowing what type of cloud functionality different applications require).

**Provide the necessary means for simple and seamless integration into IoT solutions.** Open and standard integration is key to an enabling solution that supports multiple IoT, as well as other applications. This can be achieved by leveraging existing open standards or frameworks, or by providing APIs for simple integration.

**System and management software makers**

These companies build solutions for managing a large number of IoT objects, adding application value with the help of those objects. Solutions can be either general (for example, monitoring functions) or specific to a particular industry or application.

One company that operates somewhere between a pure enabling solutions provider (like a cloud provider) and an IoT application software provider is the Spanish company Carriots, which provides an open platform (PaaS) for developing IoT solutions. It can connect to a multitude of devices and contains an environment for developing cloud-based applications for the devices. It leverages standard protocols (RESTful) for easy device integration and provides APIs for easy northbound integration into enterprise systems. To further simplify integration, it maintains a broad set of partners.

Several valuable points can be gleaned:

**Develop solutions that add value to IoT objects, in close cooperation with the object makers.** Many IoT systems will have common functionality, such as alarms and monitoring, but much functionality will be use-case specific. The wise IoT system maker will be general enough to get scale and specific enough with its application to deliver the best use case. By building the
application in partnership with customers and object makers, software companies will ensure they are developing the right solutions. With so many advanced customers and applications available in Europe, there should be plenty of opportunity.

**Enable integration of data between systems, and from outside the group of objects the system software is managing.** Substantial value can accrue when data from multiple systems—such as sensory and geographic information—can be combined. Carefully building systems can accommodate this exchange and integration of data. Solutions should support data exchange, both for export and import, so that applications can use information from many sources.

**Understand and navigate the regulatory environment to ensure that captured and interchanged data is handled correctly.** With regulations’ strong influence and the fact that additional data could be brought into a system, knowing how to reach full compliance across regions and countries will be important for system SW makers.

**Go to market through a combination of object makers and systems integrators.** The right path to market will depend on the application. In some cases the object maker will be the lead, while the systems integrator or the software solution provider will take the lead in other cases. Being open to the use of different channels also will be important to achieving the right level of market coverage.

**Enable and build a network of object makers and application SW providers that can leverage the system SW platform to build complete solutions.** As the hub of the IoT solution, the software system maker will be in charge of integrating objects and enabling solutions into the overall solution.

**Systems integrators**

IoT systems integrators build and often manage the final solutions for their customers. Most of them have the capability to address IoT. But a number of new, IoT-focused firms are emerging, like France-based Joshfire, which is a design and development studio for IoT objects and applications. Founded in 2010, it builds products and connected objects, as well as multi-device apps on behalf of its customers. It also has its own SaaS solution, which enables multi-device app development and deployment.

We can take away certain points:

**Leverage and extend industry expertise and innovation capability to IoT.** Successful systems integrators have an intimate and thorough understanding of their customers and their industries. This enables them to build leading solutions for them. As IoT often will be an extension of a company’s products or business model, so will industry and use-case specific understanding be a necessary extension of the systems integrator’s business. With so many advanced customers and applications available in Europe, there should be plenty of opportunity to work closely with customers to develop leading applications.

**Develop a thorough understanding of the underlying technology.** Similar to the way that systems integrators understand the final application, developing deep knowledge about available IoT solutions and underlying technologies will help them. The role of systems integrators is to design the best possible solution for their customers, so being as broad as possible will help them select and integrate the best components.
**Extend service capabilities to IoT.** Many systems integrators offer life cycle services to their customers, including product operations, maintenance, and IT outsourcing. The same logic will apply for IoT, where forward integration into providing outsourcing services has significant synergies with the systems integration business. See the next section for key success factors for this outsourcing capability: services and platform aggregators.

---

**Successful systems integrators have an intimate and thorough understanding of their customers and their industries.**

---

**Optimize the delivery model.** This is typically key to maintain profitability and will hold true in an IoT context, where, as discussed above, a strong local approach may need to be maintained to manage all IoT objects for a customer. An SI usually would work closely with its customers to deliver the use cases—even more diligently than before leveraging agile delivery methods—and review the balance of local versus offshore delivery.

**Services and platform aggregators**

Services and platform aggregators operate the final solution on behalf of their customers. This would be the final instance in the service chain around IoT. It is also a natural extension of the system-integration-type players, which means that many of the key success factors mimic those of the systems integrators. Many operators take this service role, but there are also focused companies, such as Swedish Volvo Group-owned WirelessCar, which provides a white label telematics platform and runs and operates it for its automotive OEM customers.

**Build a model that can effectively be tailored to the customer.** IoT will have many different use cases, most likely more than what a typical IT outsourcing operation would manage. The IoT application is also typically very close to a customer interface, making it very important to understand the customer to be able to deliver the right service. Hence, a service and platform aggregators need to show a thorough understanding of the IoT use case and the customer side.

**Pursue innovation.** As the service and platform aggregators will be close to the final use case of the IoT solution, they will be well placed to be part of generating innovation. Whether they draw benefit from it themselves or provide it as a service to customers will be up to the individual players, but key is to really make something out of this possibility.

**Build a scaling delivery model while being able to deliver locally.** As any outsourcer will tell you, building scale is essential to the business model. In IoT, however, global scale needs to be balanced with the necessity to be local, as many of the IoT objects that need to be managed and served are present locally.

---

**Policies for a Level Playing Field**

IoT has the potential to boost the European high-tech industry and to profoundly improve competitiveness across sectors. Yet, as with past technological revolutions, achieving such
ambitious plans will require bold moves from policy makers to create the conditions for IoT to thrive in Europe.

**Unleash regulated sectors**

Healthcare and utilities are two of the most promising domains for IoT value creation, as well as sectors where Europe has a competitive edge. Yet, Europe is already late in digitizing these two sectors. In healthcare for instance, a number of factors limit innovation. Rather than an open European market, each country uses its own taxonomy of illness and treatments, and there is an embargo on healthcare data. Furthermore, the social security system tends to measure the cost, rather than the ROI, of treatments.

At the same time, new entrants such as Apple, with its health kit, in the health industry, and Nest in the utilities sector, are progressively building ecosystems and collecting data that together could upend traditional players if they do not act.

Policymakers are in a position to open the healthcare and utilities sectors, allowing controlled access to data and infrastructures. They can establish incentives for creating clusters in which incumbents and start-ups collaborate, and support the emergence of new services such as those that can improve the treatment of the most serious chronic diseases or that help reduce peaks in energy consumption.

**Fund and retain future giant platforms to localize value**

The network effect of digital business models should foster the development of new giant platforms in IoT. When the same thing occurred during the first Internet wave, Europe failed to launch any of the top-20 players, ceding the ground to U.S. and Chinese companies.

Were this to happen again, not only would it negatively impact employment, but it would also have a negative effect on the trade balance of the European zone and deprive Europe of the R&D funds needed to fuel future innovations. Having Internet giants based in the EU would provide a unique opportunity to consolidate start-up hubs, due to the financing they funnel into new start-up projects.

Moving forward, it will be important for policymakers to not only foster the development of a start-up ecosystem, but also ensure that the best start-ups can scale to become global leaders while remaining based in Europe. This will entail specific measures to attract growth funds and develop a tech-equity market (similar to NASDAQ) and fiscal measures that allow the region to compete on a global scale.

**Direct public investments toward IoT**

After the Second World War, state procurement was vital to reconstruction. Similarly, it could be very effective for accelerating creation of the digital infrastructures required for IoT. Rules could be set to ensure that for any state or EU-level procurement initiative, a significant share of the investment is allocated to digital initiatives. To avoid the proliferation of subscale platforms, new rules should guarantee the generic nature of these platforms.

**Make Europe a player in standardization**

Today, IoT standardization is a focus of both international bodies and private consortiums. International groups such as ISO, CEN/CENELEC, 3GPP, and IEEE are trying to build a
comprehensive and universal set of standards at the network and individual service levels. Their time horizon is long. In parallel, a flurry of competing private consortia has emerged, including the AllSeen Alliance (led by Qualcomm), the Open Interconnect Consortium (led by Intel), and Thread (led by Google’s Nest). Their objective is to gain sufficient traction in the short term to impose their own standards and technologies.

While the EU has been active in researching standard architecture (for example, SENSEI and IoT-A initiatives), there are few European players involved in private consortia (except for Technicolor, a member of the AllSeen Alliance).

Aside from formal standardization efforts, some countries are launching their own initiatives at a country level. Germany, for instance, is developing an interesting initiative called Industry 4.0, to create a platform for players and standards in smart manufacturing. In 2014, the United States’ National Institute of Standards and Technology (NIST) organized a national program, dubbed the Smart America Challenge, to encourage the development of cross-industry platforms and standards with the support of public funding.

Healthcare and utilities are promising domains for IoT value creation, and sectors where Europe has a competitive edge. Europe can place greater focus on standardization to impact IoT governance. While private consortia are already relatively advanced with respect to business-to-consumer standards, the EU should create its own, especially in manufacturing, smart grids, and healthcare. For these areas, the EU can expand on the concept of Industry 4.0 or the Smart America Challenge and create European clusters of large and small players focused on building cross-industry platforms and standards.

Protect privacy while supporting innovation

The ability of individuals and companies to trust third parties with their private data is at the heart of IoT’s success. Yet, as one expert put it, while “big data is ethically neutral, the use of big data is not.” Confidence is closely linked to how data is used and can only exist if there is perfect alignment between the user of the service and the provider holding the data. Today, Europeans are still doubtful about data protection, fearing potential surveillance, a hidden commercial agenda, or exploitation of their information. Ultimately, this could slow down the adoption of IoT.

The current European regulations tackle this issue by requiring service providers to explain to users what they will do with their data and to obtain explicit consent before commencing the service. In the case of big data, this approach greatly limits value-creation potential, since opportunities are usually discovered only after the data has been collected and analyzed. Hence, a balanced approach to data regulation through legislation would increase user confidence without hampering innovation. One way to achieve this would be to establish a minimal set of legal obligations, applied across the EU28, that require providers to inform consumers of

---

1 Kord Davis, Ethics of Big data: balancing risk and innovation, September 2012.
how their data is being used. A more tangible legal threat would empower service providers to act in their customers’ best interest or risk erosion of their trust.

**Enhance data security**

IoT will cause a number of new security vulnerabilities and pose new threats (for example, consider recent reports on the possibility that individuals could hack and take over connected cars). Major security risks will adversely affect IoT penetration, so purposeful regulation and industry awareness, paired with continuous review, will be key to success.

The Network and Information Security Directive, currently under review by the European Commission, will bring tools to member states to improve their cyber-security capabilities and prompt companies in critical sectors to adopt risk-management practices and report major incidents. Yet, we believe that the directive is best served by adopting ambitious targets for implementation and security levels to be achieved by critical infrastructures.

Moreover, since IoT will generate large amounts of surveillance-related data, it is likely that requirements similar to those for storage of communication records also will be placed on other types of IoT applications. This will add to the complexity of developing such applications, as well as to concerns over adoption, so it is important that any new regulations be relatively light, voluntary, and fully transparent to the public.

**Support investment in telecom networks and foster universal access for IoT**

Telecommunication networks are the backbone to connect future smart objects, so they are essential infrastructure for European competitiveness.

The EU commission has the power to reshape the European telecom market and make it stronger and less fragmented by supporting cross-border mergers and the emergence of regional champions. By doing so it will enable operators to invest more heavily into infrastructures. Regulators should remove all potential barriers to deploying networks fast, for instance by supporting the release or reframing of frequencies, by ensuring that the cost of licenses is manageable, or by simplifying the construction rules to build telecom infrastructures.

For the least dense areas, Europe’s periodic review of its universal service regulations will better ensure that society’s continually evolving opinion on what should be a common utility is taken into consideration.

**Redefine the social contract and support transformation of the employment market**

Finally, the entire IoT community can encourage policy makers to adopt a new sense of purpose for the IoT-powered digital age. They are in a position to design a new contract that meets society’s broader needs and aspirations—more free time, the ability to care for an aging population, and consuming services instead of products, just to name a few—as well as the constraints of limited primary resources.

The accelerated process of creative destruction in the employment market must also be factored into policy makers’ plans. On the one hand, many jobs will no longer exist due to increased productivity and reduction of unnecessary work. On the other, new jobs will arise in a variety of domains:

- **Services and sharing economy:** Individuals will be able to provide their skills, assets, and free time to anyone needing them.
- **Infrastructure:** Roads, buildings, telecoms, utilities, and security services will all create and operate the new infrastructures that will support and connect IoT-enabled objects.

- **Technology:** Developing and manufacturing the new objects will create an opportunity for re-industrialization.

- **Platforms and IT domains:** There will be a need to design and operate services built from the data generated by smart objects. Europe failed to localize these platforms in the early days of the Internet—with most platforms belonging to North American and Asian players—but IoT brings a new opportunity.

This social contract can also tackle the challenge raised by “Uberization.” Popularized by the ride-services company Uber, the term refers to the creation of an economy in which individuals can provide services directly to others via a software platform. This model worries incumbents and states, because it establishes a parallel employment market without contractual rights or safety nets.

In summary, there is an opportunity to articulate a new social contract based on a more flexible employment market that encompasses the sharing and service economy. It would provide the basis for a renewed welfare state by supporting the development of digital capabilities and inexpensive Internet access for all. It creates a vision of a more sustainable society, where everything could be consumed as a service at a fraction of the cost and with a fraction of the inputs.

---

**Authors**

Thomas Kratzert, partner, Stockholm  
thomas.kratzert@atkearney.com  

Hervé Collignon, partner, Paris  
herve.collignon@atkearney.com  

Michael Broquist, principal, Stockholm  
michael.broquist@atkearney.com  

Julien Vincent, principal, Paris  
 julien.vincent@atkearney.com

The authors wish to thank their colleagues Jonathan Anscombe, Jan Paul Van Term, Volker Lang, Francesca Sesia, Jean Boschat, Laurent Chevreux, Jérémy Séguy, and Julien Lacroix for their valuable contributions to this paper.
A.T. Kearney is a leading global management consulting firm with offices in more than 40 countries. Since 1926, we have been trusted advisors to the world's foremost organizations. A.T. Kearney is a partner-owned firm, committed to helping clients achieve immediate impact and growing advantage on their most mission-critical issues. For more information, visit www.atkearney.com.

<table>
<thead>
<tr>
<th>Americas</th>
<th>Atlanta</th>
<th>Detroit</th>
<th>San Francisco</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bogotá</td>
<td>Houston</td>
<td>São Paulo</td>
</tr>
<tr>
<td></td>
<td>Calgary</td>
<td>Mexico City</td>
<td>Toronto</td>
</tr>
<tr>
<td></td>
<td>Chicago</td>
<td>New York</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td></td>
<td>Dallas</td>
<td>Palo Alto</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Asia Pacific</th>
<th>Bangkok</th>
<th>Melbourne</th>
<th>Singapore</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beijing</td>
<td>Mumbai</td>
<td>Sydney</td>
</tr>
<tr>
<td></td>
<td>Hong Kong</td>
<td>New Delhi</td>
<td>Taipei</td>
</tr>
<tr>
<td></td>
<td>Jakarta</td>
<td>Seoul</td>
<td>Tokyo</td>
</tr>
<tr>
<td></td>
<td>Kuala Lumpur</td>
<td>Shanghai</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Europe</th>
<th>Amsterdam</th>
<th>Istanbul</th>
<th>Oslo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Berlin</td>
<td>Kiev</td>
<td>Paris</td>
</tr>
<tr>
<td></td>
<td>Brussels</td>
<td>Lisbon</td>
<td>Prague</td>
</tr>
<tr>
<td></td>
<td>Bucharest</td>
<td>Ljubljana</td>
<td>Rome</td>
</tr>
<tr>
<td></td>
<td>Budapest</td>
<td>London</td>
<td>Stockholm</td>
</tr>
<tr>
<td></td>
<td>Copenhagen</td>
<td>Madrid</td>
<td>Stuttgart</td>
</tr>
<tr>
<td></td>
<td>Düsseldorf</td>
<td>Milan</td>
<td>Vienna</td>
</tr>
<tr>
<td></td>
<td>Frankfurt</td>
<td>Moscow</td>
<td>Warsaw</td>
</tr>
<tr>
<td></td>
<td>Helsinki</td>
<td>Munich</td>
<td>Zurich</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Middle East and Africa</th>
<th>Abu Dhabi</th>
<th>Dubai</th>
<th>Manama</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Doha</td>
<td>Johannesburg</td>
<td>Riyadh</td>
</tr>
</tbody>
</table>

For more information, permission to reprint or translate this work, and all other correspondence, please email: insight@atkearney.com.

The signature of our namesake and founder, Andrew Thomas Kearney, on the cover of this document represents our pledge to live the values he instilled in our firm and uphold his commitment to ensuring “essential rightness” in all that we do.