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The digitization of utilities

There is a will,
but is there a way?

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About the authors

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Executive summary

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The rapid advance of digital technologies presents a transformational opportunity for the utilities sector. Innovations already used in many other industries, such as decentralized production, real-time analytics pulled from big data, sensor networks, and mobile computing, will change the contours and competitive balance of utilities over the next few years. The result? Power generation and distribution, electrical grids, connected homes and businesses, customer relations, operations, and workforce processes will all be in flux as utilities navigate a course through a changing landscape.

But as much as digitization is an opportunity for utilities, it is a threat as well. It fully alters the capabilities that a utility needs to succeed, greatly lowers barriers to entry for technology and other digitally savvy competitors, and is a catalyst for products and services that are raising customer expectations but that have never been offered by utilities before.

Not surprisingly, digital transformation is top of mind for utility leadership; our research finds that most utility company senior executives believe digital technologies such as data mining and mobile customer engagement are strategically critical. The problem: Among utilities that call themselves digital leaders, more than half concede that their investments in these new technologies are at best medium and often low.

To sort out these contradictions and provide a reasonably clear picture of digital integration in the global utilities sector, Strategy&, PwC's strategy consulting group, spoke to senior-level executives including chief digital officers responsible for digital strategies in 29 leading utilities in major North American, European, and Asian markets.

We found a sector that has considerable digital ambition but suffers a mismatch between those aspirations and its digital vision, investment, culture, and capabilities — a will to embrace the future, but no way

forward. With the rapid pace of technological change already under way, the immediate period ahead will be crucial in determining whether utilities will stop playing catch-up and actually implement effective digital strategies that create difficult-to-challenge competitive advantage.

The right stuff

Probably the best summation of where utilities are today when it comes to digital transformation is this quote from the CEO of a large European firm: "For us, digital must encompass all functions, all business units, and all employees." That's a lofty aspiration, which in one way or another many utilities share. However, the PwC 2015 Digital IQ Survey found that in industries across the board, few companies are backing their ambitions with the action and investment that is needed. With an eye toward assessing how far along the utilities sector is when it comes to incorporating digitization strategies across all parts of the organization, Strategy& conducted a series of in-depth interviews with key shapers of digital strategy in the sector between April and September 2015.
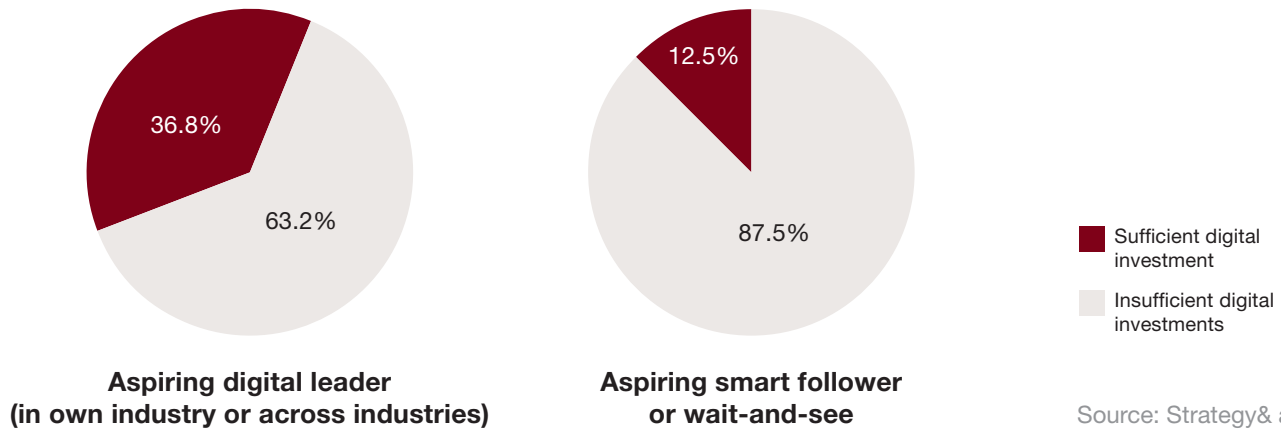
We interviewed senior board members and other senior-level executives from 29 leading utilities, including chief digital officers. Our research in 12 countries covered many major power and utilities markets in North America, Europe, and Asia. Participants came from Denmark, Finland, France, Germany, India, Italy, Norway, Russia, Spain, the United Arab Emirates, the United Kingdom, and the United States. (*See "Methodology," page 26, for an overview of topics covered.*)

Of the executives who participated in our research, a huge majority — 70 percent — said their companies want to be digital leaders in the sector; indeed, 20 percent went further, envisioning a day when they will match the capabilities of leading digital players across all industries (*see Exhibit 1, next page*). However, funding for digital strategic campaigns is lacking, despite the high ambitions. In the digital leader category, nearly 60 percent described their investments in this effort as medium or low.

Moreover, these companies have not made material efforts to tailor roles, responsibilities, talent, and organizational culture to drive digital transformation. Utilities that don't address this contradiction may find themselves optimizing their distribution assets for rival technologically savvy companies — mostly new players in the sector that will own the customer connection and service layers and, along with those, a potentially lucrative revenue stream.

Exhibit 1
Few utilities are sufficiently funding their digital aspirations

**Aspiring digital leader
(in own industry or across industries)**

**Aspiring smart follower
or wait-and-see**

Sufficient digital investment

Insufficient digital investments

These disconnected results are a bit less perplexing when responses to another critical question are taken into account: A quarter of the utility executives conceded that they lack a clear digital vision (*see Exhibit 2, next page*), and a majority of the companies that responded this way described themselves as would-be digital leaders. Moreover, in cases where a digital strategy is taking shape, it is most often fragmented and driven by disparate business units rather than by a centralized organization-wide plan.

These results should not be taken lightly; utilities are at a crossroads. Rapid advances in digital technologies offer a significant opportunity for the utilities sector, a chance for transformation in everything from production to customer service that has mostly eluded the sector.

At the same time, digitization presents a threat to the established order, lowering costs of entry and barriers to success for both startups and established technology firms hoping to pick off pieces of the wider utility business as discrete revenue streams. For example, Google, Apple, Samsung, and some telecommunications and cable operators have launched smart home initiatives that connect electrical and heating equipment in houses and automate their usage with timers and remote management features. Meanwhile, electrical suppliers are beginning to make investments in Internet of Things companies to win access to home networking expertise. That was behind the decision by Legrand, a U.K. provider of electrical and audio equipment, to take a

Exhibit 2
Responses to question "Does the board own a common digital vision?"

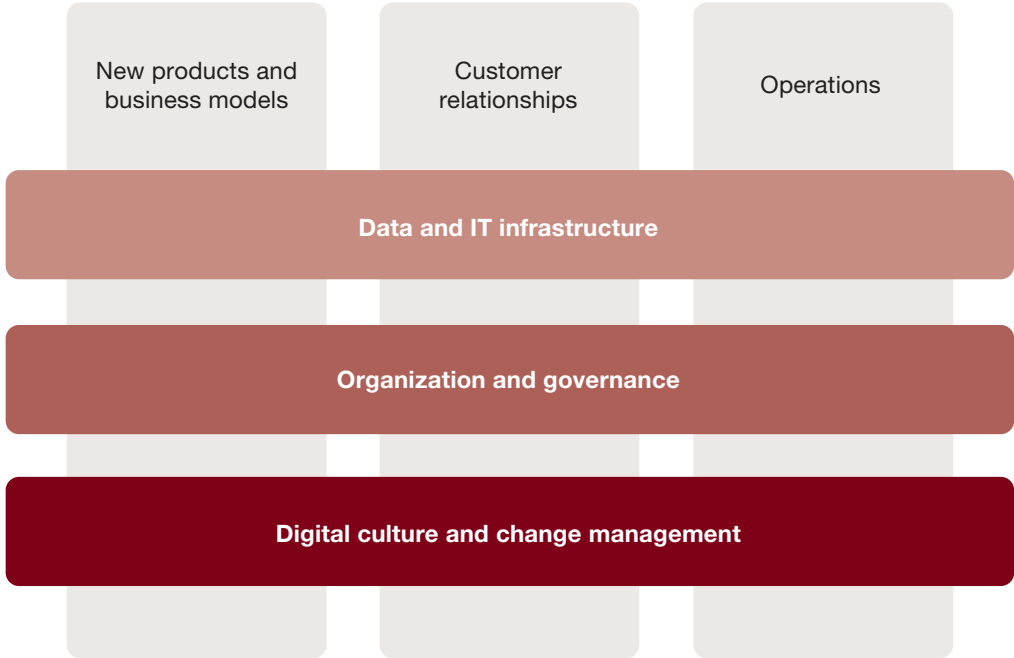|		
The board owns its own vision	39%	
The different business units/functions define their own vision	36%	
We don't have a clear vision yet	25%	Source: Strategy& analysis

more than US$40 million stake in French connected home startup Netatmo.

In Strategy&'s view of the industry, a successful digital transformation grows out of charting a course toward technological change and innovation via three critical aspects of the organization: data and IT infrastructure; organization and governance; and digital culture and change management (*see Exhibit 3, next page*). Unfortunately, our research finds that utilities are generally less than prepared in all of these areas.

Exhibit 3
Digital transformation building blocks

Key domains of digital transformation

New products and business models	Customer relationships	Operations

Data and IT infrastructure

Organization and governance

Digital culture and change management

Investing in basics

Utilities don't need to become technology firms to participate in returns held out by digitization. Nevertheless, they must be aware that companies like Amazon and Uber are redefining consumer expectations. Customers anticipate more flexibility, convenience, and transparency — also less bureaucracy — from their interactions with businesses because of the way Internet-based commerce has evolved. And utilities cannot afford to ignore the importance of being technologically adept and current in both their business and operating models. Ultimately, that requires a comprehensive digital approach, encompassing consumer relationships and employee tools and skills. Such a strategy would improve productivity and better position utilities to fend off competition.

Although global utilities may still be a distance away from taking a competitive position in the digital environment or even having a coherent plan to do so, we find that they are at least not overlooking low-hanging fruit. The vast majority of executives said digital investments in basic customer relationship activities like online accounts and bill paying, as well as in operational improvements like predictive maintenance, are priorities. In some cases, even advanced uses of technology — such as dispatching drones to identify potentially damaging tree overgrowth on power lines — were reported to be of medium- or high-investment importance (*see Exhibit 4, next page*).

In addition, about two-thirds of executives interviewed said their companies currently have smart home or building and energy analytics offerings, and some 90 percent expect to be offering such products within three years (*see Exhibit 5, next page*). They concede that their current products and services are not sufficient and would need to be greatly augmented to have significant market impact. Nonetheless, most utility executives said smart home products are essential to improving and growing customer relationships. And many have ambitions that go far beyond energy management, seeing the smart home as a platform to provide ancillary services like home security and e-health monitors.

Utilities have partnered with external technology companies for smart home installations — for example, by offering Google's Nest advanced thermostat. That approach can be dangerous because, in essence, it gives the partner direct access to critical customer data and to the customers themselves, an advantage that could turn partners into competitors that collect and sell analytics and power usage insights, as well as new consumer and business products.

Exhibit 4
Current digital investment priorities

	Medium	High	Total medium/high
New business opportunities (e.g., smart home/building/cities, mobility, energy solutions)	33%	22%	56%
Customer relationships (e.g., omnichannel, individualization)	22%	67%	89%
Lean operations and asset optimization data analytics	30%	59%	89%
Training, talent, and culture	19%	19%	37%

Note: Sums may not total 100 due to rounding.

Source: Strategy& analysis

Exhibit 5
Utilities venturing into digital offerings

Which of the following new business offerings do you have currently and which do you expect to offer in three years' time?

	Smart homes/ buildings	Smart cities	Low-cost, pure digital brands/offers	Energy analytics offers	Decentralized energy solutions
Now	67%	44%	22%	67%	33%
In next three years	89%	59%	26%	89%	52%

Source: Strategy& analysis

Complexity is elusive

More sophisticated digital advances are still outside the capabilities of most utilities, and will remain so for the immediate future. Only 44 percent of utilities in our study have smart cities programs, which enable fully networked environments of buildings, ubiquitous Wi-Fi, connected commercial equipment, cloud-based and analytics-driven conservation measures, and efficient transportation systems that are managed digitally.

The opportunity is enormous for utilities to be a central pillar in smart cities as the supplier of energy to keep equipment connected and operating. But after significant initial interest, many utilities have taken a wait-and-see attitude, in large part because they have little say in how the projects will develop. Indeed, the ambitions and political will of local governments will ultimately determine how quickly smart cities grow. As one executive told us: "We have no large smart city vision but are working on a daily basis on smart city initiatives and conversations with municipalities."

An area where utilities *should* have more influence also came up relatively short: distributed energy. This is, essentially, renewable energy equipment for homes and businesses, connected to the grid and digitally monitored and managed by the utility to distribute power efficiently and at least cost to the consumer and the environment. Just a third of respondents have distributed energy initiatives and only half expect to be in this business in three years.

One of our more troubling findings is that few digitization efforts can be considered successful from either a market or quality standpoint. That came through convincingly when executives were asked to rate the quality of their digital programs in three areas: customer relations, mobile workforce capabilities, and engineering and asset operations. Perhaps not unexpectedly, considering that utilities are engineering companies at heart, the executives believe they have distinguished themselves, at least to a degree, in the use of technology in operations but not so in customer relations.

They also recognize that improvement is needed in each of these facets of their business to catch up to top digital companies in the sector. That's a good instinct — but in our view, they must act on it quickly. Best-in-class competitors are not likely to stand still, and new players are certain to enter the market, making competition that much sharper.
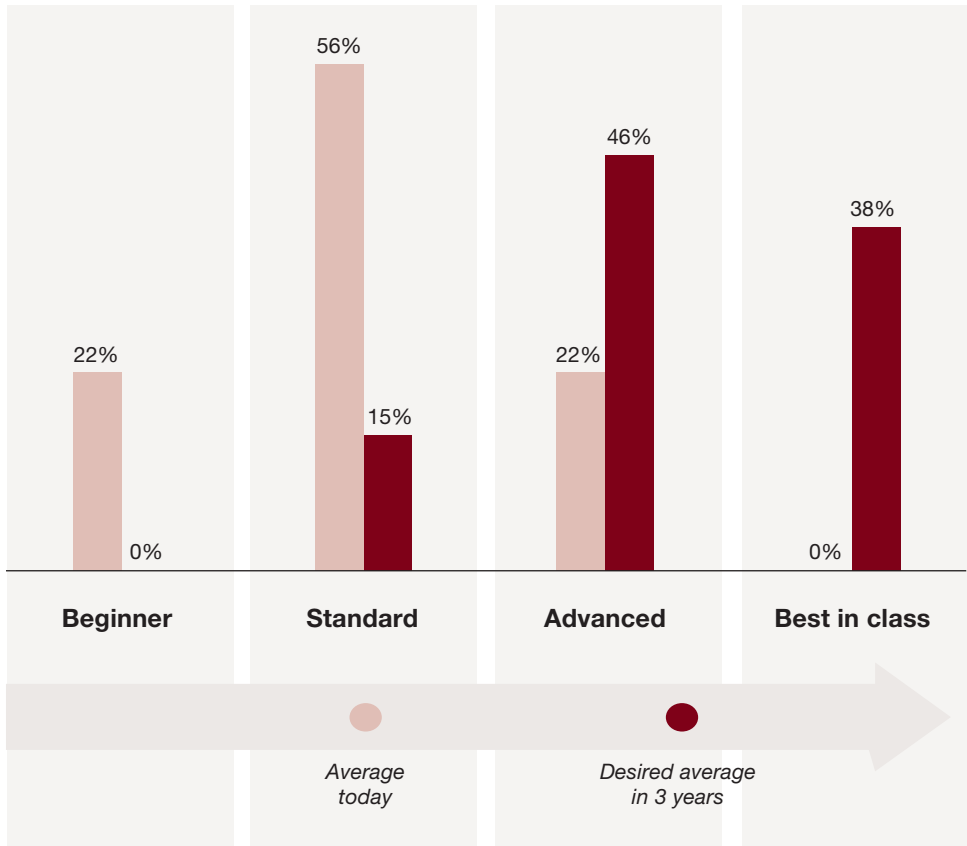
Here's a closer look at utility performance in the three categories:

- **Customer relations.** In both B2C and B2B orbits, more than 70 percent of utilities rate their digital offerings as standard or beginner (*see Exhibit 6, next page, and exhibit 7, page 15*). Only 7 percent characterized themselves as best in class in the B2B environment — a level of quality that includes at one executive's firm "a Web portal, mobile interface, and social." None claimed to be best in class in the B2C world. But within three years, 84 percent aim to rise to advanced or better for B2C, including 28 percent that hope to be best in class. Even more utilities expect to improve their B2B digital performance, with 92 percent looking to be advanced or better and 35 percent seeking to be best in class. All of the executives said they would not be content if their companies remained at a beginner level by 2018.

- **Mobile workforce capabilities.** Even if they will never be confused with Amazon or Apple, utilities cannot ignore certain advanced technology skill sets, particularly mobile applications for their workforces. With the richness of functionality available through mobile equipment — location maps, voice communications, cameras, and sensors — utilities have the opportunity to network their employees, particularly workers in the field, in closed-communications loops attached to a knowledge management system, accessible at all places and times.

  Only 35 percent of companies in our survey considered their mobile capabilities to be advanced, which broadly means they have deployed tablets and mobile devices to improve worker productivity, giving repair staff in the field a real-time channel for online troubleshooting and ordering spare parts, for example (*see Exhibit 8, page 16*). No utilities viewed themselves as best in class. But there are high hopes for improvement: More than 75 percent of the utilities expect to be at least advanced by 2018; some 28 percent are banking on reaching best-in-class status.

- **Engineering and asset operations.** For asset-based infrastructure companies such as traditional utility businesses, maintenance must be a priority — these skills directly determine bottom-line results. Digital technology and the Internet of Things are valuable in this regard by networking together equipment of all types for early

Exhibit 6
B2C digital customer relationship maturity

B2C digital levels

Beginner: Simple website with few processes digitized, no mobile app/site

Standard: Dynamic, personalized website with some processes digitized (appointments, payments, available information on outages/disruptions), mobile access, communication on social networks

Advanced: All customer processes digitized, mobile-centric services (e.g., alerts), consumption in real time through smart meters, proactive management of social networks
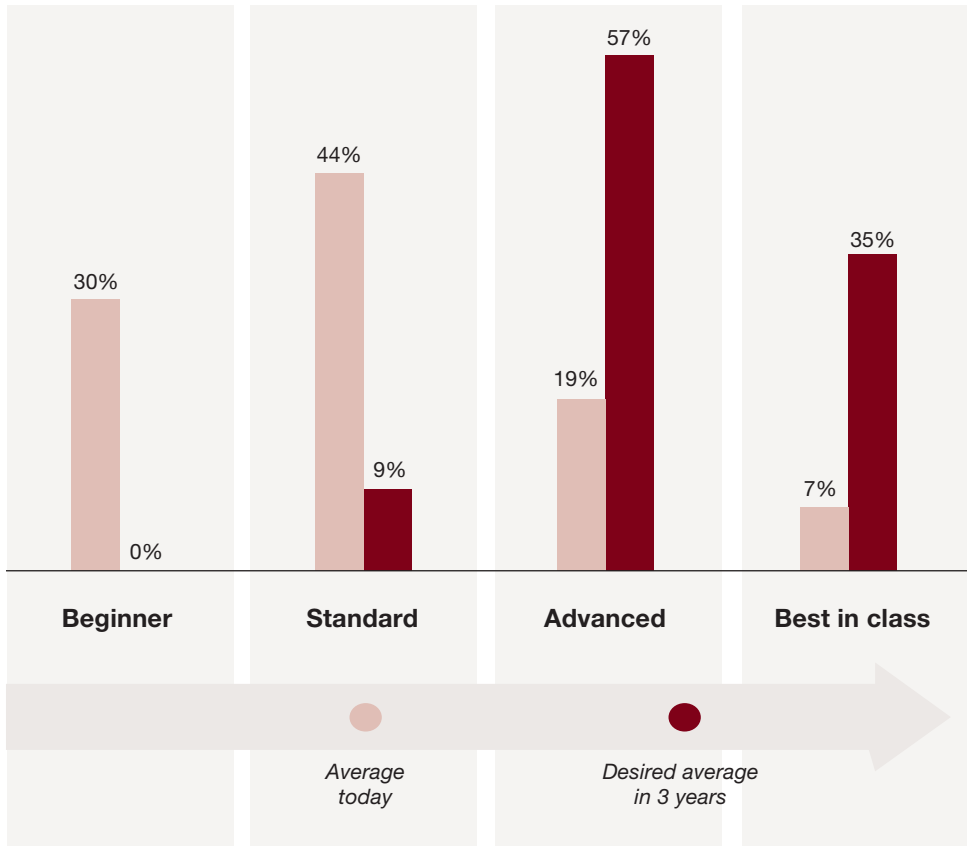
Best in class: Multi-device customized interface with curated content, energy consumption comparison services from real data from smart meters, complex B2C energy solutions, real-time crisis management on social networks

■ B2C today
■ B2C in next 3 years

Note: Sums may not total 100 due to rounding.

Source: Strategy& analysis

Exhibit 7
B2B digital customer relationship maturity

B2B digital levels

Beginner: Simple website with few processes digitized

Standard: Secured enterprise digital interface with some processes digitized (appointments, payments, available info on outages/disruptions)

Advanced: Secured and rich interface (mapping, real-time alerts), all customer processes digitized, multi-site services (aggregation, comparison, load management)
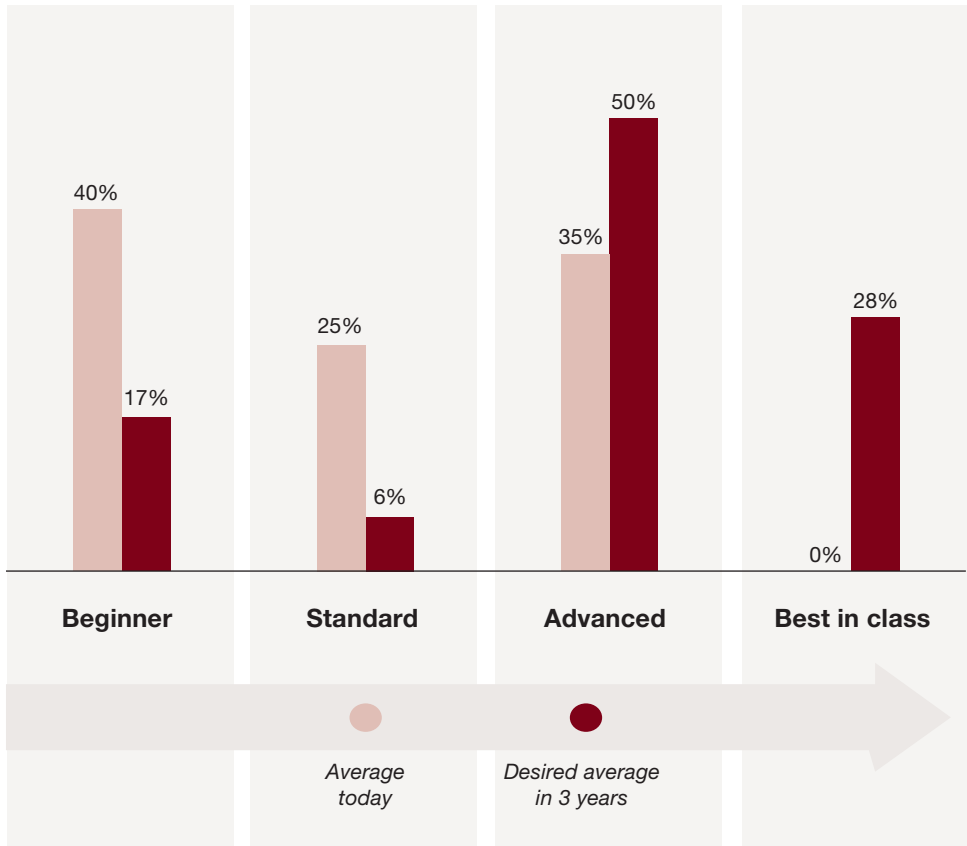
Best in class: Comprehensive B2B platform (data visualization, large project management), multi-site and multi-partner services (load curve, etc.)

■ B2C today
■ B2C in next 3 years

Note: Sums may not total 100 due to rounding.

Source: Strategy& analysis

Exhibit 8
Mobile digital maturity

Mobile digital levels

Beginner: No or limited deployment of mobile devices, and limited functionality of mobile tools

Standard: Some paper-based processes conducted on mobile devices (e.g., instructions for maintenance and security)

Advanced: Multiple functionalities of mobile devices (e.g., access to parts database, instructions for maintenance, maps with locations of assets and maintenance teams), real-time optimization of field force rounds, extension to subcontractors

Best in class: Advanced mobile functionality (augmented reality, geo-location), integration of predictive maintenance in internal and external field force rounds
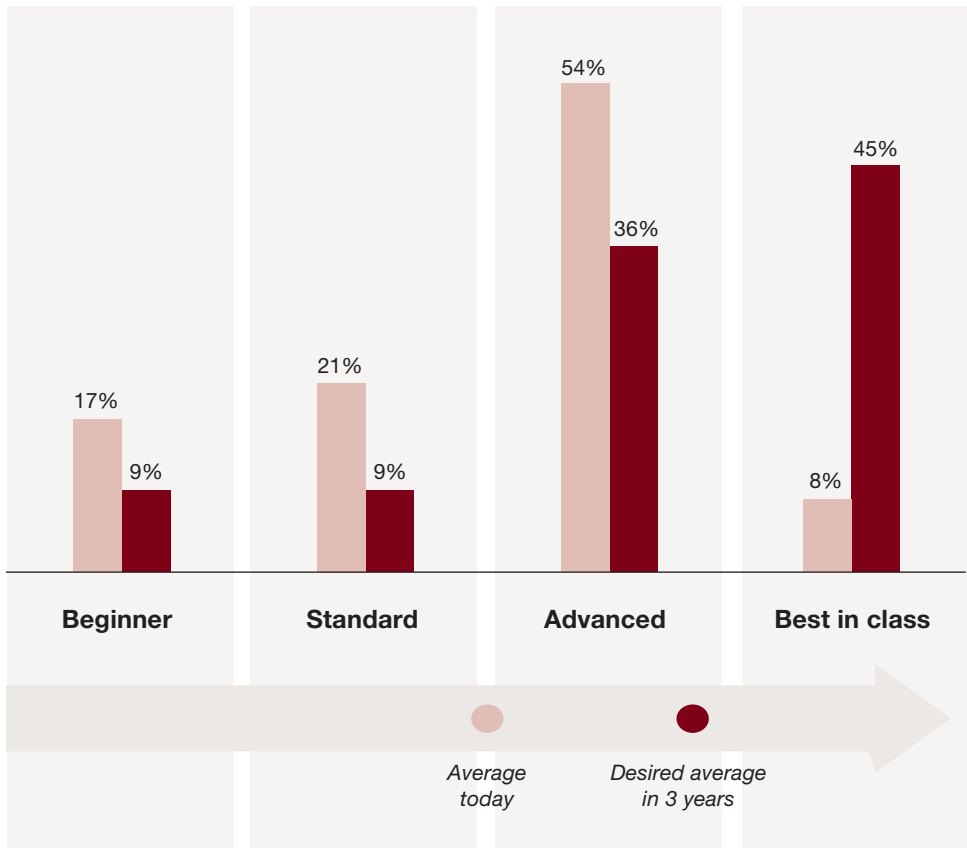
■ B2C today
■ B2C in next 3 years

Note: Sums may not total 100 due to rounding.

Source: Strategy& analysis

Chart data:

	Beginner	Standard	Advanced	Best in class
B2C today	40%	25%	35%	0%
B2C in next 3 years	17%	6%	50%	28%

Average today
Desired average in 3 years

detection of potential failures, ordering predictive maintenance, and reporting real-time status of physical assets. These capabilities yield considerable savings for capital and operations budgets and for reducing maintenance spend over the short and long terms. Moreover, some companies are combining internal digital capabilities with data from external sources such as satellite imagery and weather analysis to create state-of-the-art system performance.

Well over half of the executives we spoke to believe their companies have reached advanced or best-in-class status in their engineering digital capability (*see Exhibit 9, next page*), which essentially encompasses using computer-based equipment throughout the organization and with outside partners but doesn't include extensive applications of real-time data and performance analytics. However, given the general lack of digital sophistication in the utilities sector, the executives were much less sanguine about more advanced engineering and predictive maintenance technology applications (*see Exhibit 10 and 11, pages 19 and 20*). The combined advanced and best-in-class totals for digital maturity in real-time data was 40 percent, and in predictive maintenance only 29 percent. As with most of the other responses, three-year ambitions were high in all three categories.

Exhibit 9
Engineering digital maturity

Engineering digital levels

Beginner: Mix of paper-based and digital methods

Standard: Each major task digital but no continuity between design phases, basic use of digital collaboration internally

Advanced: Most tasks digital and some digital collaboration with key third parties (e.g., document sharing)

Best in class: Total digital implementation internally and collaboratively with third parties

- B2C today
- B2C in next 3 years

Note: Sums may not total 100 due to rounding.

Source: Strategy& analysis

Exhibit 10
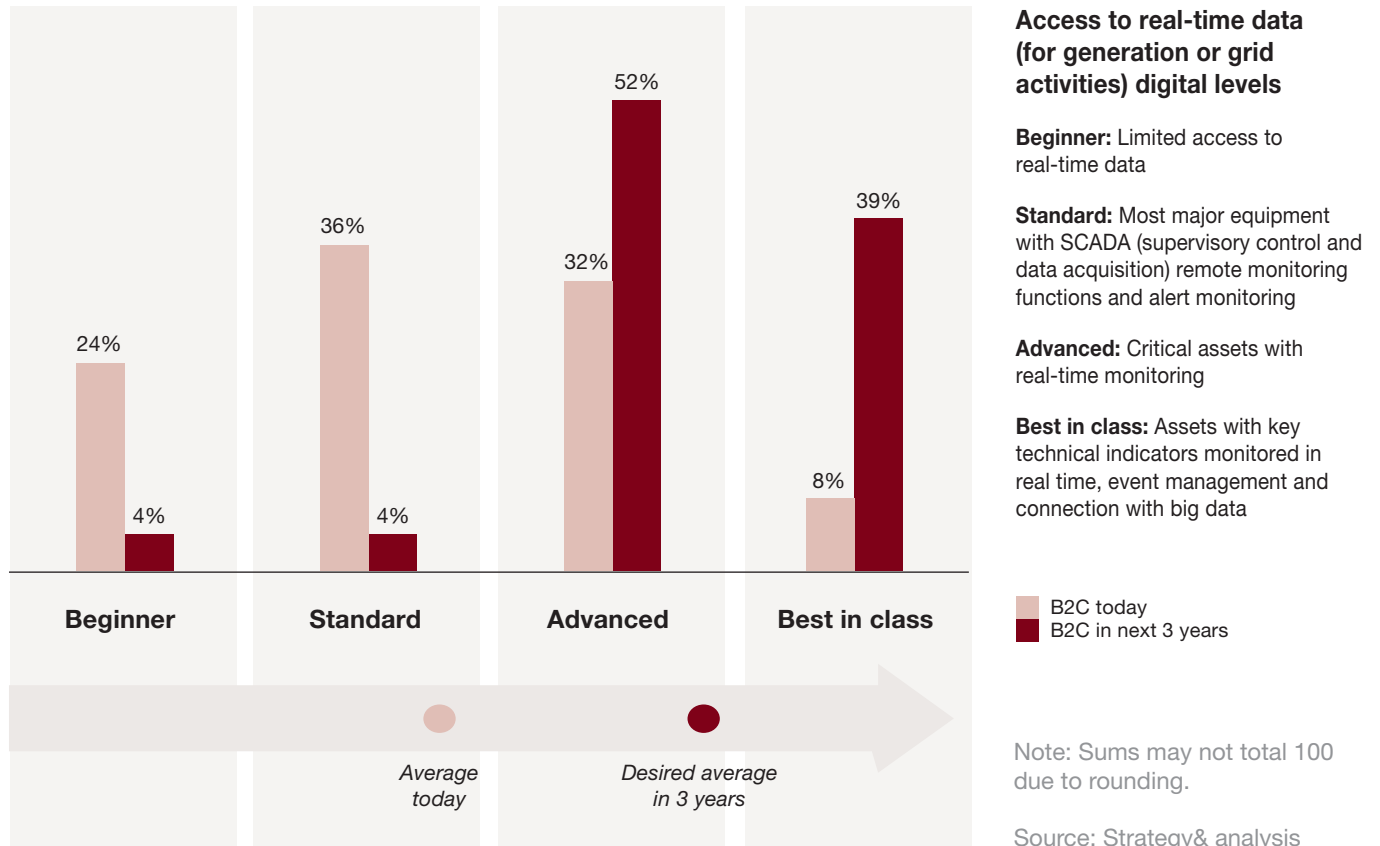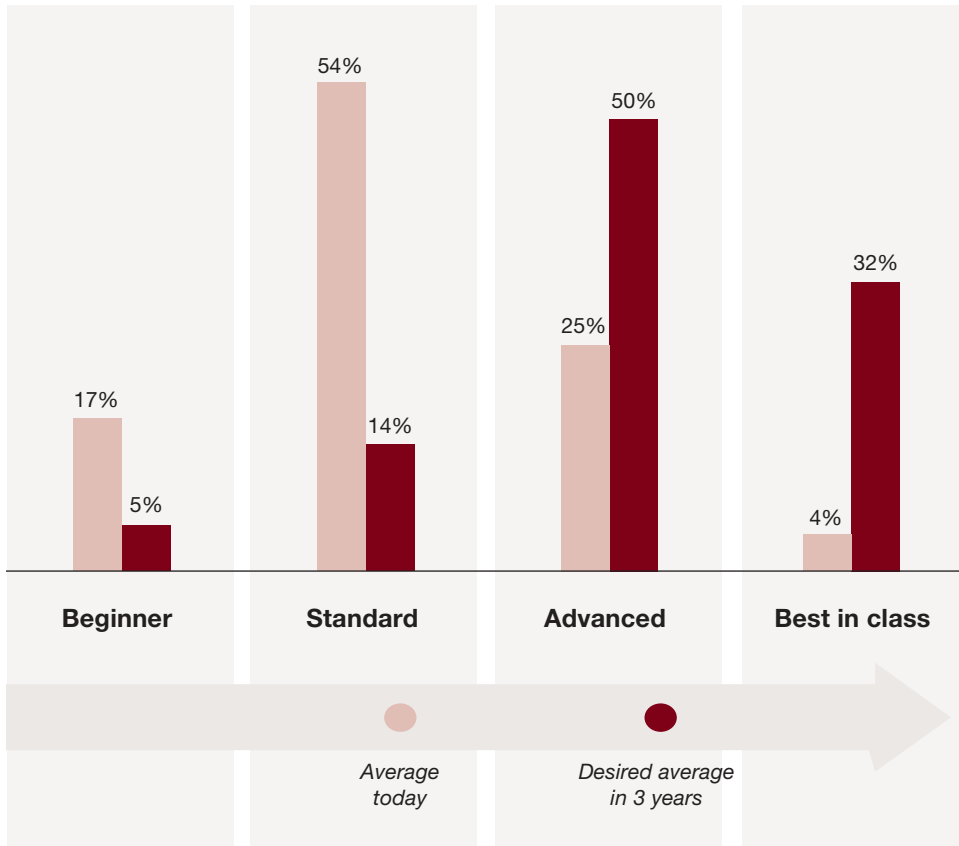## Real-time data digital maturity

Access to real-time data (for generation or grid activities) digital levels

Beginner: Limited access to real-time data

Standard: Most major equipment with SCADA (supervisory control and data acquisition) remote monitoring functions and alert monitoring

Advanced: Critical assets with real-time monitoring

Best in class: Assets with key technical indicators monitored in real time, event management and connection with big data

- ■ B2C today
- ■ B2C in next 3 years

Note: Sums may not total 100 due to rounding.

Source: Strategy& analysis

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Strategy&   19

Exhibit 11
Predictive maintenance digital maturity

Predictive maintenance digital levels

Beginner: Periodic maintenance plan

Standard: Conditional maintenance based on historical centralized data

Advanced: Predictive maintenance based on models

Best in class: Predictive maintenance based on real-time internal and external data

■ B2C today
■ B2C in next 3 years

Note: Sums may not total 100 due to rounding.

Source: Strategy& analysis

Measuring preparedness

Utilities need to make a big digital leap, and they are generally optimistic that they can do so. But that raises a salient question: At most utilities, are the building blocks in place to support such a complex set of technology improvements? To examine this more closely, it's useful to assess the chances for a successful digital transformation through the lens of its enabling categories: data and IT infrastructure; organization and governance; and digital culture and change management.

- **Data and IT infrastructure.** The importance of data analytics cannot be overstated. It is essential to offering more personalized customer relationships and optimizing the performance of capital investments. Perhaps mirroring the relatively primitive use of real-time and predictive data that our research has revealed, 77 percent of the utilities have some data analytics capabilities and infrastructure, but nearly a quarter have none. And three-quarters of those with data analytics infrastructure have earmarked small teams of 20 people or fewer to the task (*see Exhibit 12, next page*). This certainly underestimates the data analytics capabilities that utilities will need as they move progressively away from the pure provision of energy toward businesses that are built on data.
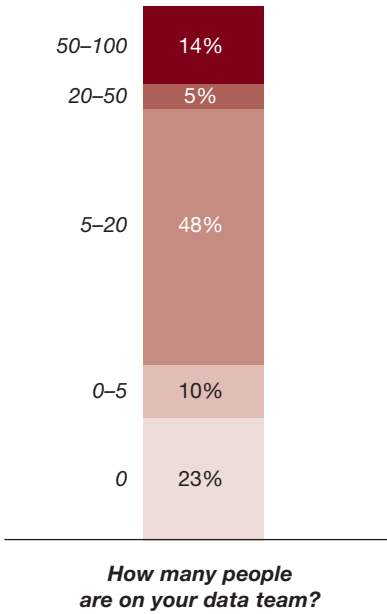
  The data analytics priorities for companies that have this capability are operational and customer relations improvements. Less than a fifth are seeking to directly monetize data. There is very little interest in open data initiatives, which would involve utilities sharing data from their network operations with third-party companies that could leverage it to provide value-added services like home analytics and connectivity to customers. The main driver for this stance is a misunderstanding by the utilities of the value of the data they own; utilities generally believe, mistakenly, that this would be tantamount to giving away assets that may prove strategic at a later date.

  Indeed, determining when and when not to share data is a capability that utilities will have to master in the digital age. By sharing some of the vast amounts of relatively generic and anonymized data they collect, utilities would at least enjoy a revenue stream and form
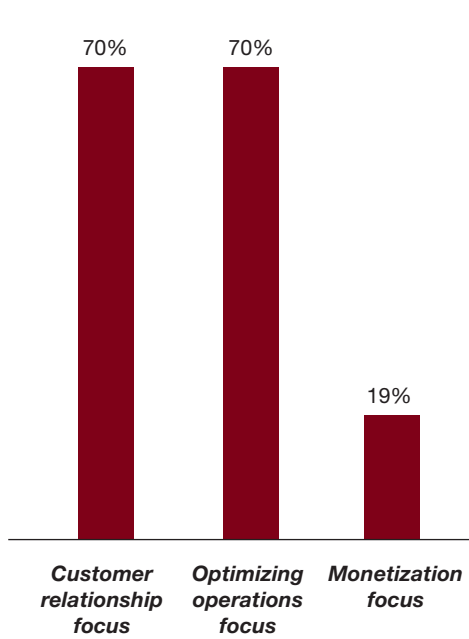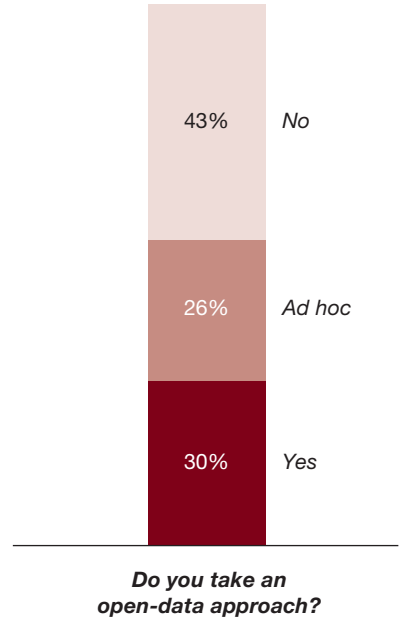
Exhibit 12
Data team and analytics capability

Half of utilities have little or no analytics capability…

Data team size	Percentage
50–100	14%
20–50	5%
5–20	48%
0–5	10%
0	23%

How many people are on your data team?

…those with data analytics capabilties aren't focused on monetization…

Focus	Percentage
Customer relationship focus	70%
Optimizing operations focus	70%
Monetization focus	19%

…and very few are interested in opening up their data

Response	Percentage
No	43%
Ad hoc	26%
Yes	30%

Do you take an open-data approach?

stronger partnerships. Sharing too much, however, is arming your competitors with ammunition to shoot back at you.

- **Organization and governance.** Most utilities recognize that having the right organization and governance in place is critical to the success of a digital transformation, and are hunting for talented staffers for critical roles. In our view, this starts with hiring (or appointing) a visionary chief digital officer (CDO) to lead the digital team. The CDO's primary role is to clearly articulate transformational digitization initiatives that lead the industry, not just follow or produce average results. In some cases, the CDO will help design and implement new business models to address digital challenges.

  But the CDO's role should be more than strategic. Tactical aspects of digitization — defining data governance, building data analytics capabilities, setting up digital factories to deliver applications, and providing experts to support transformation initiatives across the company — are also critical.

  Seven out of 10 utilities that have a CDO or equivalent filled the position with an executive from another company. Of these, 20 percent hired from outside the sector altogether. In addition, more than a fifth of the utilities we studied have recently acquired startup companies to enhance their digital talents.

- **Digital culture and change management.** All the talent and capabilities in the world may still not be enough to foster a digital transformation if the utility's culture is not focused on expanding technology use in the organization. To explore the prevalence of digital cultures in utilities, we offered a broad definition: any initiatives linked with improved use of technology by individuals, including training, reverse mentoring, and collaboration tools.

  Despite this wide designation, only a third of respondents said they had implemented digital culture programs, and only 19 percent of all respondents said such programs were a high investment priority (*see Exhibit 13, next page*). In our view, this attitude is a mistake. Utilities face the significant challenge of moving from an engineering mind-set to a more customer-focused and digitally flexible approach. That shift will not be fully possible without concomitant strategic cultural change.

  At a utility, a digital culture is manifested best by tearing down silos that stand in the way of communication, work sharing, and adoption of common goals among different departments. This collaboration is particularly important to functions that oversee customer

Exhibit 13
Digital programs as level of investment priority

Investment priority	# of respondents	% of respondents
High	1 (4%)	4 (15%)
Medium	5 (19%)	1 (4%)
Low	12 (44%)	4 (15%)
	No digital culture program currently	*Cultural program in place*

Note: Sums may not total 100 due to rounding.

Source: Strategy& analysis

relationships, sales, marketing, and product or service launches. As barriers are eliminated, utilities should adopt a service design approach for implementing new digital equipment and offerings, which promotes quick development of minimum viable products with frequent iterative improvements spawned by the response from internal users and external customers. In a utility with a digital culture, ongoing staff training emphasizes understanding the importance of innovation and the increasingly significant role it plays in the company and in the industry.

Utilities that don't encourage collaborative and open work styles can never take full advantage of digital tools such as instant messaging, social media, and popular communication apps like Slack. Inevitably, with an older workforce in place at many utilities, familiarization with these advances can't be taken for granted. At the same time, increasing numbers of millennials, who have grown up in the digitally active world, are joining the industry and expect to use these tools in their work. At some less nimble and technologically inclined utilities, the lack of a digital culture could become an obstacle to talent recruitment and retention.

How to implement a digital strategy

Given the rapid acceleration of technological change, increasing competition, and speedier innovation, the immediate period ahead will be crucial in determining whether utilities can move forward as digital businesses or risk being cast adrift. Utilities should ask themselves five questions to determine where their digital strategy currently stands:

- Is our digital strategy ambitious enough compared with that of our competitors and of best-in-class players in other industries?

- Are we investing sufficiently to match our digital goals?

- Have we engaged a broad plan covering all six digital transformation pillars (new products and business models; customer relationships; operations; data and IT infrastructure; organization and governance; and digital culture and change management) with initiatives in execution mode?

- Are we building the necessary capabilities to fully exploit the potential offered by data?

- Have we begun a full-fledged organization-wide cultural change to align with the digital transformation?

If the answers to all of these questions are not a clear and undeniable "yes," urgent work is needed in your organization to develop a digital strategy that not only responds to the activities in the industry but supports customer growth and financial performance initiatives going forward.

To define this strategy and manage the transformation, we have created the following seven-step Digital Maturity Framework:

1. Identify digital levers that impact the business across the six pillars (new products and business models; customer relationships; operations; data and IT infrastructure; organization and governance; and digital culture and change management).

2. For each lever, determine best practices to achieve performance goals, and then define the maturity scale for each lever working back from best practices.

3. Assess both current digital maturity and projected maturity in the near term of each lever from basic, to standard, to advanced, and to best in class.

4. Define the target digital maturity for each lever.

5. Bring the executive team together for a "digital immersion" to review target goals for each lever and prioritize them based on difficulty of achieving the goal and its business impact.

6. For the priority levels, detail initiatives and projects that will be required to achieve the target digital maturity.

7. Monitor regularly, at least annually, progress being made toward the digital maturity goals for each lever, adjusting the digital transformation program accordingly to match realistic expectations and the ability to meet ambitious targets.

The struggle that utilities are experiencing in matching their digital ambitions with actual investment is somewhat ironic for an industry whose pioneering innovations included the electrification of the world, starting with Thomas Alva Edison's first power station on New York City's Pearl Street on September 4, 1882.

A little more than 130 years later, utilities must learn to innovate again, this time through digitization rather than electrification. Which companies will succeed and which will fail seems very much an open question, judging by our survey results. The good news: The utilities themselves recognize the importance of the moment. They have the will. Now they must find a way.

Methodology

Researchers at Strategy&, PwC's strategy consulting group, interviewed 29 executives of power and utility companies in person and by phone between April and September 2015. The interviews included executives from major power and utility companies in Denmark, Finland, France, Germany, India, Italy, Norway, Russia, Spain, the United Arab Emirates, the United Kingdom, and the United States.

The topics covered included:

- Digital ambition and vision

- Resources allocated to digital

- Digital organization/governance

- New business opportunities around customer operations

- Digital customer relationships

- Digital in engineering and asset operations

- Value from data

- Talents and culture

Additional resources

2015 Global Digital IQ Survey, PwC. http://www.pwc.com/gx/en/services/advisory/2015-global-digital-iq-survey.html

Global Power & Utilities Survey, 2015, PwC. http://www.pwc.com/gx/en/industries/energy-utilities-mining/power-utilities/global-power-and-utilities-survey.html

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