The power of digital

An enabler and disrupter

December 2018

KPMG.com/in

Foreword

As sectors go, the power sector is a digital native. Automated SCADA systems and remote monitoring of power installations have been in vogue much before digital became a fashionable word. Similar is the story with smart meters, where the deployment of remotely accessible and manageable metering facilities has been the feature for decades globally and in India. The reason why power (and more broadly energy) sector fell behind was because it saw these technologies as means of engendering internal efficiency and not for benefiting the customer. We failed to relate to the fact that these digital technologies are powerful means for connecting with the customer.

That just changed, and it changed because the customer has now taken control using the very same digital means. Be it for managing electricity production or consumption through rooftop solar installations, or for power conservation, or simply for ease of daily life, digital is a part of everyday life for more and more industrial, commercial and residential customers, and even for farmers. We at KPMG have been closely involved in these transformations through our work in India and across geographies. We have witnessed how digital has upended established business models. Those organisations that succeeded in surviving the changes have emerged stronger. Many others have found it difficult to cope. Some have shrunk or collapsed.

In this report we bring before you the digital revolution in utilities which is ushering in cleaner renewable technologies and is being integrated into the electricity grid, supporting innovation in business models, creating revenue streams and ultimately bringing the utility business closer to the customer. Digital is finally turning the utility business into a true customer oriented business where we care to know what the user desires, and have the ability to discern those needs and preferences.

This is a cultural shift that would not come easy. It would demand openness, agility in response, nimble structures and thoughtfulness. Leaders in the utility business are seized of those issues. This report brings many of those senior voices from the industry, together. I am sure you would find it a useful read and look forward to hearing your thoughts on the same.

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Energy and Natural Resources

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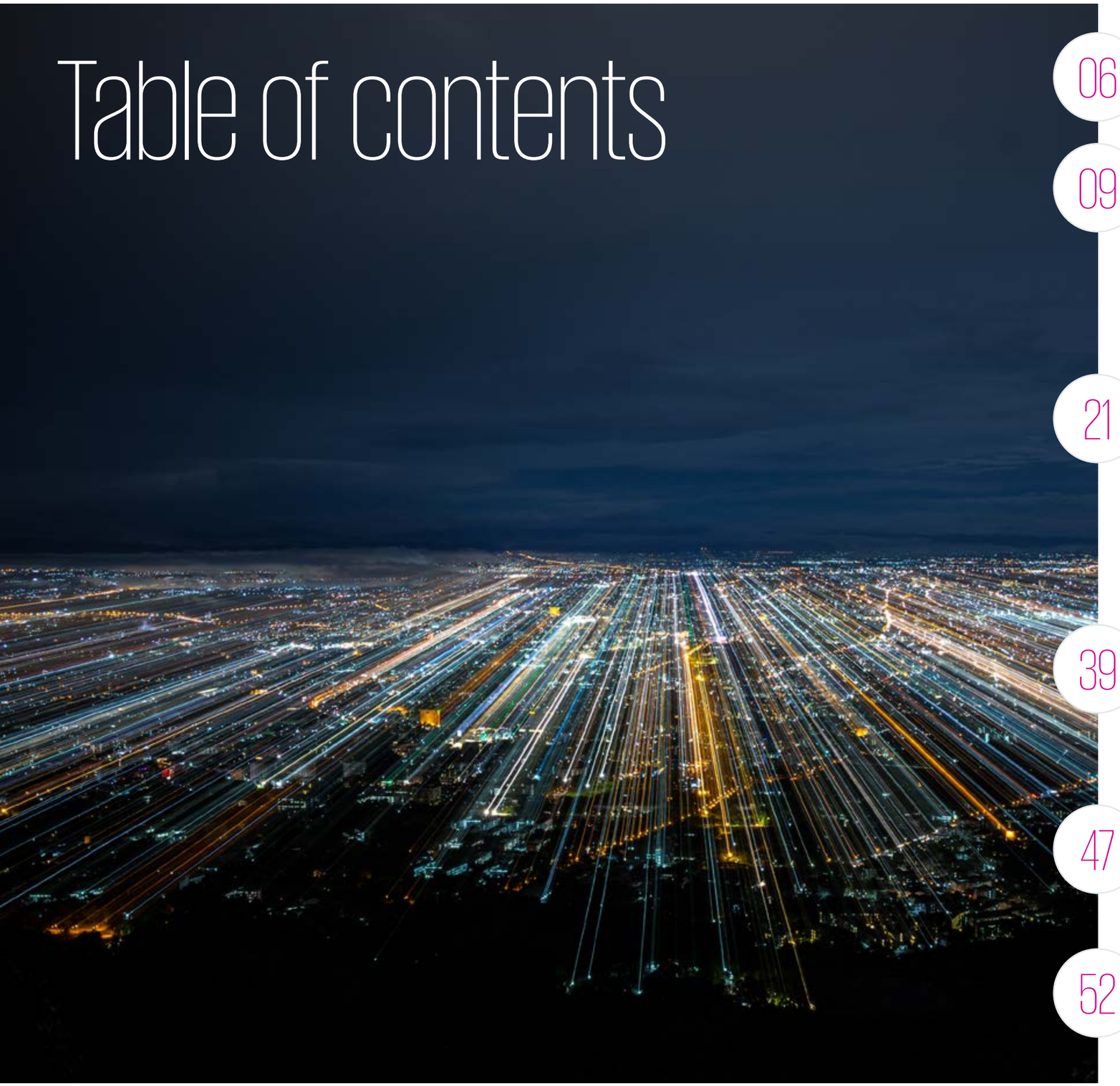

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Summary

As per the Harvey Nash/KPMG CIO Survey 2018 of global Power and Utility (P&U) companies, over 48 per cent reported investing in Internet of Things (IoT) related technologies, more than most other industries. Further, a majority of respondents cited achieving business process efficiency and improving customer experience amongst the most important goals in prioritising digital technology initiatives. Our survey with P&U leaders in India indicates that over 46 per cent have already begun the digital transformation exercise and a majority feel that it could impact their business models significantly. KPMG in India believes that the following forces will make adoption of digital technologies imperative for the Indian P&U sector:

1. The rising penetration of renewable energy, both at a utility scale and in a decentralised mode, will necessitate digital technologies to be interleaved efficiently. These technologies can help by enabling better forecasting and scheduling through advanced analytics and artificial intelligence technologies, better asset management techniques enabled by IoT and enabling demand side participation to bring flexibility in the grid. As per our analysis, even a 130 GW renewables scenario by 2022, could result in plant load factor dropping to 35-40 per cent for many coal plants in certain months. In select RE rich states, inter-day standard deviation of actual generation has been observed in the range of 8- 14 per cent of the installed solar power capacity. This requires various forms of flexibility which digital technologies can enable.

2. The falling costs and maturity of digital technologies make them critical solutions to improve the quality of power supply in our grids and help provide uninterrupted power. For example, our average distribution transformer failure rates are as high as 13.5 per cent annually, compared to less than 1 per cent for mature utilities. A simple IoT based asset management solution can bring this down substantially, and help Indian utilities save INR 3,000 crores annually.

3. Innovative approach around rooftop solar deployment such as 'utility in a box'[1] are being developed to provide access to electricity at affordable costs. Storage is also making its way into distributed renewable energy solutions and has started replacing diesel generators of environmentally conscious industrial and commercial consumers as costs reduce. Innovations in roof top solutions could lead to business model disruptions signalling disintermediation for utilities. This is also a huge opportunity for solar roof top developers as potentially 100 per cent grid independent houses can emerge (subject to other constraints such as space, etc.). In a largely business to consumer play, digital can be a powerful tool to reduce soft costs of acquisition, manage many dispersed and small assets and bring down costs of customer management.

4. Globally, utilities are increasingly looking to connect better with consumers and develop new revenue streams as power sales begin to taper off and digitally enabled new business models evolve. At the same time industry boundaries are blurring with opportunity for new entrants such as technology players to enter with business models around energy management services, home automation services and consumer analytics. The opportunities are significant and with appropriate regulatory enablers, it can provide a huge space for value added services. A deployment of 12 million smart meters[2] in India itself could entail associated business opportunities of around INR 2,100 crore per year around services such as energy management, home automation, etc.

1 Institute for Transformative Technologies

To address challenges and opportunities, most of the larger P&U companies have begun to consider the importance of adopting digital technologies and have started deliberating upon their desired path. The experience of KPMG global member firms in undertaking digital transformation with organisations provide the following learnings[3]:

1. **Wear your holistic glasses**
   Digital transformation is about an enterprise-wide transformation, which includes restructuring the entire business. Customer centricity is the foremost agenda but delivering that needs focus on four other pivotal domains - data driven operations, a sound technical foundation, a culture which nurtures entrepreneurship and reinventing the current and imagining the future business model.

2. **Use a structured but agile approach**
   In our experience, three key approaches were successful. First, ensuring a combination of representation from all levels within the organisation. Second, having representation of various critical business functions while orchestrating the strategy. Lastly, using the power of a 'do not tell, but show approach' to convince and inspire people.

3. **Be aware that 'thinking is doing and doing is thinking'**
   In a fast changing digital world, continuous experiments and learnings are key- 'doing is thinking'. This should be complemented with the approach of 'thinking is doing' as well. It helps to not only bring awareness but also bring about an enthusiastic 'action modus' among participants.

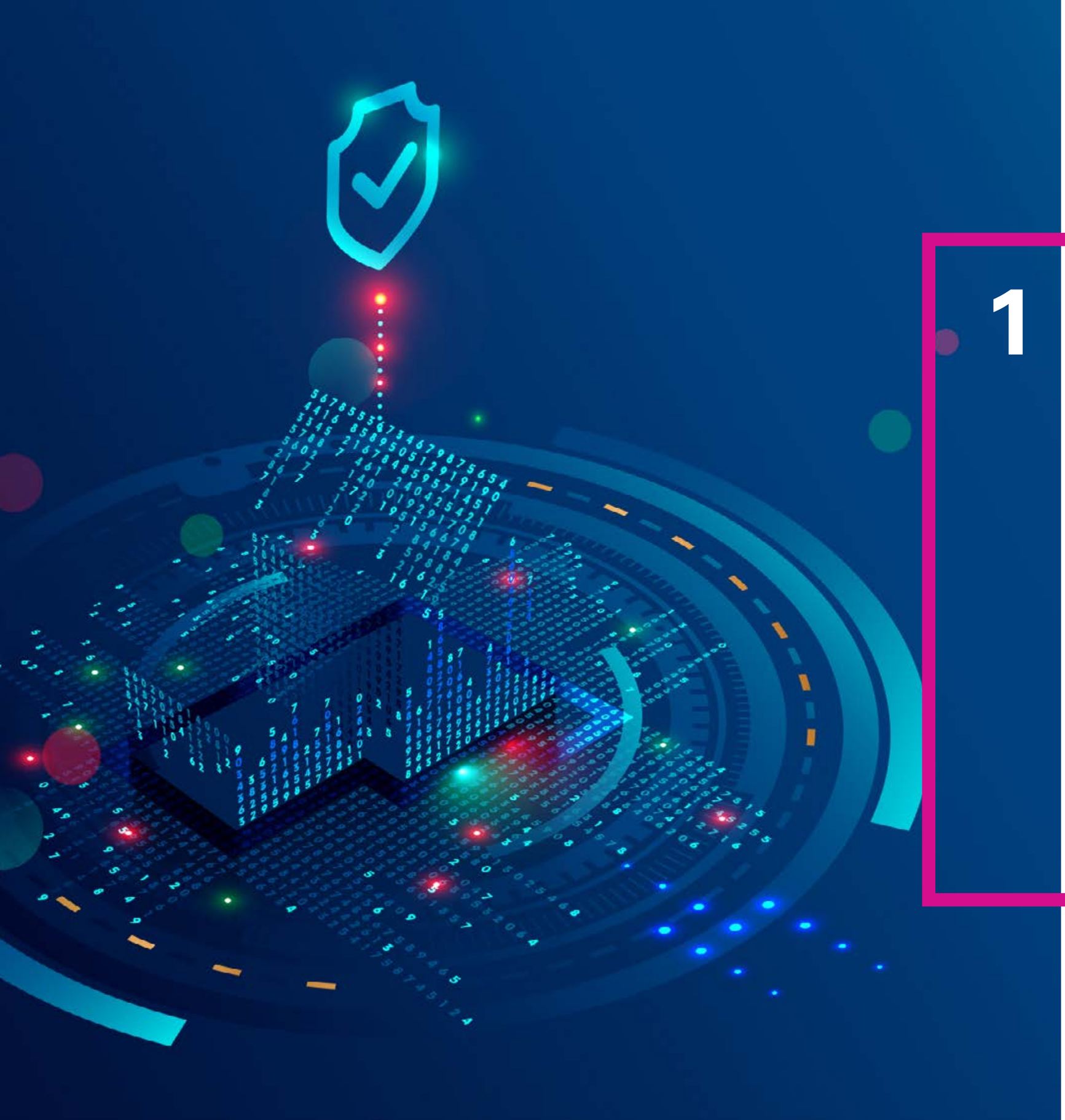
4. **Excel in the balancing act between 'how' and 'what'**
   In our experience, we have seen organisations focus too much on 'what' is to be achieved without focusing on the 'how' part of it. In order to ensure this balance, we had created five key strategic pillars. The 'what' is covered in the first three pillars- achieving customer growth, creation of a sustainable portfolio and driving innovation. The last two pillars - performance improvement and entrepreneurial culture were responsible for answering the 'how' part of it.

5. **Make sure to focus**
   One of the practices that was successful, is to break the timeline across three horizons. Horizon one contains initiatives which provide immediate impact and are incremental. Horizon two consists of initiatives which help in transforming the business over the next three years. Lastly, horizon three consists of new initiatives which ensure real-transformation through new industry models.

6. **Beware of silos**
   In order to truly leverage digital via an integrated value chain, departmental silos need to be abolished. Data gathered and integrated from various functions across the value chain has the potential for cost savings and service improvement. Hence, breaking down the walls between department and geographical business units is critical.

Companies do not have an option but to adapt to this new normal quickly. Those that do are likely to emerge front-runners, others could be left watching and feel disrupted. This is the 'power' of digital – harness it or be overtaken by it.

2 KPMG in India research based on roadmap for smart metering, 2018
3 How to build a strategy in a digital world, Compact - 2018



1 The digital imperative:

The need to embrace digital wholeheartedly

Globally, the power and utility (P&U) sector has been amongst the earliest adopters of digital technologies to manage the challenges of widespread as well as aging networks. As disruptions unfold with the influx of renewable energy (RE) and technologies such as distributed renewable energy (DRE), utilities are striving to incorporate digital at the heart of their business strategy. Many power companies are leveraging advances in digital technologies to expand the boundaries of traditional electricity delivery and innovate business models which focus on creating value for customers.

In India, as the power sector seeks to leapfrog existing challenges of electricity quality, reliability, access, and affordability, there are emergent issues being faced by some states with high RE penetration. Digital is a key enabler for organisations to address imminent challenges as well as to leverage opportunities that may be around the corner. In India, a majority of P&U industry leaders interviewed by KPMG in India have indicated that they are currently either in the process of implementation or are planning their route to digital transformation.

Key questions that organisations are seeking to answer at this juncture are:

Why should the P&U sector adopt digital?

What are the important emerging digital themes and what have been some of the experiences?

How should organisations approach their digital journey?

In our paper, we have leveraged our experiences as well as insights garnered through Harvey Nash/ KPMG CIO survey 2018 of IT leaders in P&U as well as KPMG in India's ENRich survey on digital trends – 2018 of P&U leaders, to address these questions.

While many trends in the industry that we have highlighted (underpinned through case studies and analysis) may not be unexpected, through this paper, we intend to bring it all together to garner thoughts and generate discussions, which could pave the way for companies to assimilate, plan and execute. We believe that digital is no longer an option but an imperative which P&U companies need to embrace wholeheartedly.

"For the power sector, going digital will become inevitable when concepts such as prosumers, or carriage and content separation pick up pace. Digital can also help in ensuring grid reliability when share of RE increases."

A leading thermal power generator

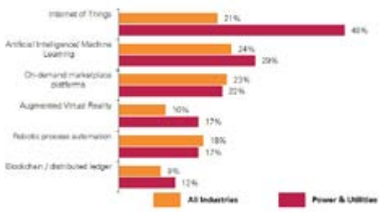
Global power utilities:

On the cusp of digitally driven transformation

The Harvey Nash/KPMG CIO Survey 2018[4] has observed that P&U companies invested in smart meters even before the term Internet of Things (IoT) existed. The survey, that involved nearly 4,000 companies across 84 countries (including 98 IT leaders in the P&U industry), found that the sector has invested more heavily in IoT than any other industry, and is also at the forefront in Investments in artificial intelligence (AI) and machine learning (ML).

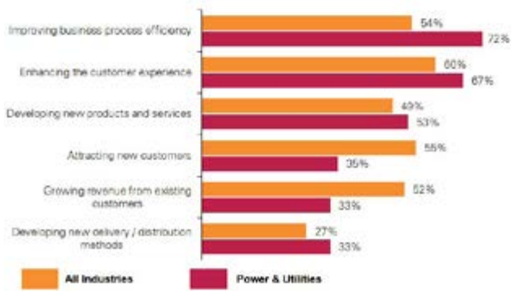
Power sector vs All industries

Investment in technologies



Power & Utilities companies have **invested more heavily in the Internet of Things than any other industry** (48% vs 21% for all industries). They have also made significant investments in artificial intelligence / machine learning (29% vs 24%)

Prioritisation of digital initiatives as per business goals



When prioritising digital investments, Power & Utilities companies **heavily focus on improving business process efficiency** (72% vs 54% for all industries). They focus much less on attracting new customers and growing revenue from existing customers

Source: 'The Transformational CIO', Harvey Nash/ KPMG CIO Survey 2018, Power and Utility Industry findings [4]

4 Investor presentation 2018-20 strategic plan - End - Sep 2018

Globally, power utilities are increasingly incorporating digital at the heart of their business strategy. Digital technologies are being implemented by utilities to focus heavily on important business goals such as improving business process efficiency, enhancing customer experience, as well as, to some extent, in developing new products and services or delivery methods, etc. In addition, technologies such as ML and digital labour have been adopted on a large scale by P&U sector companies across corporate functions such as IT, customer support, finance and HR, more often when compared to other industries.

Digital, at the heart of the strategy of P&U companies globally

Case Study

Enel - Digitalisation is a key pillar for growth[5]

Enel is one of the world's leading integrated electricity and gas operators with presence across 34 countries and managing an installed capacity of 86GW with more than 75 million consumers. Enel has identified 'digitalisation' as one of its two strategic pillars for growth. They have earmarked an overall digital investment plan of EUR 5.3 billion for the years 2018-20 with 81 per cent share for assets and the remaining on customer and people.

Enel has a new global business line, Enel X for advanced technology based innovative energy solutions for its customers. It's digitally enabled solutions such as demand response, behind the meter storage, electric vehicle charging stations, maintenance of customer assets and smart lighting are helping customers optimise as well as monetise their energy use.

Improving business process efficiency and enhancing customer experience are amongst the key drivers for adopting digital in global power utilities

5 Investor presentation 2018-20, Enel, September-2018

Going forward, the pace of digital adoption is likely to grow exponentially. With electric vehicles (EV), DRE and storage causing disruptions along the power sector value chain, digital has become a key enabler for asset and operations management. Digitally enabled solutions such as distributed energy resource management system (DERMS), virtual power plants (VPPs) and vehicle to grid (V2G) solutions are likely to enable grid operators to balance intermittency and manage the complex flow of power between numerous and dispersed generators and consumers, optimally and reliably.

For generators, digital technologies can help enhance both the operations and forecasting of renewables. Use of AI and ML, has led to significantly improved accuracy in RE forecasting. Some pilot implementations have shown an improvement of 35 per cent in wind generation forecasting, achieved by reducing the Mean Absolute Error (MAE) of forecasts[5]. Digital solutions are also critical in improving the efficiency of asset management, both for utility scale and DRE projects. For segments such as DRE, digital solutions are also being increasingly leveraged to improve the outreach and sales conversion cycle, allowing rapid scale up at lower costs.

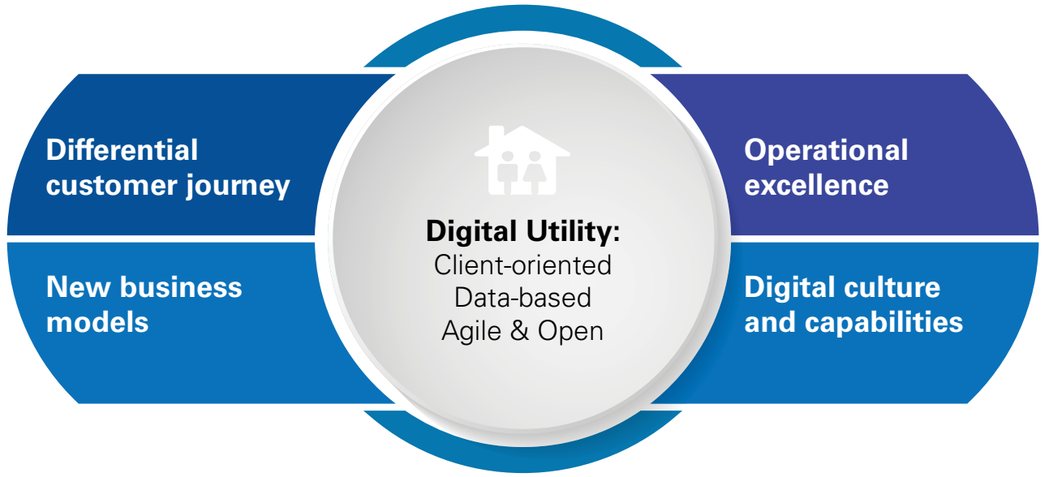
The need to think 'Beyond Utility'

Digital technologies other than being an enabler are also threatening the traditional utility model, forcing utilities to think 'beyond utility'. An increasingly smart and aware consumer is demanding greater information, better service level and higher cost savings. Advances in technologies such as data analytics, smart appliances, AI/ML and are enabling organisations to develop innovative solutions/business models which allow customers to optimise their electricity consumption and also generate value by evolving into prosumers.

The last mile disruption which was set in motion by technologies such as DRE is further fuelled by disruptive technology led platform business models for energy services, peer-to-peer (P2P) trading, virtual power plant (VPP), etc. A key fallout is the blurring of industry boundaries, with electricity related services being targeted by new competitors such as technology players, platforms, etc. This is forcing utilities to expand their frontiers and look at customer retention measures as well as new models of revenue generation. From being a supplier of a commodity, they are looking to transform themselves as a port of call to meet energy related needs of consumers in a service model.

5 Xcel Energy. (2014). Annual Report

The digital utility



Source: KPMG International analysis, 2018

As the twin disruptions of RE and technology integrate and set off a chain reaction, threatening traditional business models as well as giving rise to new opportunities, the P&U industry is increasingly embracing 'digital thinking'. As is evident from the Harvey Nash/KPMG CIO survey 2018, P&U companies are more likely to maintain an enterprise-wide digital business strategy than those in other sectors (38% vs. 32% for all industries), with 57 per cent having a clear strategy either enterprise-wide or within business units.

BNEF estimates USD64 billion of annual digital opportunity in the power sector by 2025, driven by smart meters, distribution automation, RE and fossil O&M as well as new areas such as flexibilisation and HEMS.[6]

6 Digitalization of energy systems – Bloomberg New Energy Finance – November 2017

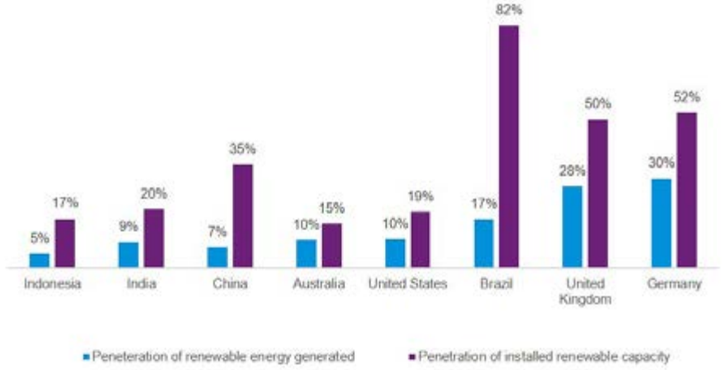
Indian P&U sector:

Need to leverage digital to address critical challenges and seize leapfrogging opportunities

Since 2000, nearly 550 million people have gained access to electricity in India. In addition, the average per capita consumption has doubled during the same period[7]. To cater to this massive growth, the infrastructure has also grown significantly with a threefold increase in generation capacity (from 105 GW in Mar-2002 to 346 GW in Sep-2018[8]). While the initial growth in capacity during the period was fuelled by large coal fired power plants, RE has contributed to the recent growth with India emerging as one of the leading RE adopters in the world. India has ambitions to add nearly 200 GW of renewables over the next decade leading to an installed share of nearly 45 per cent for renewables by 2027[9]

While on the one hand India faces the problem of effective integration of RE, India is still dealing with core issues such as high technical and commercial losses, high distribution transformer (DTR) failure rate, inefficiencies in power procurement, etc. On the customer side; access, quality, reliability and affordability of electricity still remain an issue. Large scale investments are required in IT-OT and data analytics for better data capture, measuring and controlling power flows, efficiency in energy procurement and delivery and enhanced customer experience.

Penetration of renewable energy (as on 2018)



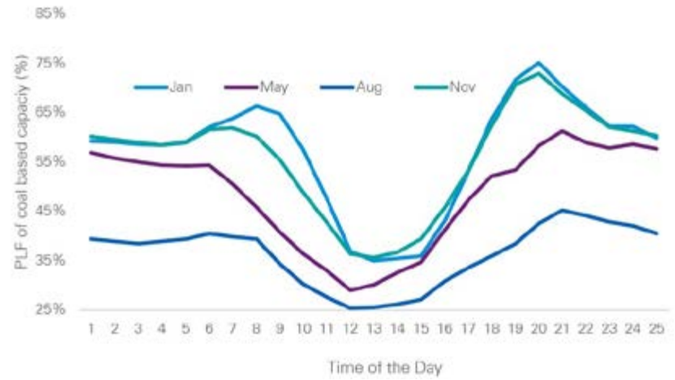
Source: Renewables 2018 global status report, BP statistical review of World Energy – 2018 - KPMG in India analysis, 2018

7 World Energy Outlook 2018 – International Energy Agency – October 2018
8 Capacity Addition – CEA – September 2018
9 National Electricity Plan (Volume I – Generation) – CEA – January 2018

Some of the current challenges and imminent disruptions along the power sector value chain in India are discussed below:

1. **Efficiency of conventional power plants under high RE scenario -** As per CEA, National Electricity Plan – January 2018, RE is expected to contribute to nearly 25 per cent of the total energy demand by 2027[10]. This could lead to duck curve effects, requiring flexibilisation of conventional power plants. Even assuming an RE capacity close to 130 GW by FY 22, KPMG in India's analysis indicates that the impact on average PLF of coal plants could be severe with some plants needing to operate at capacity of approximately 35-40 per cent during peak solar hours in certain months, or otherwise curtailment of RE would be necessary

Illustrative curve for change in PLF of coal plants – 'duck curve'



Source: KPMG in India analysis

2. **Power quality -** India still has significant outages and interruptions as compared to its peers. On an average, across India, the duration of power cuts in a month has been seven hours[11]. It is likely that rural areas would face longer power outages.

   The capacity of diesel generators is estimated at 122,000 MW at the end of March-2018 in India[12]. This is another indication of the extent of reliability issues faced.

Average duration of power cuts (minutes) per month

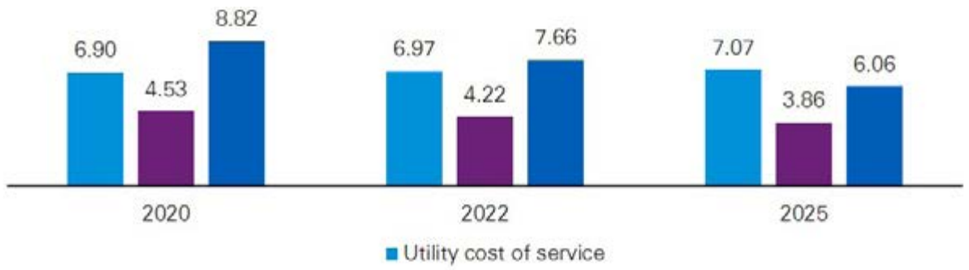
Source: Urjaindia.co.in

10 National Electricity Plan (Volume I – Generation) – CEA – January 2018
11 Urban Jyoti Abhyan – A Government of India initiative – October 2018
12 Diesel Gensets – firing up – Motilal Oswal – June 2017

3. **Penetration of distributed renewable generation** - Innovative solutions around rooftop solar panels such as 'utility in a box'[13] are being developed to provide access to electricity at affordable costs. Storage is also making its way into DRE solutions and has started replacing diesel generators of environmentally conscious industrial and commercial consumers as costs reduce. As per KPMG in India's analysis, battery storage along with solar would become a viable solution for domestic consumers post 2022[14].

   Innovations in roof top solutions could lead to business model disruptions signalling disintermediation for utilities and huge opportunity for roof top developers as potentially 100 per cent grid independent houses can emerge (subject to other constraints such as space, etc). In a largely B2C play, digital can be a powerful tool to reduce soft costs of acquisition, manage many dispersed and small assets and bring down costs of customer management.

A grid independent solar house is likely to be a reality after 2022: LCOE in INR/kWh



Source: KPMG in India, The Rising Sun-Disruptions on the Horizon, November 2015

4. **Increased adoption of EVs -** The growth of EVs could add to the complexities of grid management. While the increase in aggregate demand might be less, unplanned charging of plug-in electric vehicles (PEVs) could change the shape of the load profile at the local level which could impact both the grid and the infrastructure. Clustering effects in vehicle adoption at the local level might lead to high PEV concentrations even if overall adoption remains low, significantly increasing peak demand and requiring upgrades to the electricity distribution infrastructure.

   The illustration below indicates the potential impact even if EV charging is spread out evenly throughout the day by 2030. Right tariff framework aided by analytics can help avoid the additional EV peak contribution by demand shifting, thereby saving the capital expenditure for transmission network upgradation.

Illustrative load curve in 2030 with EV demand distributed across 24 Hours

Illustrative load curve in 2030 with EV demand shifted to 16 hours in a day

KPMG in India illustrative analysis, 2018

To address some of the forces as listed above, as per KPMG in India's ENRich survey on digital trends 2018, two out of three P&U leaders are considering end-to-end digital transformation for their businesses as they begin to comprehend that digital enablers are required across their operations.

13 Institute for Transformative Technologies
14 Rising Sun – Disruption on the horizon - KPMG in India – November 2015

2 The digital priorities:

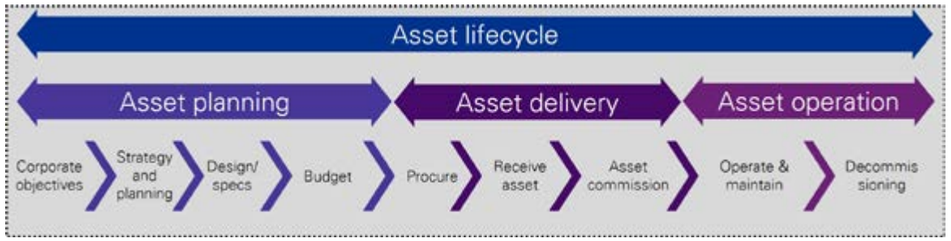
Emerging themes in digital adoption

Asset lifecycle management

Providing reliable power is the sine qua non for an economy that is aspiring to achieve double digit growth. However, the reality today for many of the Indian power utilities leaves scope for a lot of catch-up. Today, the utilities have realised the need to address this problem and are already investing to leverage digital technologies to improve asset performance. Digital solutions enable organisations to better manage and monitor all asset-related data, systems and processes throughout the asset life from planning to delivery and operation.

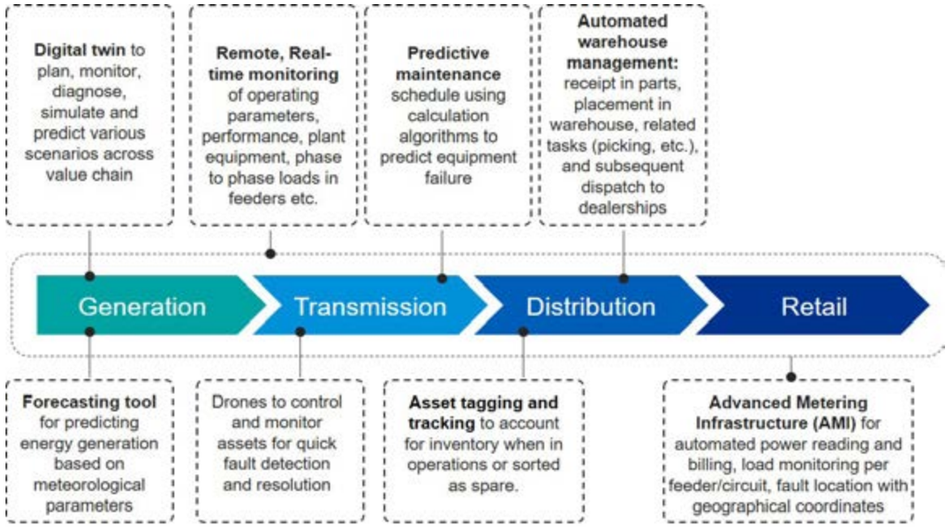
> **"While power plants today are utilising advanced SCADA systems, there is an untapped potential for organisations to create a single view of IT-OT systems across different business units. There is a growing need for control and command centers across the industry value chain."**
>
> **A leading global technology player**

Scope / coverage of asset lifecycle



Source: KPMG in India

Digital solutions in an asset life cycle management include predictive maintenance, condition monitoring, reliability centered maintenance, asset tagging and tracking for better inventory management, digital twins and forecasting and scheduling, all enabled through sensors, data analytics, robotics and AI.



Source: KPMG in India

> **"Digital twin is emerging as a transformational technology to improve reliability and productivity of power plants. While we have observed proliferation of digital twin solutions in generation companies, distribution companies are also not far behind."**
>
> **A leading global technology player**

IoT - DTR asset management - An analysis[15]

In India, the average DTR failure rate stands at around 13.5 per cent (in state utilities), as against a global average of less than one per cent. This contributes significantly to the repairs and maintenance costs of state utilities. Herein, installation of IoTs and real-time monitoring of these equipment can help utilities take data driven decisions for better asset management. Costs for sensor/IoT have declined significantly in recent times. An IoT-based asset monitoring solution for distribution transformers can help reduce the breakdown rates for DT by 40-50 per cent.

"The use of IoT solutions for DT asset management can help reduce failure rates significantly, save INR 3,000 crore in annual costs, and improve reliability and quality of power for consumers".

Case Study

A leading power utility in India leveraged an asset life cycle management software to design, analyse and facilitate reconstruction at a new plant site, resulting in 7-10 per cent saving in engineering time, 2 per cent in project costs and 45-50 per cent more energy efficiency.

A leading electric utility in Europe, leveraged digital twin technology to improve their infrastructure investment planning. This resulted in 60 per cent reduction in time and effort spent in data collection and verification.

A coal - fired thermal power plant in China, installed a sensor based plant management solution to achieve 30 per cent reduction in operating costs.

A leading European RE company, leveraged a forecasting solution to predict the operating condition of a wind farm for the next 120 hours in five minute intervals. This helped to increase productivity by minimisation of unscheduled outages and decrease in maintenance costs.

15 KPMG in India analysis, 2018

Asset life cycle management has tremendous potential and significant value to be gained from digital investments by reducing operating and maintenance costs, ensuring higher reliability of the network and reducing downtime. Data driven decision-making further aided by AI helps in better and informed decision-making. Predictive maintenance reduces maintenance cost and hence improves the business case as well.

"Digital technologies play a very vital role in improving efficiencies and reducing costs. Their impact can be felt across project design, O&M activities and office management"

A leading private distribution utility

The intelligent grid

Digital technologies can help forecast RE supply better and optimally manage the grid. This assumes significance given the increase in the penetration of RE. Digital technologies also enable better enhancement through solutions for real time load management and controls enabled by highly interconnected and 'smart' devices. Further, analytics on the data generated from these 'smart' devices and interconnected systems may allow better understanding of demand and supply in real time and in advance.

"Until recently, IoT was considered a promising digital theme. But now, disparate systems in the P&U sector have achieved good IoT connectivity and the next step lies in focusing on the AI/ML solutions and data analytics layer."

A leading global technology player

Managing RE integration – A simulation[16]

Grid management is a dynamic power-play adjusting demand and supply in real-time. Improved forecasting of RE can help manage the grid better. We have observed that the difference between forecasted and actual solar power generation can vary from 5% to 30% across time-blocks during the solar hours. Better forecasting tools leveraging data that reflects the actual weather conditions closer to the site can help reduce the variations.

16 KPMG in India analysis, 2018

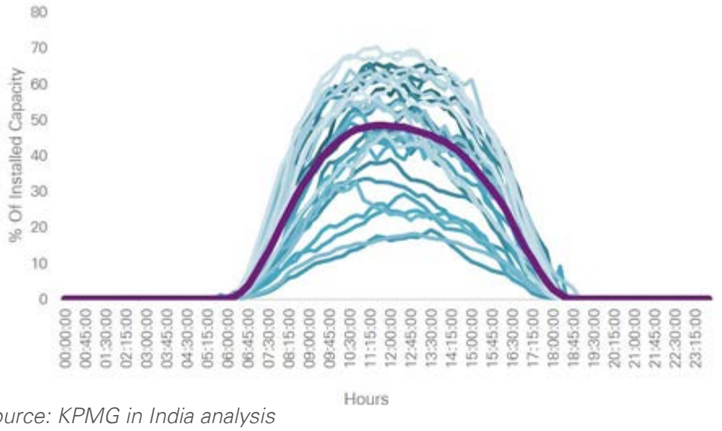
Prediction errors - Difference between forecasted and actual solar power generation during september 2018 for a southern state (MW)

Source: KPMG in India analysis

With increasing RE penetration, managing the net load curve after considering the RE availability will become more complex with higher volatility.

Our analysis for a southern state in the country with solar power generation contributing to more than 20 percent of total electricity consumption suggests significant volatility. The inter-day standard deviation of actual generation during sunshine hours ranges from around 300 MW to 500 MW across months which is in the range of 8 to 14 per cent of the installed solar power capacity. The variations in solar generation can happen within short time intervals of 15-mins. Currently, power utilities resort to either excess drawl from the regional/national grid or under exceptional situations, mange the grid through load curtailment.

Actual solar power generation as percent of installed solar power capacity during August 2018 for a southern state



During noon time, the variation in solar power generation is between 20 per cent to 70 per cent of installed capacity.

Source: KPMG in India analysis

To handle these variations, grid operators will need to maintain contingency or reserve margins. There are various ways in which these margins can be maintained. These include supply side measures such as contracting for additional thermal, hydro or gas capacities and storage solutions on the one hand and demand side measures on the other. Demand side measures include demand response (DR) solutions wherein consumers voluntarily reduce their demand in response to a grid operator alert, in return for an incentive. While this has hitherto not been deployed to a large scale, the rise of renewables and the enablement by digital technologies, will likely make this a viable solution for grid managers.

We have analysed two potential segments for DR applications. These are irrigation water pumping loads and consumer air-conditioning loads. Irrigation water pumping contributes to 18-20 per cent of India's power demand, with an estimated connected load of 50 GW. These are mostly flexible in time of use, and are used by utilities for demand load curve management. However, they are currently managed statically i.e. they operate to a pre-set schedule. Dynamic scheduling can be enabled by using digital technologies wherein loads can be switched on and off according to grid exigencies in a remote or automated manner. We believe such solutions can offer significant flexibility to grid operators since agricultural loads are large. Our analysis suggests that payback periods for such solutions are less than five years. Similarly, we estimate air-conditioning load in India to offer at least 10 GW of demand side flexibility to grid operators. With appropriate incentives, this can be tapped as a contingency measure.

Case Study

A leading Indian utility piloted an auto demand response (ADR) programme impacting 160 commercial and industrial customers, allowing them to shed 11.5 MW of load on demand.

A leading utility in Australia has implemented a Direct Load Control Programme for air conditioners. The utility provided a one-time cash incentive to consumers who signed up. DR was applied during the period of high temperature days. Cycling strategies were used which involved switching off compressors for either 7.5 or 15 minutes in each 30 minute period. Significant reduction of electricity demand (~17%) was achieved with no reduction in thermal comfort levels.

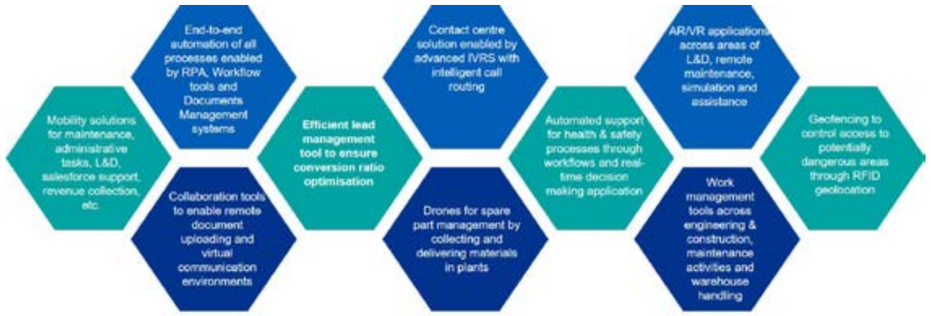
A utility in the USA has implemented a DR programme which allows customers to select from three different interruption levels: 50 per cent, 75 per cent, and 100 per cent air conditioning cycling. Each interruption level corresponds to different annual incentives of USD50, USD75, and USD100 respectively.

Digital interventions may enable the grid operators to meet their commitments to RE generators and also make the network resilient and free from fluctuations. This can bear financial benefits for all stakeholders and could be a win-win situation for generators and consumers, making it a truly intelligent grid.

Digital enablement of workforce

Digital technologies available today have the potential of significantly improving workforce efficiency whether on the field or in back office functions. The affordability of these solutions has also improved in the last few years. Technologies such as applications on smartphones and tablets, sensors and AI to predict and alert the field force on their maintenance jobs, drones to inspect equipment before a physical inspection is warranted, wearables to identify location and safety, and augmented reality to assist remote field workers by a senior at a central location – are all realities today. Robotics process and intelligent automation technologies are optimising HR, finance and IT functions and are also changing how customer service is enhanced through different kinds of text and voice based bots. For organisations with customer facing products and services, integrated digital channel strategies and self-service avenues are important for a seamless customer experience as well as optimising load on service agents, on and off the field.

Organisations in this sector are at varying levels of maturity in adopting these digital workforce enablement solutions and are still to achieve full scale digitalisation. Leading companies are investing in these solutions and looking at integrating it with their asset management digitalisation projects to achieve full potential.



Source: KPMG in India research, 2018

Case Study

A prominent energy provider in the USA, has developed a mobile tool that offers field engineers a wide spectrum of remote functions, including document management, post-field administrative tasks like inventory and map updates. This has helped improve accessibility, productivity and faster data collection.

A leading energy generator and supplier in the U.K., leveraged robotic process automation to automate back office processes of invoice statement generation, resulting in reduced full time equivalent (FTE) requirement and faster and more accurate invoicing.

A solar power generator initiated a pilot, using smart sensors and cloud based technologies for detecting soiling and weathering on solar panels to predict maintenance requirements to optimise the schedule and time of its workforce sent for the maintenance.

One of the leading discoms in India has leveraged mobile collaboration tools for collaboration, field service task allocation and resolution amongst its workforce as well as using it as a means of communication with its industrial customers to improve efficiency and customer experience with its most valued customer segment.

Potential impact of digital workforce solutions

Source: Based on KPMG in India's ENRich survey on digital trends -2018 with product vendors

Based on the experience of product vendors developing digital technologies for workforce effectiveness, it has emerged, that these technologies have the potential to double field force productivity, reduce time for administrative and repetitive tasks, improve customer experience and reduce maintenance costs. Standardised and digitalised processes improve quality and overall worker experience.

Digital Customer Management

Pervasive connectivity, increasing smartphone penetration and 'platformization' of services and experiences are changing the expectation of consumers across industries, including the P&U sector. With the changing expectations of consumers, the P&U industry also needs to move towards being more customer service centric from being solely commodity (energy) centric.

Digital natives, who are accustomed to enjoying seamless digital customer experience in other industries are pushing the incumbents in this industry to offer products and services impeccably across channels of their choice. In the industrial segment with the advent of deregulation, reduced cost of solar, storage and smart technology, alternate energy options are likely to be increasingly available. In Europe and USA the customer already has the power to choose his/her energy provider based on the experience and service he/she desires and achieves. As the dynamics of utility-customer relation shifts, utility firms will need to focus on creating a compelling customer experience and better engagement with their customers. Digitally engaged customers are much more valuable to a utility both in the short-term as well as in the long-term as they are more likely to have the 'stickiness' and participate in newer energy management programmes and products/services.

Personalisation	Billing	Service and support	Omni-channel engagement
Personalised services and recommendations based on the digital footprint of customers	**Billing digitalisation** to offer customised insights, complimented by gamification and consumption benchmarking	**Billing digitalisation** to offer customised insights, complimented by gamification and consumption benchmarking	**Omni-channel access & support** to provide seamless service by integrating all customer-facing channels
Advanced customer segmentation to offer VAS through consumption and behavioral insights	**Multi-channel payment** solutions offer convenient and secure services rendered through digital technologies	**Multi-channel payment** solutions offer convenient and secure services rendered through digital technologies	**Digital channel strategy** including social media for customer acquisition, engagement and service & support
Digital customer communication through personalised proactive notifications based on consumption and behavioural analytics			**Customer mobility solutions** provide direct access to customer-facing functionalities and real-time communication

Source: KPMG in India research, 2018

"As P&U sector in India is experiencing the value shift towards end users, customer engagement is becoming a key focus area. In our experience, solutions such as analytics for personalized service, voice assistance for self-service and gamification are witnessing traction."

A global startup in the P&U space

Case Study

A leading discom in south India has launched an analytics app for its high-tension customers to optimise their power consumption by tracking their costs in real time.

A leading utility in the U.K. has applied omni-channel analytics and customer journey system to improve Net Promoter Score (NPS) reporting accuracy, risk mitigation and multi-chat ratio of its contact centre, which has resulted in 84 per cent increase (from 10 to 18.4).

A forward-looking utility in London leveraged smart meter data to provide personalised saving recommendations to customers, which resulted in 2.25 per cent energy savings for customers and increased customer engagement with nearly 40 per cent of mobile users engaging multiple times per week.

A leading utility in Arkansas, USA, developed a gamification tool with features of reward systems, social sharing, continuous updates on consumption and periodic comparison with communities, which resulted in cost savings of upto 10 per cent for customers and decreased peak load by 210 MW.

A leading utility in USA, improved customer service and reduced customer churn by developing a channel agnostic chatbot to manage customer queries around outages and bills.

Some of the key benefits[15] realised by utilities and end-consumers by deploying digital customer management solutions are:

Benefit to service providers:

- Lower customer acquisition and retention costs
- Reduced operational costs by offering self-service/virtual assistant services
- Improved Customer satisfaction (CSAT) and NPS scores with better customer experience
- Opportunity to provide potential alternate services to digitally engaged customers

Benefits to customers:

- Improved experience through self-service and omni channels and proactive notifications
- Better control over energy usage and cost saving opportunity through consumption insights and optimization
- Convenience of services such as digital payment solutions

While foundational solutions for digital customer management have already been laid down in the sector in India– namely web portals, mobile applications, chatbots and social media engagement, true customer experience is not a priority at the moment. Digital customer management requires a data driven approach to be able to offer much more than just 'electricity'. Indian P&U firms are realising the need and opportunity to offer customised and new services beyond the energy spectrum however this is lower on the priority radar as compared to emphasis on achieving operational efficiencies. Going forward, strategic alliances between utility firms and technology vendors in areas of smart home and energy management solutions, among others are likely to be seen. These additional services can help utilities to lock in additional revenue streams through digitally engaged customers.

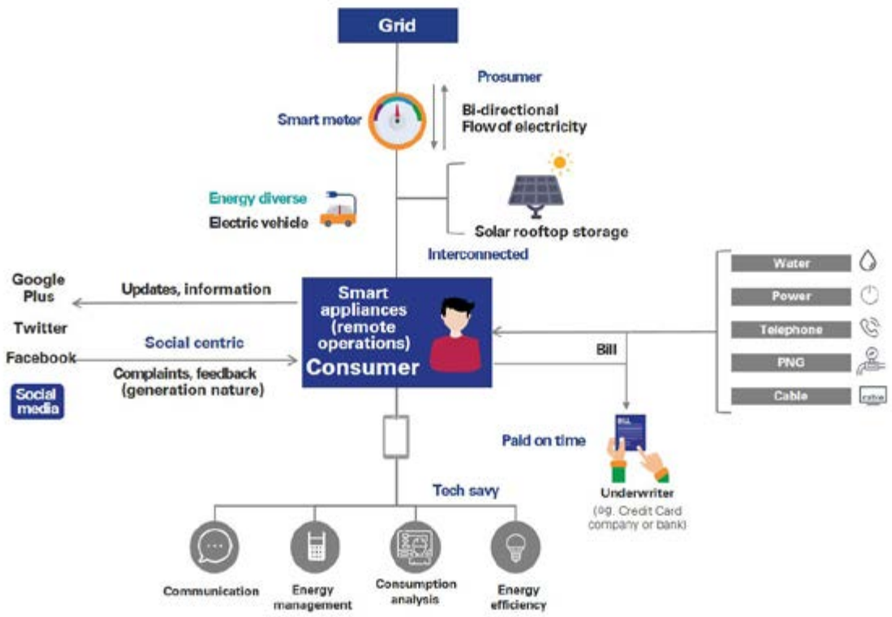
15 KPMG in India analysis based on primary research through ENRich survey on digital trends, 2018

Digitally enabled customer centric business models

Digital technologies have the ability to blur industry boundaries, as it can enable utilities to get beyond the front door into consumer applications. Examples of such applications include home automation services, security and surveillance services and energy management services. In Japan, a leading electricity utility has partnered with an electronics conglomerate to offer energy monitoring and management services to its consumers. The electronics company will provide tools that will work with different smart appliances to enable data communication and control. The alliance helps the utility to offer cutting edge home energy management solutions. Utilities in Europe have also developed 'Beyond Utility' business models. Association with start-ups to offer new age solutions in varied areas such as building energy management, smart city services, clean air solutions, and smart EV charging models is emerging as a trend. Often utilities have spun off separate businesses to focus on these new age businesses. For example, RWE has spun off Innogy to look into smart home solutions[16].

Decentralised generation through solar rooftops and battery storage solutions is also emerging as a fast growing business model. In fact, utilities in Europe have now begun to look at business models that act as enablers of these solutions. As suppliers of power face stagnant or even reducing energy sales due to emergence of self-generation by consumers and energy efficiency Developments, utilities are increasingly looking at reinventing their business models to develop new revenue streams

Consumer applications



Source: KPMG in India analysis

16 RWE – Innogy press release 2016
17 KPMG in India research based on EESL tender for smart meter services in Uttar Pradesh and Haryana
18 KPMG in India research based on roadmap for smart metering
19 Rising Sun – Disruption on the horizon - KPMG in India – November 2015

In India, the government is giving a strong push to smart meter rollout. With the fast reducing costs of deployment (currently system costs have fallen to about INR 4,000[17]/meter), smart meters offer interesting business model opportunities. Some of these include consumption analytics, demand response, energy management services and network efficiency related applications. Based on estimates, we expect the smart meter rollout to be 12 million[18] by 2022. This could lead to a services opportunity of INR 2,100 crore by 2022.

The declining costs of distributed solar rooftop systems and battery storage costs can be a strong combination posing a threat as well as an opportunity to power utilities. Our estimates suggest that a solar-storage combo can deliver on-demand power at INR7 – 8 /kwh by 2022[19]. This can lead to a sharp proliferation of this behind-the-meter solution which in many ways maybe beyond utility reach. Utilities will need to innovate to develop new business models that can capture this share of the pie, else risk losing out to new entrants in this space. Digital technology will play an important role in providing a platform to integrate these solutions, which can in fact offer useful grid services through business models such as VPPs and local trading markets.

"With the foundational systems in place, an opportunity for data centric value creation lies ahead. This consists of creating innovative products, building different business models, ensuring customer engagement and developing marketplaces & platforms."

An Indian Startup in P&U Space

Case Study

A start-up in Australia has introduced a blockchain-based platform to trade energy within microgrids. It conducted a peer-to-peer trial in Australia which showed that households can save up to USD470 annually on electricity bills.

A start-up in USA is providing a peer to peer platform for transaction of energy using blockchain technology.

A start-up from UK has developed a cloud hosted platform that enables households and businesses to participate in their local energy community. The consumers can choose and prioritise generators from where they want to buy their power. Any excess power in the system is bought by the retailer and at times of peak demand, he provides energy to consumers, thus maintaining the balance.

"The rise of prosumers has paved the way for P2P trading platforms. This will lead to democratization of the market through real-time information across players. Distribution companies are now figuring out ways to establish reliable systems for P2P power trading."

A leading global technology player

3 The digital transformation journey:

Need to wear a 'holistic lens'

In recent times, several of the larger P&U companies in India have begun to consider the importance of adopting digital technologies and have started deliberating upon their desired path. Many companies are currently evaluating solutions which touch upon specific areas such as cost optimisation/efficiency. Further, customer centric businesses such as distribution utilities are also focusing on customer centric solutions. However, efforts so far have been sparse with an attempt at 'optimisation' rather than achieving a 'transformation'. In our experience of working with P&U companies and insights from our discussions with ecosystem players, we have recognised a few key challenges in the journey of digital transformation.

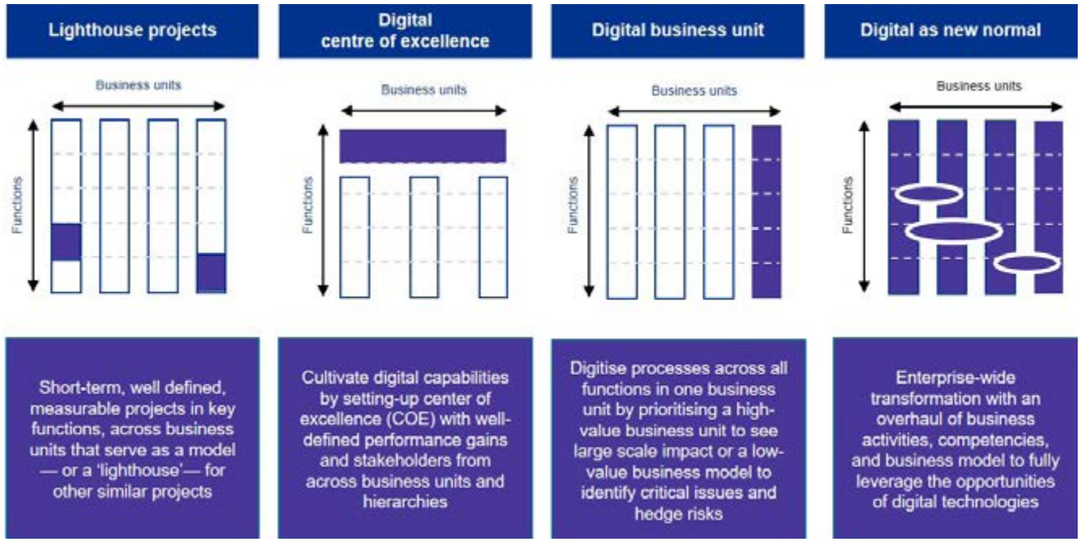
In our experience, the approach to digital must take a holistic and enterprise wide approach where first and foremost organisations need to formulate their 'digital vision' and identify core areas for digital interventions based on their business strategy and objectives. Exploring and prioritising would be the second important step where organisations would need to map the global landscape, understand uses cases across business areas, evaluate the capabilities available internally as well as externally, and prioritise across multiple initiatives.

KPMG International has identified four models for developing digital capabilities within an organisation. In order to decide an appropriate model, companies need to consider multiple factors such as business objectives, cost implications, time to implement and criticality of issues, among others.

Challenges in the path to digital transformation

Source: KPMG in India, 2018

Digital capability incorporation models



Source: KPMG International analysis, 2018

Incorporating digital capabilities also requires a hard look at critical competencies and culture. Embarking on digital transformation brings in the requirement of new skill sets and new mind sets. Further a strong and effective change management across the organisation must be planned.

The other 'must haves' for a digitally driven organisation are data driven operations, a sound technical foundation and an environment which nurtures entrepreneurship and focusses on innovations. Globally, some organisations have created separate innovation teams to foster new business ideas and have also opted for the acquisition and partnership route, in an attempt to speed up their journey in digital transformation. Some firms are also working with the start-up community and investing in new-age smaller digital businesses to supplement their digital capabilities and reduce risks.

Ovo Energy, a leading UK-based independent energy supplier, acquired a smart grid startup VCharge last year.

E.On has set up an accelerator program called Agile that accelerates start-ups in various areas related to providing digitally enabled services to its customers

In India, Shell foundation in collaboration with Zone startups, DFID India (Govt. of UK) and DST (Govt. of India), launched an accelerator called 'Powered' focusing on women led businesses in the energy value chain with the aim to scale up innovative businesses in the energy domain.

Finally, in the journey to 'digital', leadership and commitment from the top and as well as bottom up involvement is critical.

"Indian P&U players are currently adopting digital through adhoc investments in small pilots across the business. This accentuates the need for expert assistance to identify relevant intervention areas and to compute a cost benefit analysis for the same"

A leading global technology player

"An organisation facing existential threat will have strategic focus on business transformation adopting emerging technologies while others will prioritise optimising their core businesses enabling better utilization of existing assets."

A leading renewable energy developer

Case study 1: Indian utility

Client objective

- A leading public discom aimed to undergo digital transformation to be the 'best in class' utility
- Key digital focus areas included:
  - Enhancing customer experience
  - Improving operational efficiencies
  - Digitalising the learning and development program for employees

The journey

Digital maturity assessment: Assessed the current state digital maturity of the organisation and identified the leading global and Indian practices and industry trends

Voice of customer: Customer journey mapping across all customer processes of application, metering, billing, payments, fault redressal and disconnection. This was done for all customer segments.

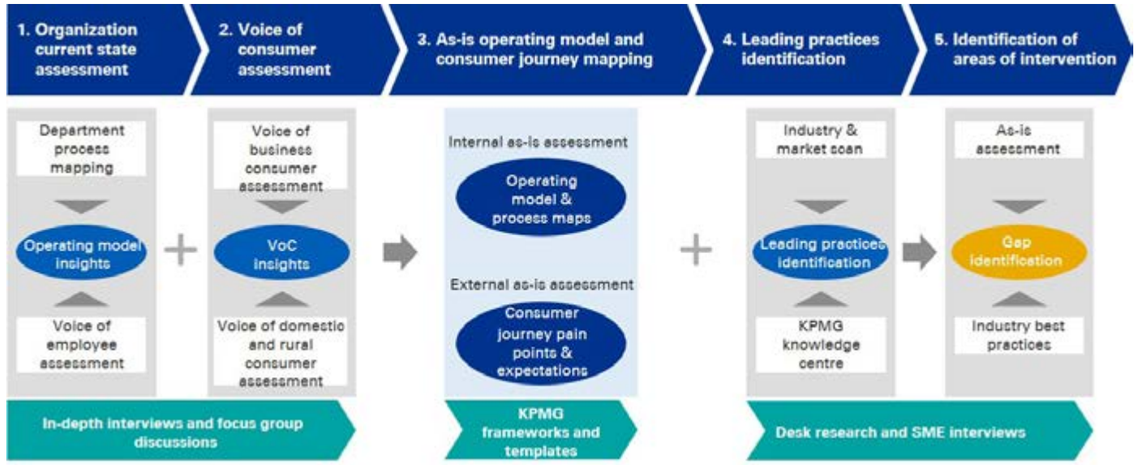
Voice of business: Interviews across key business units to understand current state and expectations.

Digital initiatives: Identified digital initiatives impacting customer experience, asset management and operations and employee enablement.

Digital transformation roadmap: Created a customised digital transformation roadmap after iterative prioritisation workshops with business stakeholders keeping the culture and business objectives of the organisation in mind.

Workshops: Workshops across circle offices to increase awareness of digital initiatives undertaken, address concerns and obtain on-ground feedback on challenges. Created a process for feedback from circle offices to corporate office to monitor progress and address challenges in adoption.

Approach for digital transformation of a leading utility



Source: KPMG in India, 2018

Key outcomes

- 16.5 per cent increase in digital payments, 47 per cent increase in mobile application downloads and doubled engagement and awareness through focused digital campaigns
- Increase in customer satisfaction through digitised processes, self-service and proactive notifications across the journey
- Improved visibility and appreciation of the digital initiatives across all circle offices and field staff through change management and awareness workshops
- Further, digital dashboards were created to monitor and measure digital KPIs across the organisation

Key learnings

Awareness of digital technologies and its impact needs to be socialised in the entire organisation to create an appreciation of digital. A top-down and bottom-up approach is essential to a successful digitalisation journey and hence the decision to conduct workshops at all levels across the circle offices. Change management is most critical and must be carefully planned for a successful transformation. Having an agile approach, achieving quick wins bolsters the confidence in any project and feeds into future projects. Last but not the least, keeping an eye on progress and measuring impact periodically enables to steer focus and course correct in time.

Case study 2: European utility

Vattenfall Heat, a leading European energy company had been active in many digital initiatives and wanted assistance to develop a digital strategy assessing the opportunities and threats, for reaching the next level of digital transformation. The key objectives were to bolster the organisation's agenda of customer growth, create a sustainable portfolio, drive innovation, improve performance and develop an entrepreneurial culture.

KPMG's team along with Vattenfall Heat's team delivered in a span of only two months a digital strategy including a road map for key initiatives. In doing so, the management got a clear overview of the current **Digital Project Portfolio**, the need for **Transparency and Portfolio management**, the necessity for the **future IT application landscape harmonisation and Data Maturity Improvement**. This was the start of a journey rather than the end and a few key learnings were deciphered as a result. Specific initiatives included the start of robotics (digital labour), Proof of Concept (PoCs) for operational excellence and breakthrough digital platform initiatives and a specific initiative for the expansion of digital competencies.

Key learnings[20]

- **Wear your holistic glasses -** Organisations mostly focus on customer facing functions when it comes to digital. However digital transformation is about an enterprise wide transformation, which includes restructuring the entire business. Customer centricity is the foremost agenda but delivering that needs focus on four other pivotal domains - data driven operations, a sound technical foundation, a culture which nurtures entrepreneurship and reinventing the current and imagining the future business model.

- **Use a structured but agile approach -** In order to improve focus and ensure coverage of digital throughout the organisation, three key approaches were successful. Firstly, ensuring a combination of representation from all levels within the organisation. Secondly, having representation of various critical business functions while orchestrating the strategy. Lastly, using the power of a 'do not tell, but show approach' to convince and inspire people.

- **Be aware that 'thinking is doing and doing is thinking'-** In a fast changing digital world, continuous experiments and learnings are key- 'doing is thinking'. This should be complemented with the approach of 'thinking is doing' as well. It helps to not only bring awareness but also bring about an enthusiastic 'action modus' among participants. This is crucial to unearth the hidden aspects of digital transformations.

- **Excel in the balancing act between 'how' and 'what'**- In our experience, we have seen organisations focus too much on 'what' is to be achieved without focusing on the 'how' part of it. In order to ensure this balance, we created five key strategic pillars. The 'what' was covered in the first three pillars- customer growth, creation of a sustainable portfolio and driving innovation. The last two pillars- performance improvement and entrepreneurial culture were responsible for answering the 'how' part of it.

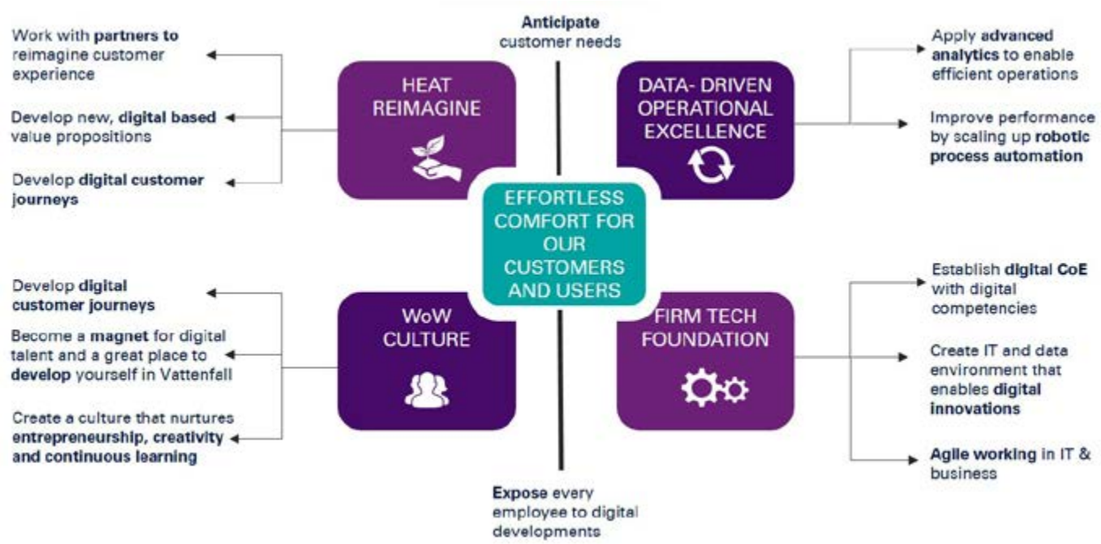
20 How to build a strategy in a digital world, Compact - 2018

- **Make sure to focus –** One of the hardest things while traversing the digital journey is to prioritise across multiple suggested initiatives. One of the practices that was a success, was to break the timeline across three horizons. Horizon one contains initiatives which provide immediate impact and are incremental. Horizon two consists of initiatives which help in transforming the business in the next three years. Lastly, horizon three consists of new initiatives which ensure real-transformation through new industry models.

- **Beware of silos-** In order to truly leverage digital via an integrated value chain, departmental silos need to be abolished. Data gathered and integrated from various functions across the value chain has potential for cost savings and service improvement. Hence, breaking down the walls between department and geographical business units is critical.

The above case studies indicate how a digital transformation journey can be undertaken by large enterprises and are instructive for utility leaders.

Digital Ambition – Vattenfall Heat



Source: How to build a strategy in the digital world – The Vattenfall heat route to success

Digital technologies are evolving at a rapid pace and digital transformation is about leveraging emerging technologies and resulting capabilities to redefine business, operating and financial models. Digital transformation while being technology led needs to be viewed as a holistic business transformation exercise and a journey, and a continuous one at that.

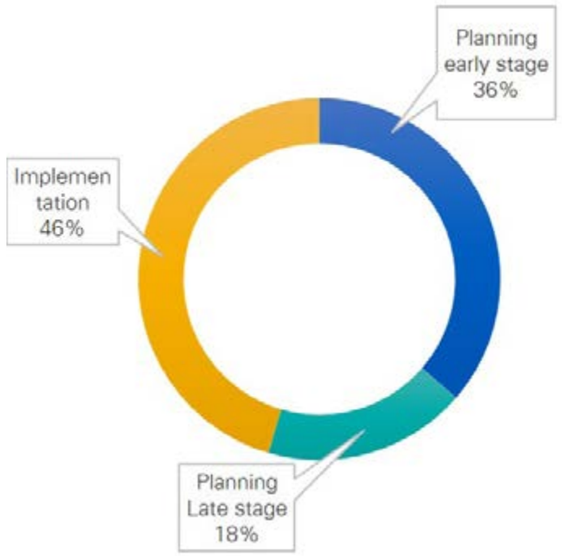
Conclusion

The emergence of digital technology at an opportune time for the Indian power sector, bodes well to meet the challenges we face today. It can help us in integrating renewable energy in a big way, improving the quality of our power supply, reducing the cost of power delivery to remote areas and engage better with customers improving customer experience and services. In some ways, it can also disrupt the traditional utility model, as it offers opportunities for new entrants to disintermediate the traditional utility services model, through models such as distributed energy resources and retail access to power markets. As a result, the rules of the game could soon be rewritten. It is for utility leaders to harness the power of digital technology to meet their needs and make their companies ready for the future. As in many technology driven industry changes, a proactive approach can help in being better prepared for the future. The choice is ours to make!

4 KPMG in India's ENRich survey on digital trends with 12 P&U leaders in India

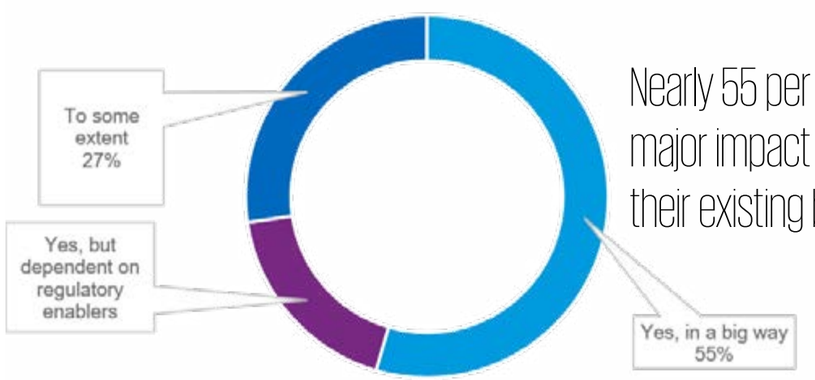
1. Digital Status

At what stage of digital journey is your organisation?



Nearly 46 per cent of power utilities have already begun implementation of various digital technologies

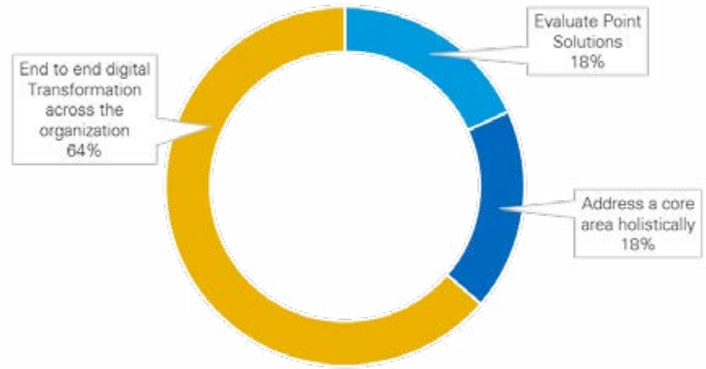
Do you envision your business being impacted due to digital trends?



Nearly 55 per cent utilities see a major impact of digital trends on their existing business models

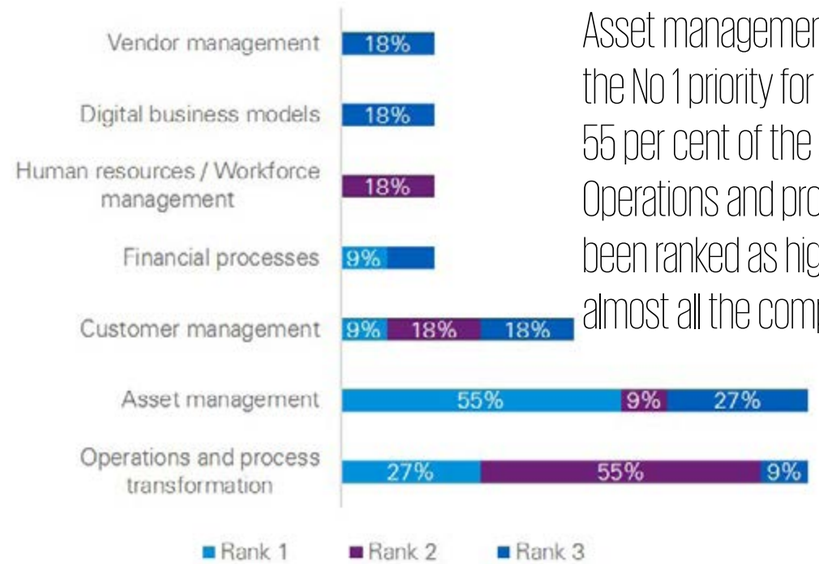
2. Digital Priorities

What is the likely path that your organisation will follow regarding digital interventions?



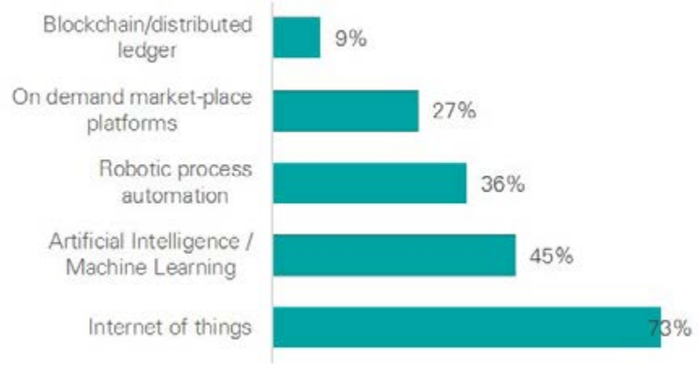
Nearly two out of three organisations are looking at an end to end digital transformation

Which core area would your organisation prioritise?



Asset management has been ranked as the No 1 priority for digital intervention by 55 per cent of the companies surveyed. Operations and process transformation has been ranked as high priority (Rank 1 or 2) by almost all the companies surveyed

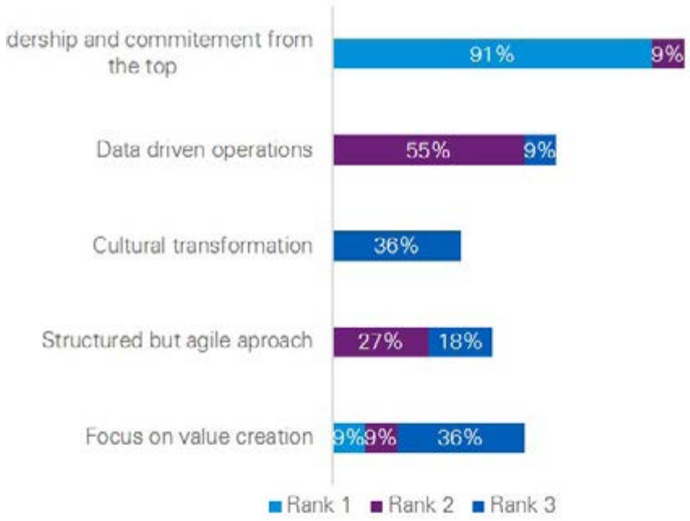
Which of the following technologies would your organisation be willing to invest?



Nearly 73 per cent of companies envisage investments in IoT based solutions, with almost half indicating willingness to invest in AI/ML solutions

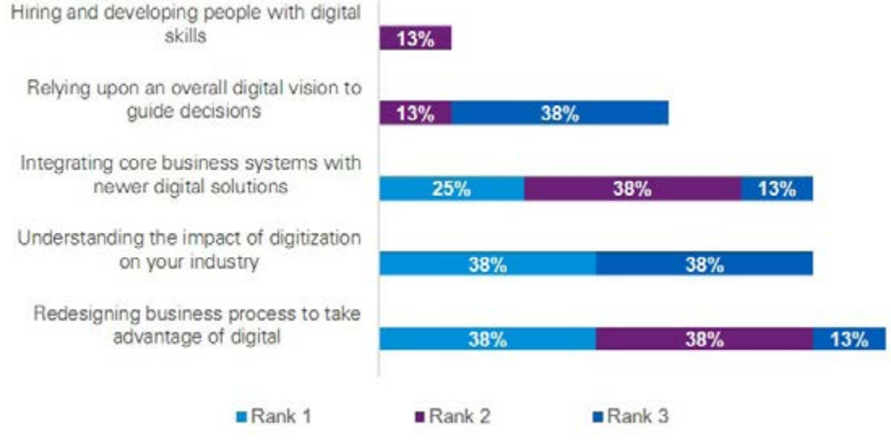
3. Digital Pathway

What do you see as the critical success factors for digital transformation?



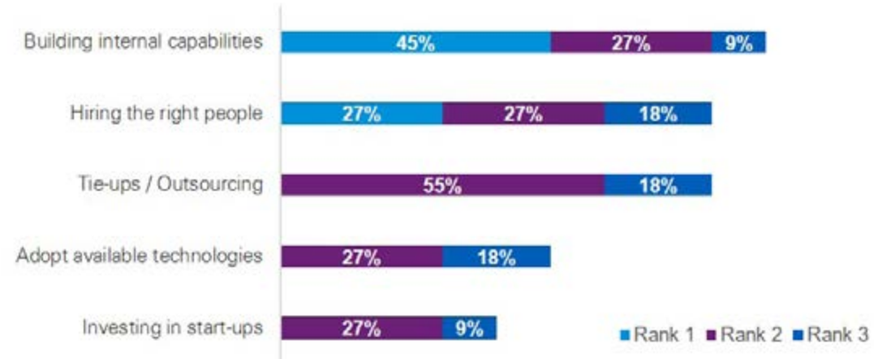
Leadership and commitment from the senior management is one of the most critical factors for success of digital transformation. A majority of the power companies surveyed have also placed high importance on the significance of having a data driven operations

What are the most effective capabilities of your organisation that you will leverage?



Indian utilities are most confident of their ability to redesign business processes to take advantage of digital technologies.

How do you see your organisation encouraging digital innovations?



Most utilities are focusing on developing their internal capabilities to encourage digital innovations.

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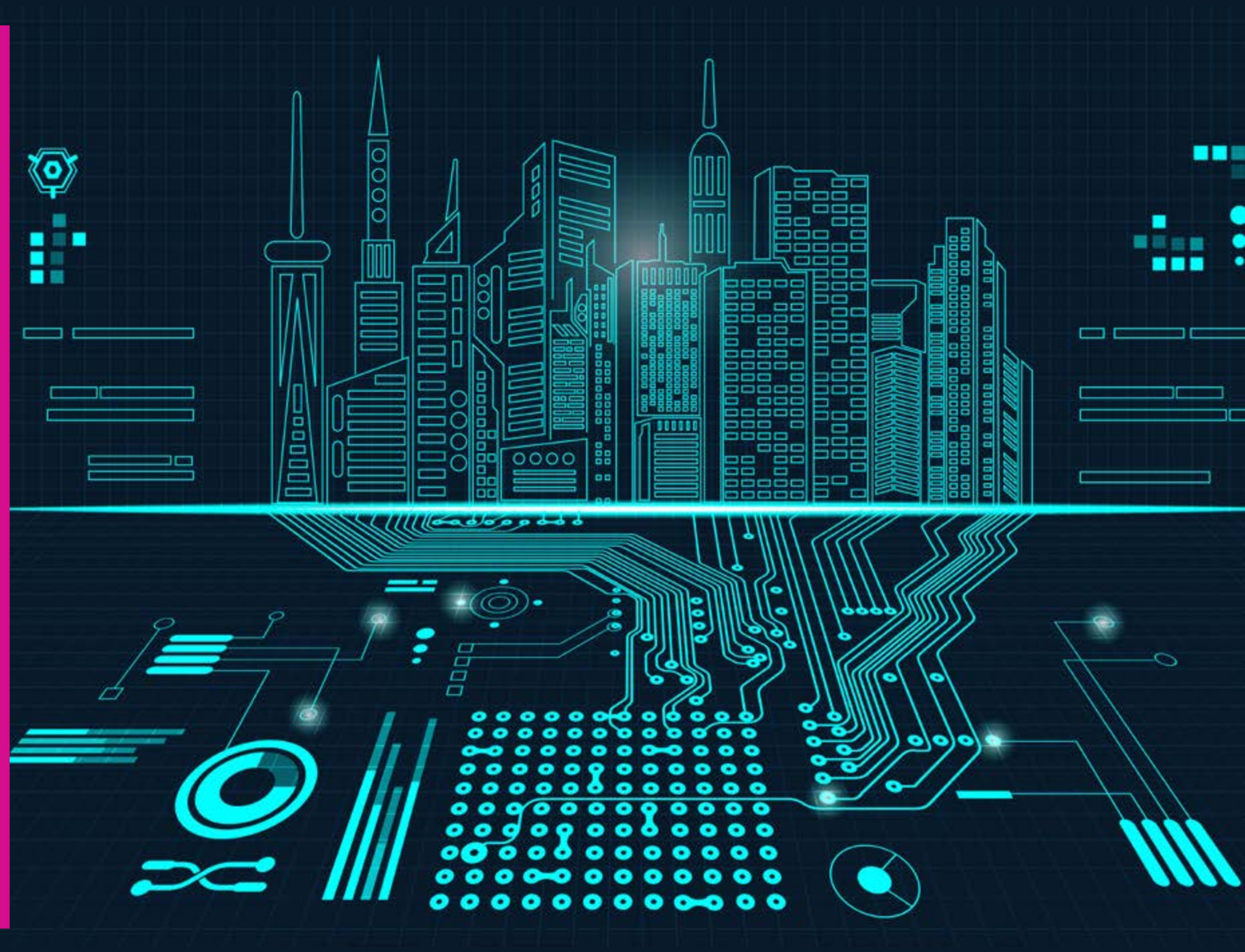

Notes

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