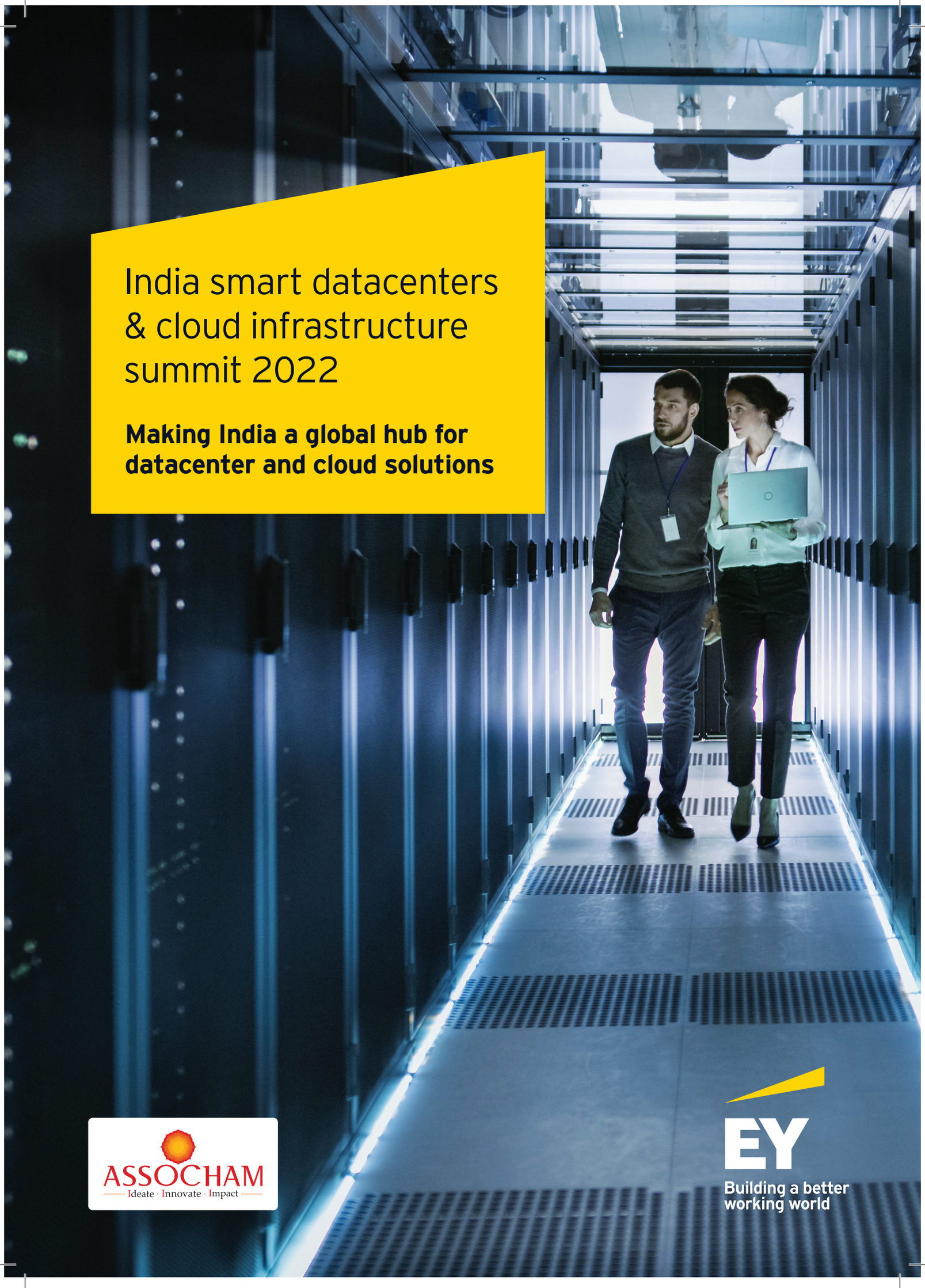

India smart datacenters & cloud infrastructure summit 2022

Making India a global hub for datacenter and cloud solutions

ASSOCHAM
Ideate · Innovate · Impact

EY
Building a better working world

Foreword

India is witnessing a transition from an emerging to a developed market economy, and digital is slated to play a vital role in this journey. Digital transformation is not only catalyzing economic growth across all sectors but also forms the bedrock for improved citizen service delivery, enabling social and financial inclusion, improving productivity, and helping create a connected ecosystem.

India has witnessed an exponential growth in digital commerce, digital entertainment, and the use of social media. India's mobile data consumption is already the highest globally and is constantly increasing. The vast size of the digital population in India and the high growth trajectory of the digital economy necessitates a robust growth of data centers, which have the potential to fulfill the growing demands of the country. The Indian data center market has witnessed tremendous growth in the recent past, riding on the explosion of data through smartphones, e-commerce, social networking sites, digital education, digital payments, and many other digital business services. This data growth is further stimulated by the adoption of emerging technologies, such as quantum computing, artificial intelligence, IoT, etc. Further, the government has been focused on facilitating the enablement of the sector.

The ASSOCHAM Datacenter and cloud council has been making efforts to support the government of India's vision of making it a global data center hub. Additionally, interventions are being facilitated to promote investments in the sector, propel digital economy growth, enable the provisioning of trusted hosting infrastructure to fulfill the country's growing demand and facilitate state-of-the-art service delivery to citizens.

I am glad that ASSOCHAM and EY jointly prepared a report on the **Indian Smart Data Centers and Cloud Infrastructure.** The report highlights the country's massive potential from the data center market perspective by leveraging the advantages India provides to the sector. This detailed report can help us expand our discussions on the subject. I thank my colleagues from the ASSOCHAM and industry stakeholders from the ASSOCHAM Datacenter and cloud committee for contributing their valuable insights to this report. I would also like to express my gratitude to the EY team for putting together this report and being the knowledge partner for this critical initiative.

Deepak Sood

Secretary General, ASSOCHAM

Foreword

The use of data in India has grown leaps and bounds over the last few years. While our growing economy and young population demographic are big factors, the telecom wars resulted in the cheapest cost of data per gigabyte compared to most parts of the world for mobile data. This coupled with work from home and study from home compulsion for most due to COVID-19, data consumption in India simply exploded. With that explosion and the data localization roadmap of the Government, the data centre demand in India is set to rise multi-fold over the next decade itself.

In line with that, India has kept up. We can now see the largest Uptime Tier IV data centre operational facility globally. The new data centres being developed provide a quality and scale compared to the best in the world. PUE factors are amongst the most competitive for being in a warm tropical climate. Data centres are providing 100% uptime guarantees to their customers. All of these benefits are at some of the most efficient cost levels anywhere in the world. Further, with the launch of 5G, we expect a similar explosion in requirements for edge data centres over the next few years as well.

I hope that that this report compiled by our knowledge partner will give you a preview for things to come.

Darshan Hiranandani

Chairman, ASSOCHAM National Council on Datacentre

Foreword

India Inc. is witnessing digital transformation at a rapid pace. Individuals are using digital methods to consume services ranging from entertainment to financial services. Enterprises are using digital platforms to provide efficient services and enhance reach and scale.

Cloud is the key enabler for this change. As per reports, the Indian Public Cloud Services (PCS) market is likely to reach US$13.5 billion by 2026, growing at a compound annual growth rate (CAGR) of 24% for 2021-26. This is endorsed by the aggressive expansion & large-scale deployments of global Cloud Service Providers' (CSPs) own or through third party data centers in India housing their infrastructure.

While cloud is the bedrock of Digital transformation, data centers are the bedrock for cloud services. Enterprise Leaders are evolving their vision for digital transformation and their data center strategy – leveraging hybrid cloud-based platforms, as-a-service offerings, digital ecosystems, and third-party data center providers to ensure positive business outcomes and future proofing their business.

Cloud service providers are major users of data center co-location space. Over and above their own build, CSPs are one of the biggest customers for third-party data center services. In the last three years, over 60% of data center capacity has been taken up by the hyperscalers; and their appetite is only growing. The CSPs also need edge data centers to interconnect with carriers and through the telecom service providers, connect to the enterprises and end users. Interconnected data centers in other cities are critical for the CSPs to be able to provide the desired level of services, all within 1 millisecond of latency with enough redundancy for 99.999% uptime.

Data centers are no longer limited to collocation infrastructure in a certain physical location. The interconnected data centers are playing a much larger role in meeting complex business requirements of interconnection between enterprises, Cloud service providers, Telecom Service Providers. Interconnection Services like metro connect connecting multiple data centers in the same city, Internet Exchange for efficient flow of content from the OTTs to the networks, Multi Cloud Exchange enabling multi cloud strategy of growing number of enterprises are all services offered by the interconnection rich data centers which are key for digital transformation and growth of data traffic.

While data center deployment in India is growing at a rapid pace, there is an increasing need for data centers to make sustainability a priority. Balancing climate goals with building out optimized digital infrastructure is becoming even more important. On the renewable energy front, India is in a more favorable situation as compared to several other countries who have very low renewable power capacities. Renewable energy now forms a quarter of India's total installed power capacity – 110 gigawatts as of March 2022 – and accounts for 13% of the country's electricity generation. In the fiscal year that ended in March 2022, India added a record 13.9GW of solar capacity to the grid.

Another aspect impacting growth of data centers in specific and the digital drive in general is the level of "ease of doing business" for enterprises rolling out the various digital platforms and services. This is still not as good as few other countries in Asia. However, several states are already taking positive steps by rolling out data center policies, which is encouraging. Meity's data center policy is still awaited and once that is out, we can look forward to a uniform policy across the country which will help the spread of Data Centers investment across the country rather than being concentrated in a few cites.

I congratulate ASSOCHAM and EY for jointly producing this report with detailed research and analysis. I hope this report will help enrich the ongoing policy dialogue on data centers and cloud industry in India, and provide the relevant stakeholders, industry leaders, state governments, government bodies (Ministry of Electronics and Information Technology) with ideas and insights to shape the future of the country's digital economy.

Manoj Paul

Co-Chairman, ASSOCHAM National Council on Datacenters

Foreword

It is a matter of great pride for EY to have received the opportunity to be a Knowledge Partner for the 3rd ASSOCHAM India Smart Datacenters & Cloud Infrastructure Summit 2022. EY, in association with ASSOCHAM, is pleased to present a report with a theme **"Making India a global hub for Datacenter & Cloud Solutions.**

Digital transformation across all sectors and the government's contribution toward digital infrastructure clubbed with multi-fold increase in internet subscribers, has led to the exponential growth in data traffic in India. India is leveraging the potential the latest technologies, by adopting 5G, Blockchain, Internet of Things (IOT), Artificial Intelligence/Machine Learning (AI/ML), Drone technologies, etc. This calls for a robust, reliable, secure, and scalable data center infrastructure.

India is among the fastest growing mobile subscribers owing to the affordable data services and increased focus on mobile based services in multiple sectors. Citizen centric services, eGovernance initiatives, complex sector specific solutions, 24X7 data access have added to the need of smart data center and cloud services. DESH (Digital ecosystem for skill and livelihood), DIKSHA (Digital Infrastructure for knowledge sharing), Ayushman Bharat Digital mission, etc., are accessed by millions of subscribers every day which necessitates these digital platforms to be always accessible, secure and above all provide customized subscriber specific data. This emphasizes the criticality of data center being at the heart of digital transformation.

Currently, India has 130+ data centers, which are likely to increase in the coming years owing to the increase in data consumption as more digital platforms are embraced, and the Government of India addressing the critical needs of data centers providers. Grant of infrastructure status to data centers will boost data center development on par with other major sectors. Draft data center policy by the Ministry of Electronics and Information Technology (MeITY) envisages ease of doing business, favorable ecosystem for the operations of data center (Power, Non IT Infrastructure, IT Infrastructure), data center Economic zones, promotion of indigenous technology development, research, and capacity building. Data protection and localization policy mandating the need for organization's customer and consumer data reside within India borders will further boost the need for setting up more data centers within the Indian region.

Multiple hyperscaler cloud service providers and large domestic and international data centers provider are setting up the infrastructure in India. The need is to provision the latest technologies and trends to save power, reduce carbon footprints, reduce operational cost, enable high computing, and services closer to the consumers. Hence, the data center providers are adopting edge computing to process the data at source, monitor unstaffed data centers to improve server to admin ratio, innovative and natural liquid/ hybrid cooling techniques, AI to improve operational efficiency, and IOT to track the operating conditions with the data centers.

With the increase in internet subscribers, the launch of mobile base services, sector specific digital platform initiatives, government and enterprises initiatives for digital transformation, and the acceptance of latest technologies, India is bound to be a global data center and cloud solution hub.

Rishi Khanna
Associate Partner EY

Executive Summary

In a digitally connected world, the expanse of data generated on a day-to-day basis is growing significantly. This has enabled technology and data to be at the core of everything. More than ever before, organizations and businesses rely highly on data generation and its related Information and Technology (IT) infrastructure. As the reliance on data increases, the need for a robust, reliable, scalable and sustainable data centers increases as well. Therefore, it is rather prudent to term data as, "the ultimate renewable resource" as it spawns a lucrative, fast-growing industry and enables myriad ways in which it can improve the world.

Furthermore, due to the complex and fast-moving environment, there is a clear operational imperative for the organizations to reimagine business resilience, unearth new opportunities, and reassess their future. The question is, how can companies achieve this, and more specifically, how can they discover or exploit the latest digital trends available in the market for this very purpose?

The data center industry has evolved radically over the years in India and will continue to accelerate over the next few years and beyond. From what was a large walk-in refrigerator, chilled to the bone and filled with giant servers, is about to get even less discernible with every passing year. The transition from legacy enterprise facilities to ultramodern, smart, hyperscale and edge data centers is evident and beneficial for organizations and government entities witnessing a steady growth and for those who want to leverage the benefits of the cloud services without having to manage the complexities. This demand for the capacity demonstrates an upward trend, and the need for more sustainable design has become ever more acute.

With the Government of India supporting the data center industry, multiple global data center and cloud service players are marking their footprint in India in addition to the local players. Besides pushing digital adoption for end-user industries and Small & Medium Enterprises (SME), there are several initiatives taken by the government to promote data localization, which have resulted in a boom. Some of the prominent initiatives worth highlighting include the Government of India Cloud/Meghraj, Storage of Payment System Data, Draft Data Protection Bill, and Single Window Clearance system, which provides impetus for further growth for data centers.

This paper will discuss how India will be an emerging nation in the data center market over the years to come with the support of the Indian Government. We will also dive into the current technology footprint and how these will impact and improve India's economy and how data centers can capitalize on innovation to lead in the Data Center market as a global hub.


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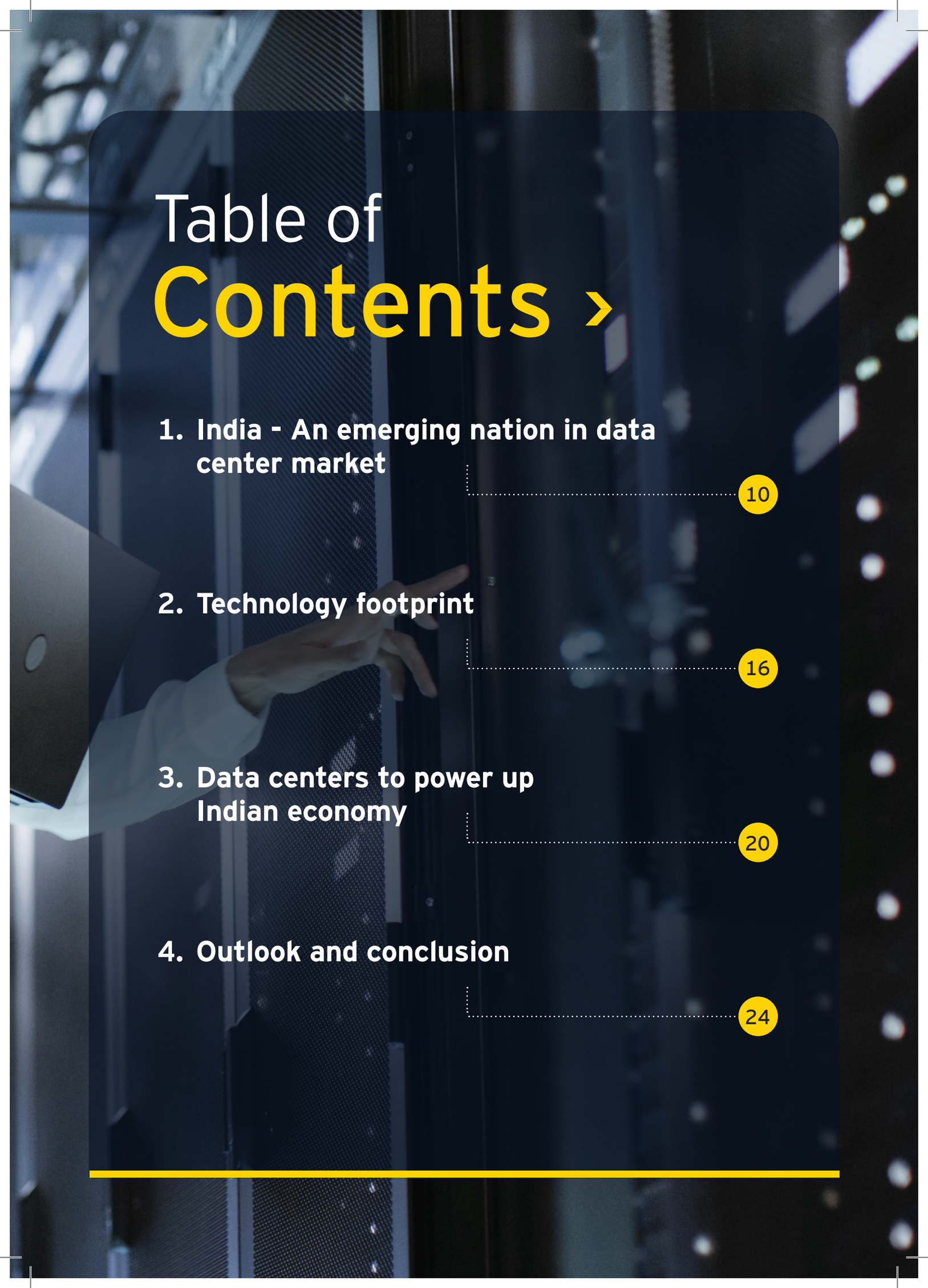

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India - An emerging nation in data center market

India's digital journey started soon after Independence with the entry of technology firms into the Indian market. This led to setting-up of various Indian IT firms, and since then, the country has witnessed a massive technology transformation in the business landscape. India in its digital journey has come to a stage where it is now deemed as one of the largest and fastest growing markets for digital consumers with more than half billion internet subscribers.[1]

The Indian government has taken massive steps by launching initiatives like National eGovernance Plan (NeGP), Digital India initiative to transform and boost the digital capabilities of the country focused extensively on leveraging digital technologies in various sectors such as education, healthcare, e-commerce, industrial, agriculture sector, etc.

1.1 Rise of data center infrastructures in India

NeGP Vision

Make all government services accessible to the common man in his locality through common service delivery outlets, and ensure efficiency, transparency, and reliability of such services at affordable costs to realize the basic needs of the common man

Digital India Vision

To transform India into a digitally empowered society and knowledge economy

At present, India has around 132+ data centers across the nation with about 45% of them located in Mumbai. Chennai is a distant second, which is emerging as the next big hub for data centers in India.

With the explosion of usage in data intensive technologies like Big Data, IOT, etc., requirement for data being collected and stored is increasing exponentially, thereby inducing Indian

data centre market growth, which is currently ascertained to be US$ 1.5 b and is expected to grow at Compound Annual Growth Rate (CAGR) of 11.4%.[2]

This trend is poised to only swing upwards and data centers are at the heart of the growing technological focus and would continue to experience multiple transformations in this journey.[3]

Factors responsible for rise of data center infrastructure in India are:

a) **Largest digital consumers:** India is already home to one of the world's largest and fastest-growing bases of digital consumers and is digitizing faster than many mature and emerging economies. Propelled by the falling cost and rising availability of smartphones and high-speed connectivity. India currently has the second highest number of internet subscribers as manifested by the latest subscriber data published by Telecom Regulatory Authority of India (TRAI) with 78 Crore broadband subscribers[4]. The telecom sector has seen remarkable growth over the last few years due to many factors, such as affordable tariffs and wider service availability, evolving consumption patterns of subscribers, and a conducive regulatory environment.

b) **Rising virtual work culture:** The onset of COVID-19 has provided renewed impetus to digitalization, with the operations largely turning towards the virtual mode. The government's continuous push to provide high-speed internet connectivity across the nation through its initiatives like BharatNet, National Knowledge Network (NKN), etc., and to extend the connectivity to the grassroot level was leveraged during the COVID-19 lockdowns. The experience has inspired the government to strive towards eradicating digital poverty on a mission mode and empower every citizen to contribute to the growth of the economy, gain employment, etc.

c) **Government digital initiatives:** The Government of India, in its ambition, has launched citizen- centric applications like E-Aadhaar, e-Parivahan, Digi Locker, Crime and Criminal Tracking Network and Systems (CCTNS), e-Courts, Poshan, e-District, eNAM, ePFO, DIKSHA, GSTN, etc. As Winston Churchill once said, "Never leave a good crisis go to waste". Similarly, the government has handled the COVID-19 crisis by creating a national hospital management information system and issue digital vaccine certificates to the citizens through "Aarogya Setu" app. The government has also launched applications like e-Sanvad grievance redressal, Su-Swagatam, Ente Thai, Pauti, mSevanam, to serve the different sections of the society.

1 Digital India: Technology to transform a connected nation | McKinseyk
2 http://www.library.nic.in/e-journalNew/Dataquest/Archives/DQDec2018Nov2019/DQSept2019/output1/67%20-%20Data%20Center.pdf
3 India | Data Center Market Overview | Cloudscene
4 https://www.trai.gov.in/sites/default/files/PR_No.40of2022_0.pdf

d) **Leveraging new technologies:** India is now deriving ways to establish "smart cities" leveraging technologies like Automation, IoT, Machine Learning, Artificial Intelligence, etc. Increase in online citizen services and digital initiatives being launched by the government, data center market is poised for an exponential rise in the coming years.

e) **Digital economy:** The continuous push from the government to formalize financial transactions through online payment mechanism is also increasing the need for data centers to be setup to handle huge volumes of data being thus generated. The launch of Unified Payment Interface (UPI) in April 2016, in which only 21 banks had subscribed initially, has increased to 330 banks as of June 2022 with a transaction volume of INR10.14 Lakh Crore[5]. The compounded annual growth rate in volume of UPI transactions has been almost 400% and is expected to grow multi folds in the next five years as it is increasingly occupying the pole position of one of the most favored mode of financial transactions in India. Apart from the UPI method of payment, RuPay card, Immediate Payment Service (IMPS), Bharat Interface for Money (BHIM) and Bharat Bill pay are all equally popular to make financial transactions. The government had also launched the *99# mobile banking service based on Unstructured Supplementary Service Data (USSD), which has generated traction of INR 12.48 Crore worth of transactions as of June 2022[6]. With India planning to grow its clout, the requirement for data centers handling these humongous transactions is also growing.

f) **Data localization:** The Government of India had proposed the Data Protection Law in 2021, which advocates data localization. This law emphasized on India's strategic objectives regarding national security, privacy, and building a domestic data economy. This shall mandate that a mirror copy of the sensitive personal data (SPD) and critical personal data (CPD), already with foreign entities, be mandatorily brought to India timely.

India is one of the fast-growing markets of digital consumers and had 560 million internet subscribers before pandemic hits the nation which is second to China. Indians have 1.2 billion mobile phone subscriptions and downloaded more than 12 billion apps and consume 8.3 gigabits (GB) of data on an average per month, compared with 5.5 GB for mobile users in China, an advanced digital economy.

Source: Mordor Intelligence (https://www.mordorintelligence.com/industry-reports/india-data-center-market)

1.2 Few of the digital initiatives launched in last one year[7]

a) **Pauti:** Pauti, the local Odia name of "Rent Receipt", is referred by government authorities for providing services to citizens. Recently, the citizen-friendly web application "Online Land revenue Payment" has also been implemented. This data base of tenant ledger holds 1.73 crore records, facilitating service to the citizens for paying their land revenue online from anywhere.

b) **DESH:** National Skill Development Corporation (NSDC), under the guidance of Ministry of Skill Development and Entrepreneurship (MSDE), is working towards developing a digital infrastructure with governing protocols for the education and skill community termed as DESH. DESH will allow friction-less exchange for skill development, deployment and associated supply-chain and enabling services. It is a set of configurable, extendable modular, open-source digital building blocks, with robust data privacy. It is not a monolithic platform but a unifying framework that will allow many platforms, applications, service providers, business models to innovate with the underlying framework, protocols, and specifications.

c) **VPMDP:** It is a mobile app developed to disseminate district based information like administrative setup, population, educational institutes, health care institutes, agriculture details, tourism, etc.

d) **Arogya seva:** This patient app is an initiative to bring health care services to the patient's location and in a way that suits his needs. Telemedicine application of e-hospital aims to provide remote delivery of healthcare services and clinical information. This app helps patients to connect with doctors from anywhere.

e) **mSevanam:** A mobile app has been designed by the Government of Kerala to provide online services offered by various government departments under a single umbrella.

f) **Jagruti:** This mobile app is perceived to provide timely alerts on the cases filed by petitioners in court against district administration.

g) **Ente ration card:** An android mobile app developed for civil supplies department related to ration card management system. The Government of Kerala has enhanced 19 e-services related to ration card management system. This enables the citizen of Kerala to apply for online services .

5 https://www.npci.org.in/what-we-do/upi/product-statistics
6 https://www.npci.org.in/what-we-do/99/product-statistics
7 https://informatics.nic.in

h) **Su-Swagatam:** This is a mobile app launched by the Ministry of Home Affairs and developed by NIC, Government of India. The objective of this app is to facilitate visitors seeking Indian visa abroad and obtaining visa related services within India during their stay.

i) **RoL Ladakh:** National Informatics Centre (NIC), Leh, developed this mobile app to facilitate registration and verification of migrants and native laborers in Leh and Kargil Districts. This app also builds up a database of laborers for assessment of the availability of workers in the district.

1.3 Vision/ Support and policies of Indian government

Government of India is focused on economic liberalization of the country's economic policies with the goal of making the economy more market and service-oriented and expanding the role of private and foreign investment. The government is also encouraging the manufacturing of active and passive Information and Communication Technology (ICT) devices in an effort to draw investment and technology into the country under the ambitious Make in India initiative.

India is also focusing on increasing the power capacity via solar, hydroelectric, and wind which will attract National and foreign players in the Indian data center market. MeitY, Government of India, is coming up with the data center policy to attract investments and accelerate the existing pace of data centre growth in the country. It also envisages to make use of renewable energy to reduce carbon footprint along with the creation of data center economic zones and Data Center Facilitation Unit (DCFU), incorporation of data center under Essential Services Maintenance Act (ESMA), and creation of separate category code for data center under National Building Code of India.

The government has consulted and sought suggestions from all the stakeholders and respective market players to make the policy more effective and efficient.

Haryana Policies Glimpse

- State GST, stamp duty, electricity duty exempted
- Data center to be declared as a separate infrastructure industry and energy intensive industry
- Data centers to be declared as an essential service under ESMA
- Right of Way to be accorded under State Communication and Connectivity Infrastructure Policy

Karnataka Policies Glimpse

- Land conversion fee, stamp duty, electricity duty exemption, concessional power tariff and green power tariff reimbursement
- Special package of incentives for projects of strategic importance

Uttar Pradesh Policies Glimpse

- Capital subsidy @7% up to INR 10 Crores
- Interest subsidy @60% on annual interest for seven years subject to maximum INR 50 Crores per park
- Land subsidy 25% in Madhyanchal and Paschimanchal; and @50% on prevailing sector rates in Bundelkhand, and Poorvanchal up to INR 75 Crores to parks and units
- Stamp duty exemption @100% on the first transaction and @50% on the second transaction to both parks and units
- Electricity duty Exemption @100% for 10 years to units
- Dual Power Grid power supply to first three DC parks established in the state. Energy department to bear the cost of the second grid.
- Transmission and wheeling charges exemption for 25 years @50% on intrastate sale of power; @100% for intrastate transmission system and
- for 5 years import of energy from outside UP to both parks and units

Tamil Nadu Policies Glimpse

- Power incentives to Data center investment above INR 500 Crore and at least 30% energy consumption through renewable sources
- Conditional concession in stamp duty and land fee
- 10% of remuneration of local employees to eb reimbursed
- Training subsidy to be provided

Telangana Policies Glimpse

- 50% rebate on Building fees and concession on land fee
- Preference to start up/ SMEs for data center services
- 25% reimbursement on internet charges capped at INR 250,000 per year for first three years of operation
- Concessional fuel price for backup power sources
- Exempt from purview of statutory power cuts

In addition, several States such as Haryana, Karnataka, Uttar Pradesh, Odisha, Telangana and Tamil Nadu (not limited to) have also launched their Data Centre Policies.

Some of the state governments viz. Telangana, Karnataka, Uttar Pradesh, etc., have provisions of special incentives like exemption on stamp and electricity duty, power subsidies, land at subsidized cost and other concessions by some of the state governments to boost the data center investment.[8]

8 Indian Data Centers Growth: Indian data centers to see 5-fold capacity growth with up to Rs 1.20 lakh cr investment - The Economic Times (indiatimes.com)


WWW
HTTP

2

Technology footprint

2.1 Smart data centers: Way forward

In this era of digital transformation and cloud, operational agility and efficiency are of paramount importance for maintaining a competitive advantage. Undoubtedly, there is a surge in the adoption of cloud-based business operations, IoT, virtualization technologies, etc., to handle huge volumes of data that are being generated.

Smart data Centers offer the required infrastructure, platforms and computing capabilities that aids the organizations to remain agile and embrace the change. As opposed to the conventional data centers, these are based on modular design for higher sustainability, are environment friendly by adopting green initiatives, and these centers encourage adoption of IoT with perspective intelligence for management. Smart data centers also automate decision-making, create an intelligent, energy efficient environment, deliver real-time insights and guidance from predictive analytics and provide control to implement an outperforming infrastructure strategy.

Smart DC in India

National Payments Corporation of India (NPCI) is set to launch Smart Data Center in Hyderabad and Chennai

Source 1: https://www.npci.org.in/PDF/npci/press-releases/2020/NPCI_Press_Release-NPCI_to_launch_Smart_Data_Center_in_Hyderabad.pdf

Source 2: https://www.npci.org.in/PDF/npci/press-releases/2020/NPCI%20Press%20Release%20-%20NPCI%20to%20launch%20Smart%20Data%20Center%20in%20Chennai.pdf

2.2 Technology going green - eco-smart future

Cloud technology comes with multiple benefits, including cost-savings and boosting productivity. On the other hand, it also helps organizations to optimize the consumption of energy, reduce their carbon footprint, and to create a healthy future by sharing hardware to increase utilization. Servers are kept in a climate-controlled room where temperature and humidity levels are carefully maintained, and cloud providers can use high-density efficient layouts that are challenging for in-house centers to replicate.

Conventional data centers pack more computing power into smaller spaces to consolidate workloads and accommodate processing-intensive applications, such as AI and advanced analytics. As a result, each rack expended more energy and generated more heat, putting pressure on cooling systems to ensure safe and efficient operations. To maintain safe operating temperatures, data centers could rely on air cooling, which is also dependent on energy.

Contrastingly, Cloud infrastructure contributes to two keys elements of a green IT approach that can build an eco-smart future: ***energy efficiency and resource efficiency.*** If the cloud data center is located in areas that source renewable power, cloud computing can not only save billions of dollars in energy costs,but can also reduce carbon emissions by millions of metric tons. The cloud is getting greener, with a growing number of server farms supported by renewable power.

Eco-smart designs conserve energy by using air containment and liquid cooling, investing in sustainable computer processing hardware, uninterruptible power supply (UPS) systems, and cooling systems, implementing high-efficiency power and cooling infrastructures, such as transformer less, modular UPS, higher-voltage equipment, or full liquid immersion cooling. Some green data centers also implement fuel cells for on-site energy generation or clean renewable energy sources, such as solar and wind.

While countries like Singapore, Australia, New Zealand have already shifted their focus on bringing sustainability in data center industry, India also has a huge potential to transform itself into a global hub for green data centers. This can be done with the government's decision to provide infrastructure status to the data center and storage of the green energy in recent **Budget 2022.**

2.3 Key technology trends

With the rise of various emerging technologies being introduced, innovation within an organization has become a pivotal characteristic for an organization to be relevant to its customers. With the rise of various new technologies such as AI, ML, robotic automation, the IoT, blockchains etc., organizations must continuously evolve themselves to be able to stay updated to and focus better on their key business activities. Various cloud platforms enable organizations to adopt these emerging technologies in line with their key business activities and goals to provide various innovative solutions and services to their customers.

1 Adoption of 5G and edge computing

Adoption of 5G and edge computing will also add to the growth of data centers. As most of the Telecom adopters, within the country, are working tirelessly to roll out 5G to its users as soon as possible, it is expected that 5G technology will provide us with Gbps of speed compared to 4G's Mbps, resulting in India consuming, creating, and replicating data at a very fast pace. Edge computing will help to process this data at the source itself. Edge Computing and 5G will co-evolve with each other and to manage such a large amount of data, we need to support these technologies by establishing more data centers within the country.

2 Adoption of liquid / hybrid cooling

As data center houses numerous IT equipment and hardware, which constantly generates heat, this leads to change in operating conditions of the data center. Hence, it is pivotal to maintain the temperature and humidity inside a data center by deploying various innovative and natural cooling techniques.

For instance, immersion cooling systems submerge servers and other components in the rack in a fluid, eliminating the need for air cooling. This approach maximizes the heat exchange and is the most energy-efficient form of cooling on the market. Data centers can also employ natural water bodies as well to ensure the optimum temperature is maintained.

3 Server to admin ratio

The number of servers is increasing rapidly every year. The server-to-admin ratio is changing rapidly as server growth continues to accelerate, along with the data imprints being created every day. Hence, the push to create and manage intelligently monitored unstaffed data centers will come to the fore in the coming years. Adoption of novel approaches for designing the unstaffed green data centers is in play while incorporating Automation, Artificial Intelligence, and robotics.

4 Artificial intelligence

Based on data shared by a leading research organization10, approximately 50% of the data centers will employ advanced robotics with AI and ML, which will lead to an increase in operational efficiency of data centers by approximately 30%.[9]

The day-to-day activities and tasks within a data center are tedious, complex, and repetitive in nature, such as capacity planning, rightsizing virtual machines and container environments, or ensuring optimum usage of resources by users.

By employing advanced robotics with AI/ ML capabilities, key areas which can be automated are:

Server upgrades and maintenance: The task of disposing of, decommissioning, and destruction of obsolete servers and various other ICT infrastructures can be efficiently and quickly carried out by industrial robots.

- **Monitoring:** The introduction of the IoT has made human intervention minimal as well as made monitoring of data center easier for various data centers and cloud service providers. Various types of sensors, probes, and robots can be deployed that can monitor even the smallest change in the operating conditions and can take necessary pre-defined actions to ensure commissioning, decommissioning, and troubleshooting of data center and cloud resources quickly.
- **Data center security:** Data center security physically or digitally is a major concern for all data centers and cloud providers. Smart cameras, intrusion detection systems, and robots coupled with AI/ML capabilities can ensure the protection of the data center from unlawful entry physically or digitally through heat sensors, motion detectors, cameras, etc.

9 Gartner Predicts Half of Cloud Data Centers Will Deploy Robots with AI Capabilities by 2025

2.4 Emerging technology trends

India is now getting ready for numerous emerging technologies and it is pertinent to state that the government has also taken cognizance of these trends and is in the process of chalking out a national strategy some of these technologies. As stand-alone solutions, many emerging technologies are quite compelling, and adoption rates are accelerating in areas such as robotic process automation and the IoT. Others, artificial intelligence and blockchain, are still being explored for their potential to deliver business value at scale.

1 Networking

Networking capabilities within servers are also shifting from traditional Network Interface cards (NIC) to smart NIC, allowing processing capabilities at the hardware level. The introduction of smart NIC such as application-specific, Field Programmable Gate Array (FPGA) and system-on-chip NIC will allow one to program these NIC as per the requirements and functionalities the users require.

2 Compute

Previously the Central Processing Unit (CPU) computers were based on X86 or RISC based architecture, however, the industry is witnessing a shift towards Graphical Processing Unit (GPU) and Programmable Processing units by employing FPGA, which allows the hardware engineers to program these units to a specific application and use cases providing push to AI/ ML. The next wave of revolutions in the ICT infrastructure will be brought by the introduction of AI Chips, which will aid parallel computing and faster execution of AI related tasks compared to legacy CPU architectures.

3 Automated cloud orchestration and optimization

Cloud platforms will continue to develop automated cloud orchestration and optimization as the complexity of managing both the quantity and quality of interconnected services across applications and services overwhelms even the savviest of IT organizations.

4 Serverless functions

Serverless computing is now being given more importance by the majority of bigwigs of the cloud computing world. It promises a legitimate pay-as-you-go model that lets organizations pay only for the services that are actually used. This way, the infrastructure can execute the function depending on the requirements of an application without any need to reserve the compute resources. It also helps eliminate the risk of back-end failures and provides safe sandboxes for organizations to implement their code.

5 AI, ML and automation

Cloud computing has been a very effective catalyst in enabling and developing AI, ML, and automation. Cloud computing can also offset the upfront project costs associated with AI and automation. It also supports businesses make efficient, data-driven decisions using AI and driving companies to adopt, implement, and scale automation services. It enables better data management, insights, security, and scale.

6 High performance computing (HPC)

Cloud services continue to improve and become more reliable and powerful, much of that growth is expected to be in cloud based HPC deployments. The near future will witness a convergence between big data and HPC, which will help analyzing big data and run simulations and HPC workloads on the same number of ICT resources. As those two technologies converge, the result will lead to innovation as more computing power and capacity will be available for both big data and HPC

7 Edge computing

Edge computing is an alternative approach to computing and storing data at source. It is an emerging cloud trend that involves building localized data centers for computation and storage at or near where it is being gathered, rather than on a central location that might be thousands of miles away.

This kind of decentralized computing infrastructure helps in decreasing latency issues and increasing application performance. Since the data and resources are closer to the end user's device, it can be processed locally, thus allowing organizations to save money as well.

3

Data centers to power up Indian economy

The Digital India initiative marked the beginning of a new era with a vision to ensure that India emerges as a technologically empowered country. Over the last few years, the government has initiated numerous fast-paced reforms as a part of Digital India initiatives that have transformed India into one of the fastest growing large economies in the world. It is estimated that the value of the Indian digital economy will reach US$1 trillion[10] by the year 2025. This showcases the power of transformation and lays down a roadmap for the next phase of growth.

3.1 The omnipresence of data centers in India's economy

Digitization plays a massive role in boosting the economy, the digital economy to be more specific, for India. The digital economy is growing by the day with no end in sight, and the demand for computing technologies and data processing is also increasing.

Relatively, it means that data is enormously pressuring the IT infrastructure. Therefore, the demand for data centers, through which the businesses are taking place and processing huge workloads of data, is also increasing. At least one data center is involved in everything we do in our daily lives. No matter where we are and what we are doing, data centers are embedded deep in our lives and play a significant role in our economies. India's mission of emerging as a digital economy will generate massive mounds of data in e-commerce, online education, digital healthcare, live-streaming entertainment and more.

Data centers drive growth, generate employment, and boost the digital economy. The data center represents the growth in economic value. Every significant investment in the data center space shortly will boost several allied industries. A sizable portion of this investment will happen in constructing the IT infrastructure, creating thousands of new jobs with the demand for engineers, IT specialists, Cloud experts, etc.

Currently, India has 80+ third-party data centers with a total count of approximately 130+ data centers, which is likely to increase in the upcoming years as India strives to become a truly digital economy.[11]

As enumerated in the previous section, with the increase in usage of AI, ML, and the IoT, India has seen exponential growth in data creation and consumption. Adding to it, the volume of data is on the rise due to an increase in the number of online gaming platforms, over-the-top (OTT), social media, streaming, e-commerce, and online education sites availability, thus creating a need for more data centers and cloud service providers to have a with robust digital infrastructure to cater growing demands of users. Subsequently, the launch of 5G services, in the near future, will further boost the demand for data center and storage capacities.

3.2 Data center market growth in India - current and future

India has been experiencing a massive digital transformation for the past few years. The surge in internet users, massive rise of startups, fast adoption of cloud computing, Government's investment in the IT sector are some of the critical drivers of digital and economic growth in India. Favorable market conditions in India, such as low cost of internet and data plans, high demand and low supply and a nascent market, have shown immense potential growth. Earlier in 2016, the Indian data center market stood at US$ 1.3 billion and US$ 4.4 billion in 2020. Further, the Indian data center market is anticipated to grow US$ 8.0 billion by 2026[12].

Data centers are also evolving as an alternate real estate asset class for varying real estate portfolios. Hyperscale data centers are being developed by reputed Indian real estate developers in partnership with global operators. The real estate or the land cost for data centers is usually about 8% to10% of overall capital expenditure. In key data center markets like Mumbai or Chennai, the land prices have already grown by 30% to50% in a short span.

TIER 2 and TIER 3 cities emerging as forefront of digital revolution

The data center market in India is witnessing healthy growth primarily driven by the availability of large hyper-scalers that have started outsourcing their storage needs to third-party data center providers. Indian corporate tycoons and foreign investors are investing in Tier 1 cities' Indian data centers to cater to the increasing demand.[13]

The preliminary IT boom was also restricted to Tier 1 cities such as Delhi, Bangalore, Mumbai, Chennai, Hyderabad etc., as these cities provide promising factors for growth, including superior infrastructure and skilled manpower, among others. While several of the Tier 1 cities are already reaching a saturation point, Tier 2 and Tier 3 cities are witnessing a spate of infrastructural developments that have made them coveted destinations for IT/ITeS investments.

10 India's Trillion Dollar Digital Opportunity - By MeITY
11 https://www.livemint.com/technology/tech-news/data-centre-firms-ramp-up-capacity-in-india-11640332271873.html
12 https://www.trai.gov.in/sites/default/files/CPAH_14022022.pdf
13 https://www.bisinfotech.com/expansion-of-data-center-market-in-india-in-2022/

On the other hand, taxes on real estate and buying large land sites to set up a data center prove challenging as well. In such circumstances, again, Tier 2 and Tier 3 cities prove to be more reliable, offering affordable real estate options and lower labor costs.

Currently, **most data centers in India are based near Tier 1 cities, leaving open the market opportunities in Tier 2 and Tier 3 cities.** It is expected that the Tier 2 cities will have more investments towards Edge Data Centre use cases with an intent to drive seamless digital experience for citizens. Introduction to a greater number of Special Economic Zones (SEZs), Software Technology Parks (STPs), fostering skill development and entrepreneurial ecosystem, provisioning various tax and non-tax incentives in these cities may further bolster India's digital economy.

3.3 Investment analysis - India data center market

- One of the leading hyper-scalers has planned to invest more than US$ 2 billion to set up two data centers in Hyderabad.
- One of the Japanese firms has also declared their investment plans of around US$ 2 billion in India over four years, considering the growing data center market in India.[14]
- Higher demand for colocation data centers in both global and local enterprises is another factor contributing to the Indian DC market growth. As a result of this, during 2021, over ten colocation providers made significant investment in the Indian DC market[15].
- According to a forecast made by the Uptime Institute, data center-related jobs will grow globally 2.3 million by 2025[16].
- Leading Telco in India has planned to invest INR 5,000 Crore to build seven hyper-scale data centers, which will triple its capacities and support India to become a regional hub for data centers[17].
- Similarly, another leading Telco has also planned to build a data center in Uttar Pradesh with an investment of US$ 950 million[18].
- The Government of India proposes an incentive scheme to facilitate the setup of data centers.[19] Moreover, the government also aims to invest over US$ 1 billion in the next five years as part of a hyper-scale data center scheme.
- The market for IT infrastructure is on the rise due to the rising investments in data center and hyper-scale data centers. Adding to it, Cloud, Big data, and IoT contribute to data centers and IT infrastructure demand.
- Two of the hyperscale operators globally have planned to open their respective data centers and cloud facilities in Pune and Delhi.
- Key initiatives such as Digital India, Smart Cities, 5G deployments, Digital Saksharta Abhiyan (DISHA), National Broadband mission, Industry 4.0, etc., jointly shall multiply the demand for telecom, driven by improved internet penetration, uptake of data usage, increased penetration of social media. This will result into demand for more data centers and cloud spaces. Considering the same, India's digital economy has the potential to reach US$ 1 trillion by the year 2025[20].

14 Japan's NTT to invest $2 bn in India to set up data centres over next 4 yrs | Business Standard News (business-standard.com)

15 https://www.bisinfotech.com/expansion-of-data-center-market-in-india-in-2022/l

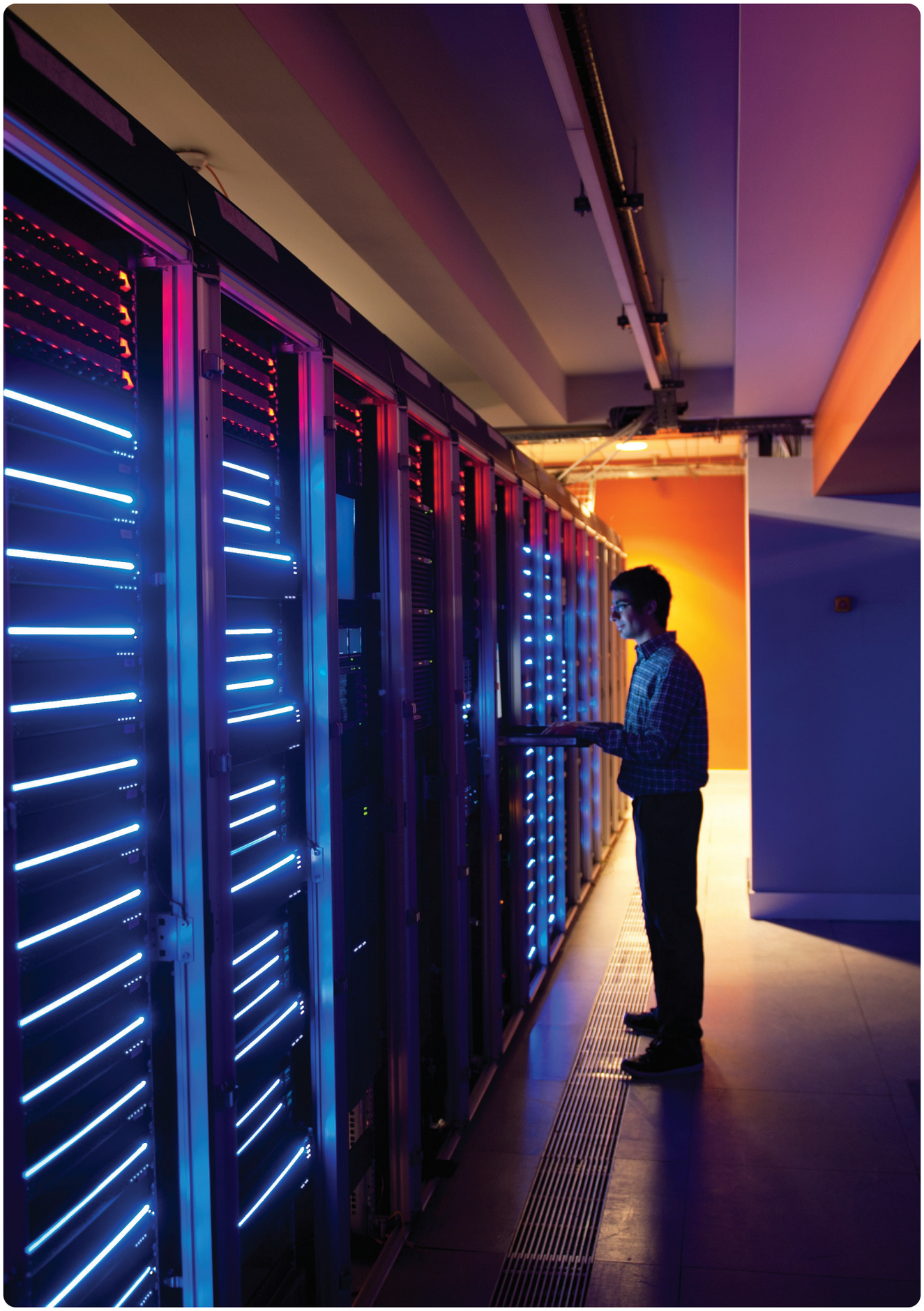
16 Uptime Institute Announces Industry's First Global Data Center Staffing Forecast Report - Uptime Institute

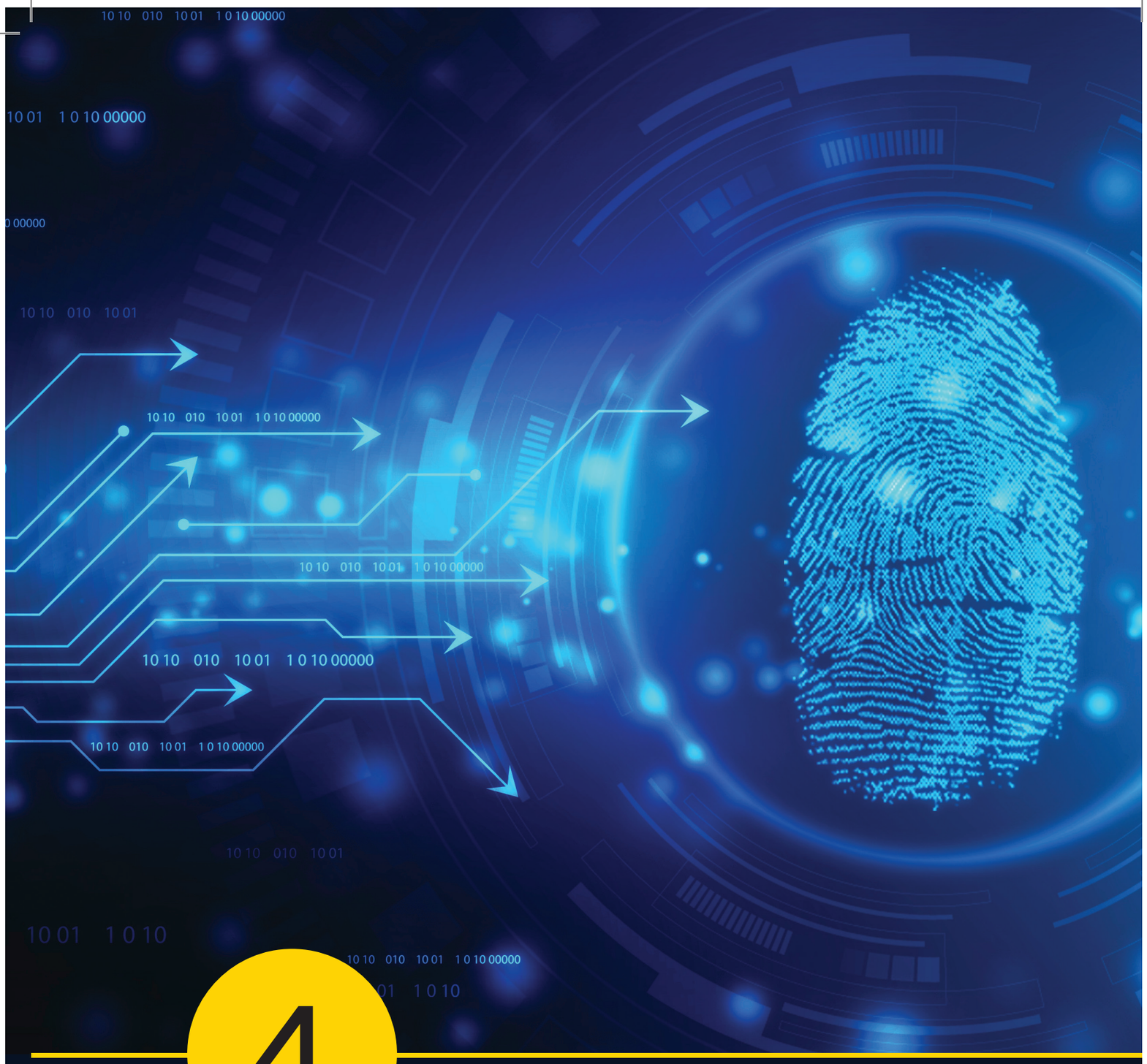
17 Regulatory Framework for Promoting Data Economy Through Establishment of Data Centres, Content Delivery Networks, and Interconnect Exchanges in India – TRAI Consultation Paper, Dec' 2021

18 Jio plans near $1 bn data centre in UP | Mint (livemint.com)l

19 https://www.globenewswire.com/en/news-release/2022/02/24/2391742/0/en/India-data-center-market-to-be-worth-10-09-Billion-by-2027-Hyperscale-Data-Center-Market-to-Witness-1-Billion-Investment-from-the-Indian-government-in-the-Next-Five-Years-Arizton.html

20 https://www.trai.gov.in/sites/default/files/CP_11022022.pdf





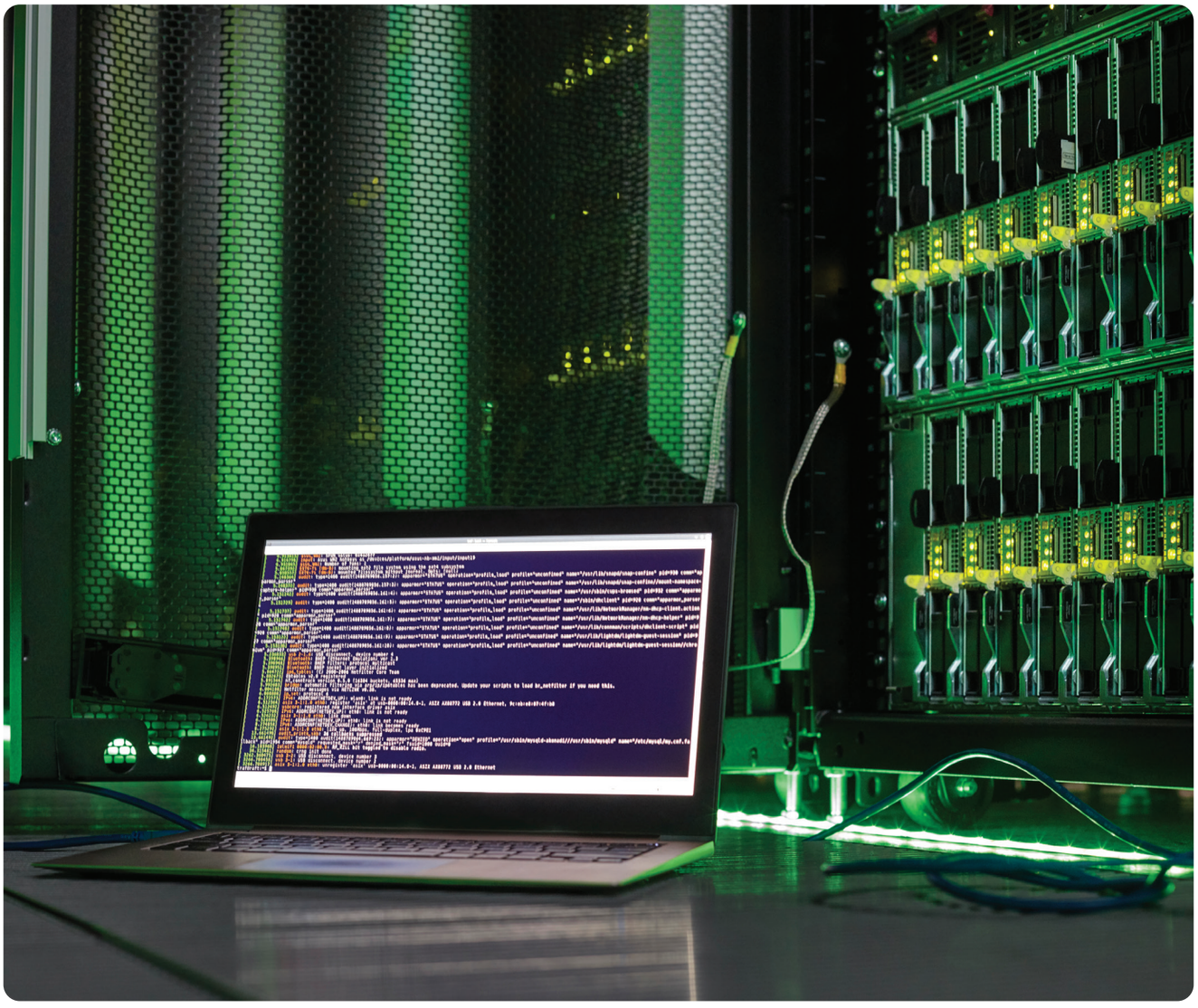
4

Outlook and conclusion

The IT and data center are not just a vertical anymore and are now a part and parcel of every sector and domain. The view for the future in these areas is exceptionally optimistic, as previously described in the sections above. With the government's digital government mission to make systems more intelligent and reliable and other sectors leaning towards the technology for driving their business, the demand for the data centers is only likely to increase.

In addition, the smart data centers or the cloud-powered networks can deliver substantial positive environmental impacts and economic savings. This is possible by capitalizing on economies of scale achieved through shared infrastructure, power, and physical premises. Industries are also increasingly focusing on delivering energy efficient and sustainable solutions.

The next decade will witness an unprecedented change and new emerging technologies and it is very evident from the that the data center – in all its new forms, shapes, and roles – will continue to aid innovation and drive technological and business transformation. As the country has the ability to leap directly into the multi-cloud age, India will be a main data center growth hub for the next decade



About ASSOCHAM

The Associated Chambers of Commerce & Industry of India (ASSOCHAM) is the country's oldest apex chamber. It brings in actionable insights to strengthen the Indian ecosystem, leveraging its network of more than 4,50,000 members, of which MSMEs represent a large segment. With a strong presence in states, and key cities globally, ASSOCHAM also has more than 400 associations, federations and regional chambers in its fold.

Aligned with the vision of creating a New India, ASSOCHAM works as a conduit between the industry and the Government. The Chamber is an agile and forward-looking institution, leading various initiatives to enhance the global competitiveness of the Indian industry, while strengthening the domestic ecosystem.

With more than 100 national and regional sector councils, ASSOCHAM is an impactful representative of the Indian industry. These Councils are led by well-known industry leaders, academicians, economists and independent professionals. The Chamber focuses on aligning critical needs and interests of the industry with the growth aspirations of the nation.

ASSOCHAM is driving four strategic priorities - Sustainability, Empowerment, Entrepreneurship and Digitisation. The Chamber believes that affirmative action in these areas would help drive an inclusive and sustainable socio-economic growth for the country.

ASSOCHAM is working hand in hand with the government, regulators and national and international think tanks to contribute to the policy making process and share vital feedback on implementation of decisions of far-reaching consequences.

In line with its focus on being future-ready, the Chamber is building a strong network of

knowledge architects. Thus, ASSOCHAM is all set to redefine the dynamics of growth and development in the technology-driven 'Knowledge-Based Economy. The Chamber aims to empower stakeholders in the Indian economy by inculcating knowledge that will be the catalyst of growth in the dynamic global environment.

The Chamber also supports civil society through citizenship programmes, to drive inclusive development. ASSOCHAM's member network leads initiatives in various segments such as empowerment, healthcare, education and skilling, hygiene, affirmative action, road safety, livelihood, life skills, sustainability, to name a few.

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