The strategic role of data centres in empowering India's digital revolution

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Foreword by PwC

Data centres are at the forefront of India's digital revolution. They serve as a foundation of the digital infrastructure and help drive economic growth by fostering innovation and collaboration.

In this paper, we explore the contributions made by data centres across industries and sectors. We discuss how data centres are helping in supporting the Government's digital initiatives and empowering the start-up ecosystem. We also highlight the key challenges faced by India's data centre industry such as regulatory complexities and operational costs and establish the need of technology innovation. Such challenges need to be addressed by facilitating close collaborations between the industry, policymakers and regulators. This will help in creating an environment that is a catalyst to growth and innovation for the data centre industry in India.

PwC is proud to partner with ASSOCHAM as the knowledge partner for the 6th ASSOCHAM India Smart Datacentres and Cloud Infrastructure Summit. At PwC, we are committed to leveraging our technology consulting expertise to support the evolution of India's data centre and cloud ecosystem. We aim to be the trusted advisors for our clients and partners as they embark on the journey to unlock the true potential of data centres.

Together, let us be part of India's growth story of sustainable digital transformation powered by data centres as the strategic enabler.
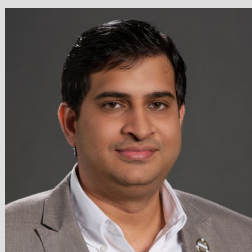
Vamsi Krishna Rupakula
Partner – Cloud and Digital Transformation
PwC India

Foreword by ASSOCHAM

India's journey towards becoming a data powerhouse has been marked by rapid advancements in technology, supportive Government policies, and proactive investments from both domestic and international players. This confluence of factors has positioned India as one of the fastest-growing markets for data centres globally, catering not only to its own burgeoning digital economy but also serving as a critical hub for global data traffic.

In the visionary roadmap towards Viksit Bharat 2047, India's ascent as a global leader in data centre infrastructure plays a pivotal role. India's commitment to nurturing a robust data infrastructure ecosystem has been underpinned by visionary policies, strategic investments, and the ingenuity of our technologists and entrepreneurs. This confluence has positioned India as a preferred destination for global technology investments and a hub for digital transformation across industries. As we look ahead to Viksit Bharat 2047, the role of data centres will continue to expand, driven by breakthroughs in cloud computing, artificial intelligence (AI) and other emerging technologies. These advancements will not only accelerate our journey towards a digitally empowered society but also unlock new avenues for economic prosperity and societal well-being.

I am glad that ASSOCHAM and PwC jointly prepared a whitepaper report for the 6th ASSOCHAM Indian Smart Datacentres and Cloud Infrastructure Summit. The report highlights the strategic role of data centres in empowering India's digital revolution and how data centres are helping in driving India's economic and technological advancements. It brings together insights from industry experts, policymakers and thought leaders who have been instrumental in shaping India's digital infrastructure journey. This report can help us expand our discussions on the subject. I would like to thank all stakeholders for contributing their valuable insights to this report. I would also like to express my gratitude to the PwC team for putting together this report and being the knowledge partner for this initiative.

Deepak Sood
Secretary General
ASSOCHAM

Message

India in 2024 is at the helm of a digital revolution. The rising number of internet users, booming e-commerce, widespread cloud adoption and AI integration have driven significant data growth and digital innovation. A core aspect of this is the data centre industry. Data centres provide essential services for digital transformation and AI technologies, offering scalability, power, cooling systems, high-bandwidth internet and secure connectivity. Moreover, not only do they reinforce India's stature as a global technology leader, but they also highlight it as a premier destination for AI innovation and digital transformation.

Advancements in AI, machine learning (ML) and edge computing are driving the demand for specialised data centre solutions. The data centre industry has consequently evolved, offering co-location with built-in AI capabilities, high performance computing (HPC) resources and advanced analytics tools. Furthermore, the rising number of edge data centres in rural areas is meeting the demand for low-latency processing and real-time data analytics. These developments are significant drivers for local economic growth.

Cloud computing is crucial in this transformation. Integrating the cloud within data improves efficiency, enables scalability and ensures connectivity for companies which want to on their digital transformation journeys. Now with India's data centre infrastructure, cloud providers can deliver serverless computing, AI-driven analytics, secure data storage and other advanced services.

I trust that this report, compiled by our esteemed knowledge partner, provides valuable insights into the future of the Indian data centre market.

Sunil Gupta
Chairperson, ASSOCHAM
National Council on Datacenter

Message

As we all gather for the 6th ASSOCHAM India Smart Datacentres and Cloud Infrastructure Summit 2024, let us take a moment to reflect on the role data centres play in our rapidly changing digital landscape. The data centre industry is at the forefront of global technological advancements and is witnessing unprecedented growth and transformation across various sectors.

The rapid adoption of modern technologies like the internet of things (IoT), AI, 5G and quantum computing has boosted the growth of the global data centre industry. AI and ML also revolutionised data centre operations with predictive maintenance and energy optimisation. Additionally, 5G will promote edge computing and interconnected ecosystems by expanding the capacity to transport more data traffic and handle applications with low latency.

Despite this scenario, the industry is still burdened with numerous challenges. Regulatory clarity and ease of doing business can further promote the expansion of data centres in our country. The Government can play a significant role by eliminating many of these prevailing challenges. Providing incentives for adopting renewable energy and streamlining approval processes like single window clearances can reduce operational costs and promote sustainability.

Data centres provide the infrastructure for digital transformation and are the foundation of technological advancements. Deploying AI and ML modules and IoT in data centres makes real-time insights and automation possible, thus improving the operational efficiency and security of data centres.

Security, efficiency and reliability in data centres are paramount and can be improved by complying with global standards and best practices. Indian data centres can follow international standards by getting certifications like ISO/IEC 27001, TIA-942 certification, Uptime Institute's Tier Standards and Leadership in Energy and Environmental Design (LEED).

The data centre industry, a dynamic and ever-evolving sector, must constantly innovate and adapt to meet the growing demands of end consumers and enterprises in the digital era. I extend my gratitude on behalf of ASSOCHAM and look forward to driving collaborative efforts that will shape the future of the data centre industry.

Surajit Chatterjee
Co-Chairperson, ASSOCHAM
National Council on Datacenter

Message

As the Co-Chair of the Data Centre Committee, it is my honour to present an overview of the tremendous growth potential within India's data centre industry, along with the critical expectations we have from our regulatory authorities.

In this era of digital transformation, data centres are the backbone of our economy, facilitating efficient data storage, processing and management. India is experiencing an unprecedented surge in internet usage, mobile penetration and digital services. The wide adoption of digital payments and cloud services adoption, exponential growth in e-commerce, and increasing adoption of IoT technology has redefined the IT landscape completely, and our country's ambitious digital transformation heavily depends on reliable and scalable data centre infrastructure.

India's data centre market is concentrated in large markets like Mumbai, Chennai, Hyderabad, Bangalore and the Delhi NCR region. Additionally, micro markets like Lucknow, Patna, Kolkata, Chandigarh, Bhubaneshwar and Ahmedabad are the upcoming potential regions for edge data centres in India.

To unlock the full potential of data centres in India, we must address the key expectations from the industry and regulatory authorities:

- Bold investments are required by the industry to create a data centre ecosystem in Tier 2 cities.

- Increased investment in R&D is required to reduce energy consumption by innovating new ways of cooling data centre infrastructure. The Government also needs to support the industry by the way targeted subsidies for R&D in this sector.

- Simplified regulatory framework: Simplified and standardised regulatory framework across India will enable faster turnover of assets and make the sector more lucrative for global investors.

- Enhanced financial incentives: As data centres are capital intensive, the domestic industry needs access to low-cost capital and subsidies in order to compete with its global peers in the market.

- Reliable and affordable power supply: Even though power production capacity has gone up significantly in India, distribution capacity and quality remains a challenge. Additionally, access to 100% renewable power sourcing is key for sustainable growth.

- Skilled workforce development: Industry collaboration with educational institutions will help bridge the skill gap within the data centre industry.

Future prospects

Due to significant increase in data due to rapid digitalisation, the future of data centres in India is full of potential. Faster adoption of technologies like 5G, edge computing and AI/ML will drive the need for localised, resilient and highly efficient data centres across the country. Moreover, strategic collaborations between the industry, international partners and regulatory authorities will play a key role in harnessing the full potential of India's data centre industry.

Responsibility towards society

The data centre industry has significant responsibility towards society. The industry needs to adopt sustainable practices, improve efficiency of the data centres and source renewable power for operations. Moreover, net carbon neutrality target should be an important consideration in all the data centre-related investment decisions.

Gitesh Mahajan
Co-Chairperson, ASSOCHAM
National Council on Datacenter

Message

Data centres are the backbone and enablers of digital transformation, which will play a pivotal role in India's remarkable digital growth story.

The unprecedented growth of digital-first companies and a digitally empowered population, coupled with supportive Government policies and robust digital infrastructure, has been and will continue to be a key driver of India's growth trajectory. With the second-largest base of internet consumers and the world's second-largest smartphone user base, the development of India's digital public infrastructure – including Aadhaar, Unified Payments Interface (UPI) and Open Network for Digital Commerce (ONDC) – will continue to drive data and data centre growth.

In addition, in the last year, AI and ML have emerged as the fastest growth drivers for the data centre industry, with an impact as big as traditional IT infrastructure outsourcing and the cloud. India has started leading the way on AI and HPC innovation front with data centres getting ready to host HPC AI/ML infrastructure. Despite our massive digital user base, India's per capita data centre capacity still needs to scale-up considerably, indicating the market is still underserved and demand for data centres is only going to increase.

With significant growth being expected, the focus on sustainability is going to be even higher. Therefore, the industry will need to increasingly adopt best practices and standards for energy efficiency, carbon footprint reduction and water conservation. These measures will play a pivotal role in ensuring that the industry's operations are aligned with the environmental and social goals of the nation. All this will necessitate a robust digital infrastructure, powered by data centres, to meet the surging demand for computing power and storage.

High growth will also require continued efforts towards following regulations and streamlining processes related to construction, operations and compliance, thus reducing costs and lead times. Uniform policies addressing key areas such as land acquisition, power distribution and taxation through collaborative efforts with industry bodies and government agencies will become even more crucial for addressing sector-specific challenges and promoting sustainable growth.

As India moves towards becoming a global digital hub, the demand for data centres will continue to grow exponentially. Therefore, the data centre industry is poised to support the digital aspirations of its customers and the country, by providing world-class and sustainable data centre solutions that will meet their current and future needs.
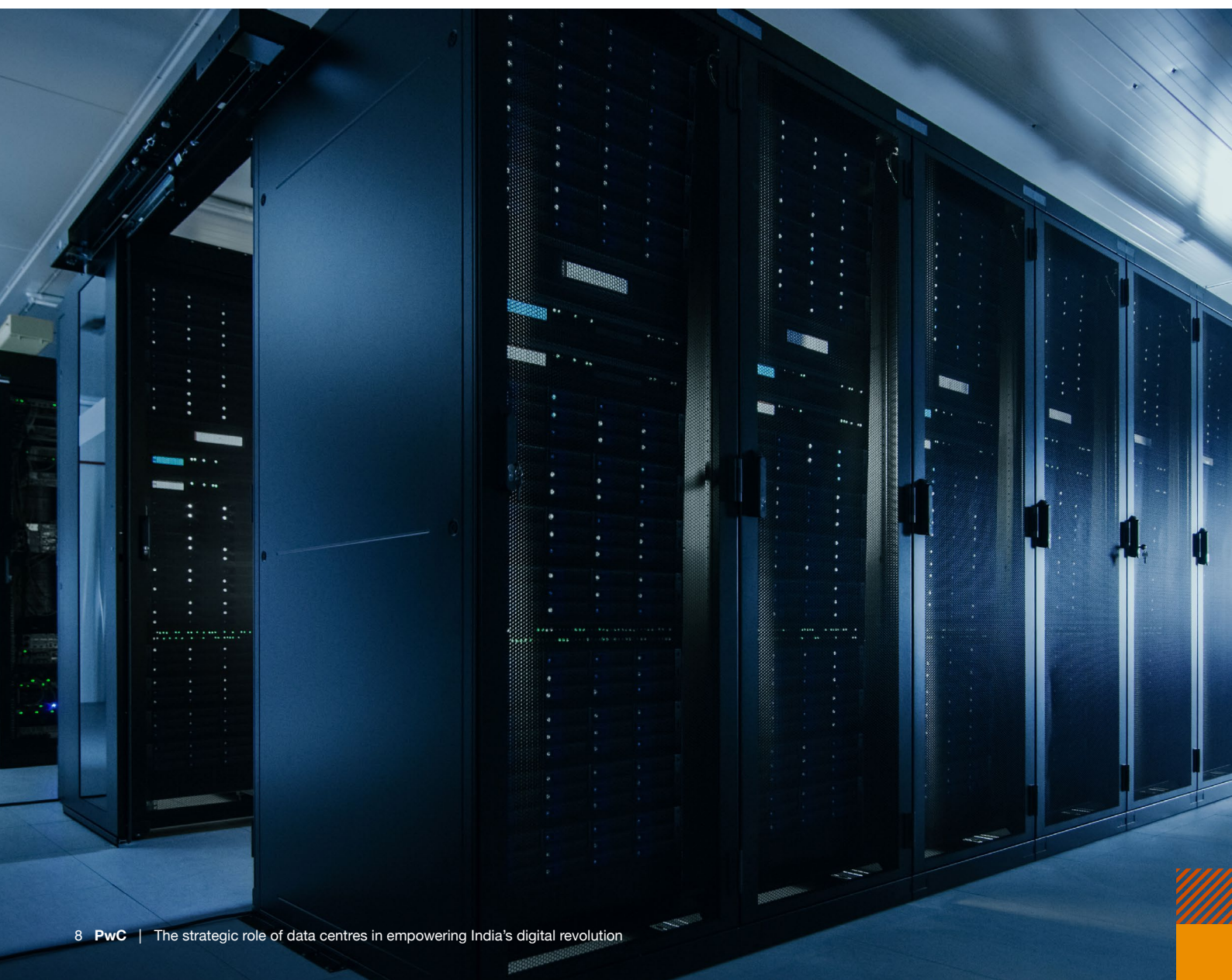

Jatinder Singh Pabla
Co-Chairperson, ASSOCHAM
National Council on Datacenter

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Introduction

India is at a crucial milestone of its digital transformation journey, powered by improved internet access, progressive Government policies and a thriving start-up ecosystem. One of the pivotal catalysts to this transformation are data centres, which act as IT powerhouses supporting this rapid digital advancement. Data centres are key enablers to the digital revolution in India, transforming Government services, enabling remote work and education, and fostering start-up innovation. Data centre facilities manage huge amounts of data and help store the same, along with data processing and fulfilling the IT management needs of a digitally evolving nation. In this paper, we explore the strategic role of data centres in empowering India's digital transformation.

The rise of emerging technologies such as artificial intelligence (AI), internet of things (IoT) and 5G is pushing the demand higher for robust and scalable infrastructure required for data storage and processing. India is one of the fastest growing markets in terms of data usage in both consumer as well as enterprise segment. It is reported that Indians will consume the most data in the world by 2028, ahead of developed markets such as the US, Western Europe and China.[1] Similarly in the enterprise segment, the big data analytics industry in India is expected to grow to eight times the current levels, and expected to reach USD 16 billion by 2025 from the current level of USD 2 billion.[2] This reflects phenomenal growth in data usage.

To support this spurt in demand for data consumption, data centres needs to undergo transformation to improve their capacity and capabilities. The global data centre industry has been at the forefront of innovation. Therefore, the industry's Indian counterparts can align with some of the key global standards and best practices for advancing innovation as well. This alignment will ensure reliability, efficiency and security, and help in making our data centre industry globally competitive.

The data centre industry in India faces several hurdles such as navigating complex regulatory frameworks, cumbersome approval processes, high data centre operational expenses and navigating technological complexity. The Government can step in to act as a catalyst in resolving some of these issues, which can help in making India a global data centre hub. In this paper, we've analysed a few such opportunities in terms of bringing regulatory clarity simplifying approvals and single window clearance, and reducing operational costs through targeted policies and schemes.

The transformation of data centres also requires technology innovation, which can be done by upgrading the existing infrastructure and technology in order to enhance security, scalability and efficiency. This change can be made by utilising emerging technologies such as AI, machine learning (ML), 5G, quantum computing, software defined networking (SDN), edge computing and IoT. In this paper, we've evaluated a few challenges in data centre transformation and discussed ways to solve them – i.e. modernisation of legacy systems, maintaining regulatory compliance and managing cybersecurity threats and process complexities.

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1 http://timesofindia.indiatimes.com/articleshow/101175695.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
2 https://economictimes.indiatimes.com/tech/ites/big-data-analytics-to-become-16-billion-industry-by-2025/articleshow/59410695.cms?from=mdr

Key contributions of data centres in empowering India's digital revolution

There are various Government initiatives that aim to bring technological advancements to citizens to help them in their day-to-day needs and bring transparency and simplification to the way Government services are consumed. The Digital India initiative, launched in 2015 by the Government of India, made Government services available to citizens electronically by improving online infrastructure and increasing internet connectivity. BharatNet, a key scheme under this initiative, aims to connect rural areas with high-speed internet, and facilitate the development of smart cities to improve urban infrastructure and services through technology. Besides these initiatives, the Government also continues to focus on enhancing cybersecurity, expanding digital literacy, and leveraging emerging technologies like AI and blockchain.

State governments across India are also spearheading various digital initiatives – like MahaOnline (Maharashtra), e-Pragati (Andhra Pradesh) and Akshaya centres (Kerela) –which are aimed at enhancing governance, improving public services and fostering economic growth. These initiatives are part of a broader effort to align with the national Digital India campaign, which focuses on local needs and leverages technology to drive development.

Data centres and cloud computing are integral to these initiatives, providing the necessary infrastructure and capabilities to manage, store and process vast amounts of data efficiently. Data centres play a key role in supporting a myriad of services and applications utilised daily by millions of Indians. Therefore, having a robust data centre infrastructure is essential to ensure efficient, swift and reliable operation of businesses and Government services.

Revolutionising Government services

The Indian Government's ambitious Digital India initiative aims to transform the country into a digitally empowered society and knowledge economy. Platforms for e-governance, digital identity systems like Aadhaar and public sector information management rely on the robust infrastructure provided by data centres. For instance, Aadhaar, the world's largest biometric ID system, supports over 136 crore registered users and depends heavily on data centres for its operation.[3,4] These facilities ensure that Government services are more accessible, transparent and efficient, thus benefiting millions of citizens.

Cloud platforms and data centres enable the delivery of services anytime and anywhere, enhancing accessibility for citizens. For instance, the MahaOnline initiative by the Government of Maharashtra allows citizens to have online access to numerous government services offered by the respective authorities at state, district and Taluka levels, making the often cumbersome process easier.

Additionally, the BharatNet Project aims to connect 2,50,000 gram panchayats with high-speed internet by 2025.[5] This connectivity will enhance people in rural areas to have easier access to e-governance services, educational resources and healthcare information, thus bridging the urban-rural divide.

Enabling remote work and education

The COVID-19 pandemic accelerated the adoption of remote work and online education in India, with data centres playing a pivotal role in supporting this shift. With the surge in demand for video conferencing, online collaboration tools and e-learning platforms, data centres provided the necessary bandwidth and processing power to manage the increased traffic. This capability allowed businesses to continue operations and educational institutions to offer uninterrupted learning experiences, ensuring continuity and productivity during such challenging times.

With the rapid expansion of data centres, more cloud-based e-learning platforms can be introduced, thus making digital literacy programmes more accessible. This is crucial for initiatives like the Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDSA), which aims to make 6 crore persons in rural areas digitally literate.[6]

Fostering start-up innovation

India's start-up ecosystem is flourishing, with data centres providing the infrastructure necessary for these ventures to thrive in. Start-ups across various sectors – such as FinTech, HealthTech, and EdTech – rely on data centres for scalable and reliable computing resources. Cloud services hosted in data centres allow start-ups to launch and expand their operations swiftly, without the need for substantial upfront investment in IT infrastructure.

By 2025, the Indian SaaS market is expected to grow from USD 13 billion in 2022 to USD 35 billion by 2025,[7] with data centres contributing to this growth. This democratisation of powerful computing resources fosters a wave of innovation, enabling start-ups to develop and deploy cutting-edge solutions rapidly.

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3 https://uidai.gov.in/images/ISSUE_OF_AADHAAR_CARD_English.pdf

4 https://www.businesstoday.in/latest/policy/story/aadhaar-safety-where-is-uidai-13-feet-high-5feet-thick-wall-246996-2018-03-23

5 https://ddd.gov.in/scheme/bharat-net/

6 https://www.myscheme.gov.in/schemes/pmgdisha

7 https://economictimes.indiatimes.com/small-biz/security-tech/technology/the-next-phase-of-growth-and-innovation-for-indias-saas-sector/articleshow/106086659.cms?from=mdr

8 https://telecom.economictimes.indiatimes.com/news/indias-data-centre-capacity-to-double-to-1700-1800mw-by-fiscal-2025-crisil/92076024

Current gaps in the Indian data centre industry and global best practices

The data centre capacity in India is expected to double from 870 MW in fiscal 2022 to about 1,700-1,800 MW by fiscal 2025.[8] The industry must therefore align with the global standards and best practices to support this growth and maximise its potential. This alignment ensures reliability, efficiency and security, making the industry globally competitive.

01 Infrastructure reliability

Infrastructure reliability is one of the key attributes on which a data centre's quality is measured by a consumer. Data centre infrastructure is classified into four tiers which consider the quality of systems, countermeasures against external factors and security, among other factors.

Data centre tier classification

Tier I – basic infrastructure, absence of redundant deployment, cooling the majority of IT equipment

- Available for 99.67% of the time – acceptable breakdown of 28.8 hours per year

Tier 2 – redundancy of selected components is added (excluding deployment and cooling)

- Available for 99.74% of the time – acceptable breakdown of 22 hours per year

Tier 3 – redundancy of deployment, cooling and other selected components is added

- Available for 99.98% of the time – acceptable breakdown of 1.6 hours per year

Tier 4 – redundancy of all components. Failure of any component of the data centre does not influence the operation of the system/services at all (fault tolerance)

- Available for 99.99% of time – acceptable breakdown of 0.8 hour per year

Source: Cloud Security Report, PwC

Indian data centres should aim to achieve Tier III or Tier IV standards in order to ensure high uptime and resilience. Significant investment and focus on infrastructure is required to achieve at least these levels of reliability. This includes enhancing availability, fault tolerance and implementing robust power and cooling systems.

02 Energy efficiency

Globally, data centres strive for low power usage effectiveness (PUE). PUE is a widely accepted key performance indicator (KPI) for measuring data centre energy efficiency and is calculated as the factor of total power used by the data centre over the total IT power consumption. Lowering PUE not only helps in reducing the operational expenses associated with a data centre but also contributes to lesser carbon emissions.

Utilising advanced cooling techniques and renewable energy such as solar and wind power and energy-efficient hardware, Indian data centres can also significantly lower their PUE.

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03   Data security and privacy

The ISO/IEC 27001 certification for information security management and ISO/IEC 27017 for cloud security are important standards that ensure robust data protection and risk management. As of 2022, over 70,000 certificates have been issued globally under ISO/IEC 27001.[9] Adhering to these standards will enhance trust and compliance with international regulations.

Although the largest data centres in India have to comply with ISO standards, smaller and medium-sized facilities often experience downtime and lag, thereby posing risks to data integrity and security. Therefore, the Indian data centre industry must ensure that all data centres, irrespective of size, comply with ISO/IEC 27001 and ISO/IEC 27017 standards. Moreover, regular audits and updates to security protocols should be ensured to mitigate emerging threats.

04   Sustainable data centres

There is a global shift towards sustainable and green data centres, adhering to standards such as Leadership in Energy and Environmental Design (LEED). As of March 2024, there are over 1,400 LEED-certified and registered data centres representing over 447 million square feet (41 million square metres) across the globe.[10] Implementing eco-friendly practices like water recycling, using renewable energy and minimising carbon footprints are essential for sustainability. It is important to encourage green certifications like LEED and implement sustainable practices in India as well.

Many data centre operators in India are adopting eco-friendly practices, such as utilising renewable energy sources and implementing energy-efficient cooling technologies. This commitment to sustainability is helping reduce the environmental impact of data centres, thus aligning with India's broader environmental goals. By promoting sustainable development, data centres ensure that the digital revolution progresses in an environmentally responsible manner.

9   https://www.iso.org/committee/54998.html?t=KomURwikWDLiuB1P1c7SjLMLEAgXOA7emZHKGWyn8f3KQUTU3m287NxnpA3Dluxm&view=documents#section-isodocuments-top

10   https://support.usgbc.org/hc/en-us/articles/12154267763987-Applying-LEED-to-data-center-projects

Government support and strategic recommendations

Regulatory clarity

The process of setting up a data centre involves navigating complex regulatory frameworks, including land acquisition, environmental clearances and building permissions. Clear, consistent regulations are essential for the growth of the data centre industry. Streamlining the approval processes for setting up data centres, including land acquisition and environmental clearances, can significantly reduce setup time and costs.

Maharashtra Government's new IT and ITES Policy 2023 offers many benefits to the data centre industry. As per this policy, data centres now come under the Essential Services Maintenance Act. Additionally, eligible units can now avail of renewable energy under open access and develop captive power plants for data centres. This will help in reducing the operational costs for data centres.[11] Karnataka's Data Centre Policy 2022 offers special incentives for companies to set up data storage infrastructure outside Bengaluru. Some of these incentives offer capital subsidies of up to INR 10 crore, 10% land subsidy up to INR 3 crore, 100% stamp duty exemption up to 10 acres, concession on registration charges and 100% exemption on land conversion fees.[12]

The Government of India has accorded infrastructure status to data centres with more than 5 MW capacity of IT load.[13] This will help data centre companies to get easier access to institutional credit at lower rates and attract foreign investments. Furthermore, it will help in the sustainable development of the industry and fuel the growth of data centres in India.

Approvals and single window clearance

The data centre industry faces somewhat lengthy and cumbersome approval processes involving multiple authorities, which can delay project timelines and increase costs. As a solution, the Government can implement a single window clearance system to streamline the approval process. This would centralise and expedite the permissions required from various departments.

The Maharashtra government has introduced a single window clearance system for data centres, significantly reducing the time taken for approvals. In the global market, the Economic Development Board (EDB) of Singapore provides a single point of contact for all data centre investment-related approvals, significantly expediting the process.

Optimising high operational costs

Operating a data centre involves significant operational expenses related to power, cooling and infrastructure maintenance.

Governments can provide subsidies or incentives for renewable energy adoption, which would reduce operational costs and promote sustainability. Government incentives for renewable energy use and stringent environmental regulations can drive the shift towards greener data centres. Considering the future growth in this sector and considerable energy requirements, several data centre industry companies are trying to achieve net zero goals.

Use of green energy in data centres in India is becoming increasingly significant as the country strives to balance its technological growth and environmental sustainability. Green data centres are designed by considering concepts such as energy efficiency, water conservation, building material and Indoor Environment Quality (IEQ). Owing to the increased demand for reducing carbon emissions and building a sustainable future, green or renewable energy sources (solar, wind, hydroelectric and geothermal power) are increasingly being adopted.

11 https://www.hindustantimes.com/cities/mumbai-news/maharashtras-new-it-policy-offers-subsidies-and-benefits-to-attract-investment-and-create-3-5-million-jobs-in-mumbai-101685474272059.html
12 https://www.deccanherald.com/india/karnataka/karnataka-data-centre-policy-plans-rs-10000-crore-investments-1101889.html
13 https://economictimes.indiatimes.com/news/india/govt-accords-infrastructure-status-to-data-centres-with-over-5-mw-capacity/articleshow/94831976.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

The Government of India has set a target of achieving 500 GW of installed capacity from non-fossil fuels by 2030, in line with the prime minister's announcement at COP 26.[14] Moreover, it offers various incentives for adopting renewable energy, such as the Solar Energy Corporation of India's (SECI) schemes. These incentives can help data centres reduce energy costs and carbon footprints.

Cross-subsidy surcharges on renewable energy can make usage of renewable energy less attractive for data centres. Therefore, eliminating or reducing cross-subsidy surcharges can help in making renewable energy more economically viable for data centres – for instance, Rajasthan's policy allows data centres to procure renewable energy directly from producers without additional surcharges.

Right of way for fibre infrastructure

Obtaining the right of way (RoW) for laying fibre infrastructure is often fraught with bureaucratic delays and high costs. Thus, standardising RoW policies across states with reasonable charges and faster processing times can help facilitate seamless fibre deployment. The Ministry of Communications' National Digital Communications Policy 2018 aims to standardise RoW procedures, helping telecom and data centre industries.

Driving technological enablement

Countries across the globe are increasingly leaning towards building a data economy, so that data can be democratised and used by companies and individuals alike to create economic value. An open data exchange framework and a self-sustainable mechanism for incentivising data sharing is at the heart of enabling data economy. Open data exchange can play a pivotal role in the growth of a data economy when facilitated for common purposes among various stakeholders and participants.

The Open Government Data (OGD) Platform (data.gov.in) is a centralised platform to help support multiple initiatives of the Government and facilitate data decentralisation by enabling easy access of data which is published by various Indian ministries/departments to the public. Such access encourages public innovation as it allows people to use the data for multiple use cases and insights, while being transparent. A community portal (http://community.data.gov.in) has also been made available to serve as a platform for knowledge collaboration and discussions through various communication channels such as blogs, infographics and visualisations by using the data available on the platform.

With the Government's increased emphasis on cybersecurity, data centres play a crucial role in ensuring secure data storage and processing. This is vital for protecting sensitive information and maintaining data sovereignty. Modern data centres incorporate advanced security measures to protect sensitive information. For instance, this is crucial for projects like Bhoomi, which is an online portal for land records in Karnataka, aimed at digitising and securing land ownership records and streamlining property transactions. The physical and virtual security offered by data centres helps to ensure that Karnataka's land records are protected from unauthorised access and cyber threats.

14 https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1944696

Enabling data centre technology innovation

Technological advancements can help transform data centres in an efficient, sustainable and scalable manner. This can be done by incorporating technologies like AI, ML and IoT. By deploying and scaling these cutting-edge technologies across the ecosystem, data centres can help drive digital transformation across industries, including healthcare, agriculture and manufacturing.

01 | **Adoption of emerging technologies**

India's AI market is projected to grow at a compound annual growth rate (CAGR) of 25–35% and reach around USD 17 billion by 2027.[15] Data centres enable this growth by providing the massive infrastructure required for computing and data processing needed by AI and GenAI algorithms.

Data centre operations are automated using AI and ML. AI algorithms help improve data centres' dependability and efficiency through predictive maintenance and energy optimisation.

Using AI-powered predictive analytics, data centres can be incorporated with the ability to foresee and avert possible problems before they arise. Developing AI-powered data centre management software and leveraging ML algorithms for predictive maintenance and anomaly detection can greatly improve the overall resiliency of data centre operations.

As cybercriminals target data centres to obtain sensitive information, such emerging technologies can be leveraged to develop advanced threat prevention and detection solutions.

Quantum computing provides advanced data processing capabilities in data-intensive fields like finance and cryptography. It can revolutionise processing power and data analysis capabilities in data centres and lead to breakthroughs in complex problem solving and optimisation tasks.

5G networks provide high-speed connectivity with ultra-low latency which can help data centres to support increased data traffic and processing requirements. Opportunities in this space include building 5G edge data centres, and developing apps and services that leverage 5G capabilities and provide network infrastructure for 5G deployments.

15 https://economictimes.indiatimes.com/tech/technology/indias-ai-market-projected-to-reach-17-billion-by-2027-report/articleshow/107856845.cms?from=mdr

02 Interconnected ecosystem

An interconnected ecosystem in a data centre refers to a network of interconnected data centres, service and network providers which facilitate seamless data transfers and collaboration. It offers improved data transfer speed, enhances data security by establishing private connections to prevent cyberattacks, supports hybrid environment deployments, and enhances performance and sustainability of data centre operations.

We've highlighted some key components below which are used by data centres to build an interconnected ecosystem:

- Robust physical infrastructure – inclusion of high-speed network fabrics, high bandwidth connectivity, fibre optic cables etc.

- Interconnection between platforms – enables direct and secure connections, internet exchange points etc.

- SDN – enables dynamic and programmable network management

- Deployment of edge computing – edge location infrastructure remains closer to end users and devices to reduce latency and improve the performance of interconnected systems.

Edge computing helps decentralise computing resources and moves data processing closer to the network's edge, where data is generated. Moreover, it reduces latency, conserves bandwidth and eventually improves performance by processing data locally. It is a technology that is particularly valuable for applications requiring real-time processing and low latency – such as IoT devices, autonomous vehicles and smart cities. This space, therefore, offers lucrative opportunities which could include building and managing edge data centres, developing edge computing platforms, and providing edge services such as content delivery and IoT applications.

Data centre monitoring is being revolutionised by IoT technology, which offers real-time insights into a variety of operational aspects. To ensure peak performance and efficiency, sensors and smart devices are used to monitor everything from power consumption to temperature.

These investments in data centre modernisation will generate numerous job opportunities in the IT, construction and maintenance sectors, thereby bolstering the Indian economy. Additionally, the presence of state-of-the-art data centres will help attract increased foreign direct investment (FDI), creating a positive feedback loop that will further strengthen the Indian economic landscape.

Challenges and way forward

While data centre technology innovation is needed to support effective growth in this sector, this transformation is fraught with all kinds of challenges. Upgradation and integration of legacy systems in data centres can be complex and expensive. The investments required for upgrading the hardware, software and network aspects can act as deterrents to such modernisation initiatives. Moreover, advanced networking, maintaining multiple data centres to cater to high availability and business continuity planning/ disaster recovery requirements can also add to the overall cost.

However, such costs can be optimised by understanding the business need with a clear return on investment and setting the correct targets to avoid unnecessary technology investments. For instance, adopting open-source solutions and pay-as-you-go pricing models can reduce upfront costs and ongoing expenses.

We've highlighted a few key challenges in data centre technology innovation and the approach to overcome them below:

01 Modernisation of legacy systems

Typically, many data centres host legacy systems which are difficult to integrate with modern technologies due to outdated protocols, lack of support and compatibility issues. Also, data migration from such legacy system to modern data centre can be complex as well as time consuming, making data conversion and ensuring data integrity and consistency a challenge. Therefore, custom solutions are needed to migrate such legacy systems.

Organisations should thus perform detailed assessments, identify business value and plan a strategic roadmap for such systems. The decision to retire or modernise legacy systems should be strategic. In case such systems are relevant, they should be modernised with comprehensive modernisation planning, including data profiling, cleansing and validation.
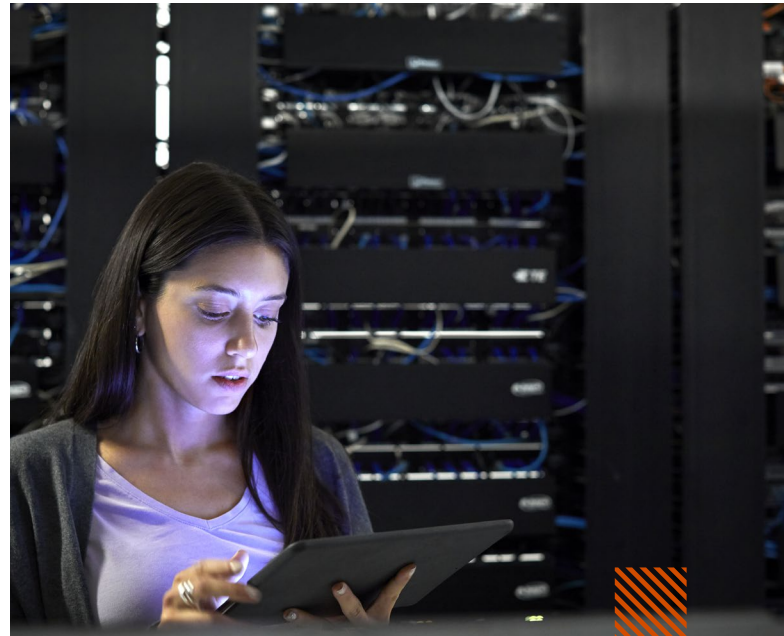
Note that existing applications on data centre may be using specific hardware and software configurations. Therefore, it is important to ensure their compatibility with modern infrastructure without disrupting the existing applications thorough testing, validation, and potentially re-architecting certain components.

02 Regulatory compliance

Regulations and compliance frameworks aim to standardise practices, enhance compliance, and protect sensitive information while aligning with global standards. With initiatives like the Personal Data Protection Bill and various guidelines from departments such as Ministry of Electronics and Information Technology (MeitY) and the Reserve Bank of India (RBI), India is fostering a robust framework to support data sovereignty and build trust among businesses and consumers alike.

Continuous monitoring of relevant regulations and applicable standards, followed by continuous updates to internal policies and procedure, is the best way to ensure compliance to regulatory requirements. Practices like audit trails, data governance and access controls help ensure regulatory compliance within data centres.

03 Cybersecurity threats

Security measures in data centres are important in order to safeguard sensitive data and ensuring integrity and availability of services. A thorough security plan covers every facet of a data centre – including the networks, servers, power systems, and the information and operations they support. Furthermore, because data centres are a lucrative target for threat actors searching for vulnerabilities, there are specific security threats associated with them which need to be addressed as quickly and effectively as possible.

Regular security audits, vulnerability assessments, and adherence to industry standards and regulatory requirements are integral for maintaining robust security in data centres.

Presently, tools with easy access and newly built infrastructures are more susceptible to cybersecurity attacks due to obsolete security protocols. This is due to the increased usage of online tools due to the rise in remote working.

Therefore, ensuring proper encryption, access controls and security protocols are crucial in order to mitigate these risks, and this can be done by using AI and ML. Additionally, employees should be trained on security best practices in order to ensure regulatory compliance within their organisations.

04 Managing complexities of the data centre technology innovation process

Date centre technology innovation can lead to lost revenue and productivity due to any downtime during the transformation process. Strategies such as phased migration, failover mechanisms, rollback procedures and redundancy planning can help minimise the downtime and ensure continuity of operations during the transition.

Considering the speed with which IT workloads change, organisations must regularly and incrementally update data centres so that their capabilities can adequately meet the requirements. Modern data centres must therefore be scalable enough to accommodate future growth and evolving business needs.

Data centres must be designed with a scalability- and flexibility-first mindset. Leveraging cloud-native technologies, serverless computing and elastic scaling capabilities along with continuous monitoring and evaluating emerging technologies can also help to address future needs.

One of the main drivers for data centre transformation includes maximising resource utilisation, while improving efficiency and reducing cost. This involves the implementation of advanced concepts like containerisations, infrastructure automation and automation technologies to dynamically allocate resources based on demand while avoiding over-provisioning or under-utilisation.

Conclusion

Data centres play a very important role in India's digital transformation, providing the essential infrastructure required to support a rapidly digitalising society. They drive economic growth, enhance Government services, foster start-up innovation, enable remote work and education, and propel technological advancements.

By aligning with the global standards and best practices, the Indian data centre industry can enhance its reliability, efficiency and sustainability. Addressing current gaps through strategic investments and policy support will position India as a competitive player in the global data centre market, fostering economic growth and technological advancements.

Furthermore, Government support through suitable policies and schemes is essential and will play a pivotal role in addressing key challenges and fostering growth in the industry.

In addition, data centre technology innovation will cater to the growth in demand in an efficient and scalable manner.

Challenges such as legacy system upgrades, complexities in data centre modernisation process and cybersecurity risks need to be solved with strategic planning, and by implementing robust security controls with the help of innovative technologies.

All of the above measures will help ensure that data centres remain efficient and resilient in supporting India's ambitious digital revolution. The recommendations outlined in this paper provide a comprehensive roadmap for enhancing the industry's growth and competitiveness. With concerted efforts from all stakeholders, including central and state governments, India can achieve its vision of becoming a global data hub.

As India continues its journey towards a fully digital future, the role of data centres will become increasingly vital, ensuring that the benefits of such digital transformation are accessible, beneficial and sustainable for all.

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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