



Cloud and the age of continuous disruption

The journey of digital
transformation

June 2021

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Foreword



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For the past few years, organisations across industries are embracing digital technologies and rapidly migrating from legacy IT infrastructure to cloud to be more innovative and achieve higher business agility. Using cloud technologies, modern businesses are looking to increase operational efficiencies and go to market faster, as well as be dependable, resilient, and elastic. They need a cost-effective infrastructure, along with the ability to ‘innovate at scale’.

This emerging trend is an example of “disruptive innovation,” a term coined by Clayton Christensen, a professor

at the Harvard Business School. Such a disruption has sprung from shifts in technology that has enabled businesses that simply were not there – in some cases even 20 years ago. This century has ushered in several firsts – digital natives, unicorn companies, smartphones, and social media. It has also seen the exit of big organisations, upended by faster and innovative businesses that have rapidly gained market share and eminence. Given the advancement in technology and its easy accessibility (after the pandemic), the way of conducting business has transformed. Cloud is a disruptive technology that has the potential to accelerate organisations’ digital journey, rewrite business success rules, and enhance growth. When COVID-19 (the mother of all disruptions) caught the world off guard altering the normal course of life and the way businesses were operating, cloud came to the rescue of organisations.

In this paper, CII and Deloitte have put together a perspective on “**cloud in the age of continuous disruption**”. I hope you find the information shared in this paper insightful.

Happy reading!

Foreword



Vishal Awal

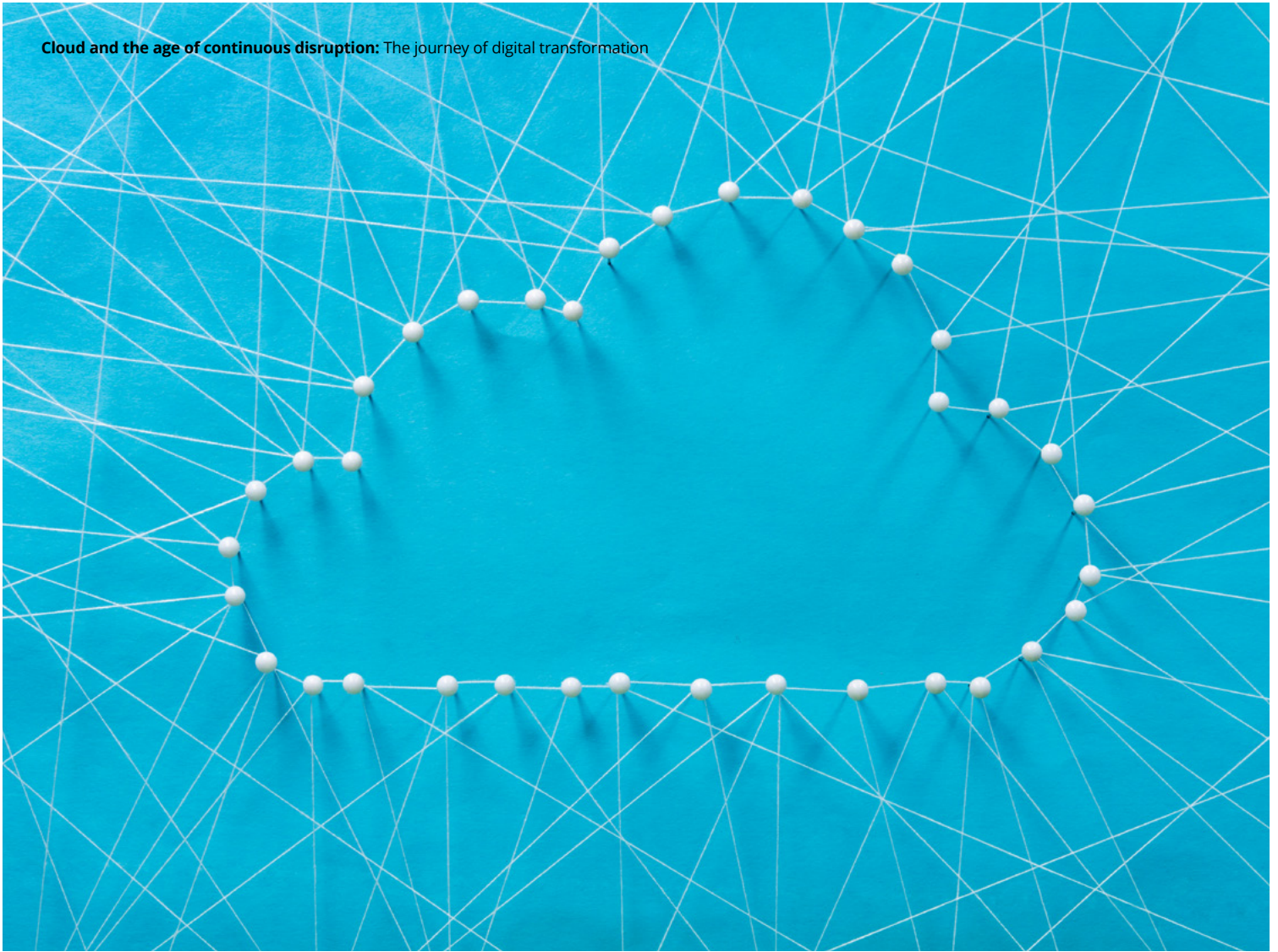
Summit Chairman and
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The world is in the midst of rapid and unprecedented realignments in the post COVID-19 era. Business enterprises across industries are in an urgent need to adopt a low-touch, high impact execution model, driven by intelligent workflow, artificial intelligence, and automation. Cloud computing is helping reshape, rebuild, and reignite businesses via seamless digital transformation. Cloud computing companies help enterprises overcome the pandemic-induced challenges, and meaningfully accelerate innovation and agility towards the market.

Thriving in the digital era will require innovative platforms and solution

launches across industries such as retail, telecom, and financial services, as well as gaming and entertainment solutions for the global market. The underlying IT governance and security foundation will accelerate rapid scaling of digital transformation across industries. The integration of big data and artificial intelligence to generate real-time insights is becoming a hygiene issue for enterprises to compete effectively and win in the market.

The latest developments across the ecosystem viz. exponential technologies, edge computing, and 5G help business enterprises quickly progress digital and intelligent transformation to effect a step change in operational efficiency, customer experience, and business growth. Building and driving ecosystems and business networks can lead to creation of newer, non-traditional revenue streams that often span across industries and geographies. This can also accelerate economic development. Cloud computing helps bridge the digital divide, and paves the way forward for digital inclusion across the social and economic strata. Business enterprises that use cloud technologies to seize the emerging opportunities will thrive in the new world order.



Introduction

COVID-19 has infused the urgency to transform the way business is conducted across the world. It has accelerated the pace of digital transformation, spurring organisations to innovate faster or risk losing eminence or even going out of business. Fortunately, this urgency of transformation can be supported by rapid advances in digital and software systems. **Cloud computing is one such technological marvel that has taken the world of business by a storm.** It can help organisations to find a way to survive and thrive in an uncertain business environment.

Organisations have just touched the surface of cloud that still has huge untapped potential. They need to brainstorm on how to build cloud in their strategies to capture the maximum value, and put cloud at their core.

This paper discusses how technology has shaped up over the past two decades of this century to the present day of **cloud computing**, while bringing in a host of tech advances fueling the present generation of businesses. It also covers **accelerators** for cloud adoption and the driving force behind those accelerators. Thereafter, it details out what we consider **barriers** preventing organisations from embracing cloud to the extent some other first movers and digital natives are using. The paper finally encapsulates with a view on how businesses can move forward when you are either the disruptor or the disrupted!



Rise of the cloud

The modern day **cloud computing** is a result of multiple advances made in several underlying technology infrastructure, such as hardware, software, networking, and storage. In the past two decades, big tech companies have grown exponentially. However, growth of the cloud infrastructure has been so profound, courtesy the push-button accessibility, that it has transformed how businesses look at technology now.

Earlier in the days of **mainframe computers**, the focus was on managing large and complex business transactions, large data warehouses, and reporting. IT infrastructure required huge capital expenditure and changes to systems were slow, prone to errors, and costly.

How monoliths gave way to microservices

Technology companies, such as Google, Amazon, and Uber spawned new business models on the back of tech innovation. They became both creators and consumers of the tech they were producing. **Bigger, faster, and cheaper** became the mantra driving tech innovation.

Soon enough, **massive monolith** systems started **becoming decoupled** with the launch of **client server tech**. It was an **intelligent innovation** that in part came out of the fundamental understanding that software systems can be fragmented into independent components and then made to talk to each other to perform desired operations.

This concept of decoupling led to an innovation in **distributed server technology**, which was not new, but its application to build commercial grade applications took time to evolve. The idea was to use resources such as servers and storage, more effectively and efficiently to improve returns on IT capex.

Software engineering paradigms were combined to build decoupled modular applications based on **microservices + API frameworks**. Infrastructure of massively scalable compute and storage systems was upscaled; application and data were no longer needed to be packaged in a single monolith architecture.

Business imperatives (agility, faster go to market, lower costs, and scale), technology innovations (distributed computing, microservices, API economy, serverless, and cloud), and academic research (faster algorithms, and cheaper and more efficient compute and storage devices) converged to bring about the explosion in the world of business we are witnessing today.

Welcoming big data, Machine Learning (ML), and Artificial Intelligence (AI)

Hardware design and software engineering paradigm shifts led to the emergence of big data whose roots can be traced to the original map-reduce paradigm developed by Yahoo.

A dearth of skilled talent

Using new-age technologies requires advanced skills. Businesses migrating their local captive data centres to cloud, need data engineers and scientists, and software developers to fill the roles thus created. New roles, such as product owners, scrum masters, and agile coaches mirror needs of modern software development paradigm predicated on agile principles, (such as iterative software development in time-boxed sprints, autonomous teams working as pods with cross-functional skillsets, frequent product releases, and automated deployment and releases). This has led to serious dearth of talent and the need to re-skill (retire/retrench) existing workforce.



Moreover, data, data analytics, and data management gained importance as a discipline. ML and AI have become new buzzwords.

Data generation and dissemination saw a sudden and massive rise. And, big data had to have its own set of processing standards to convert raw data into information. ML algorithms became one of the ways of taming big data to distill useful information. Data scientists could run these algorithms and other advanced **ML technologies** to crunch huge volumes of both structured and unstructured data taken directly from massive storage systems (data lakes). Moreover, they could successfully make predictions and classifications. This was the precursor to **AI**.

Data-related job roles and opportunities have mushroomed across the globe. Even Harvard Business Review calls the role of a data scientist as “the sexiest job of the 21st century”¹

Cloud infrastructure (provided by AWS, Microsoft, Google, etc.) allowed the widespread use of these technologies. This scale would not have otherwise been possible.

The chart below tracks the evolution of technologies from the days of the mainframe to the present day of cloud and advanced analytics, including ML and AI.

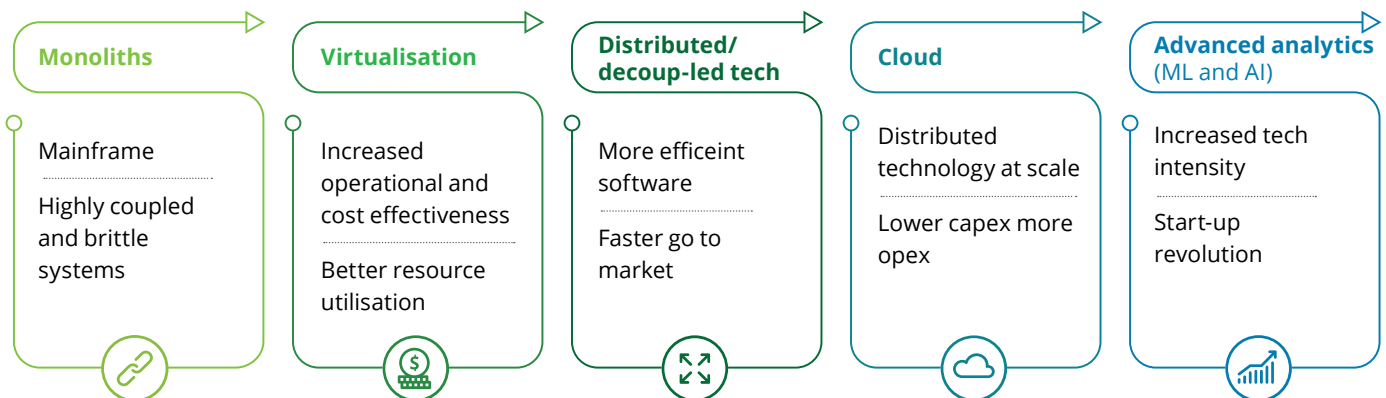
¹ Why ‘Data Scientist’ Will Continue To Be ‘the Sexiest Job Of the 21st Century’ (entrepreneur.com)

Not on “cloud”? You have no position on “earth” either

ML programmes require tech infrastructure at scale, robustness, and resilience that only cloud systems can provide. The earlier avatar of IT infrastructure, ubiquitous data centres, are gradually being replaced with large networks of machines with almost infinite resources via public clouds. Amazon, Microsoft, and Google are pioneers of the cloud revolution.

Reports from Gartner, Forrester, and others assert that digitisation, AI, and ML will lead ‘tech transformation’ agenda, necessitating it for companies to invest (if not already done) in building cloud capabilities in 2021 and beyond.

Cloud is no longer merely a ‘technology upgrade’. Many large IT service providers and other companies using technology (in-house, or through subsidiaries and captives or outsourced vendor-partner arrangements) are recognising cloud’s immense influence on their business models.



Digital transformation using cloud

Digital became the catch phrase to denote organisations’ penchant for using innovations and creating their own space. Various companies embarked on a multi-year journey to bring about digital transformation. For instance, banks are increasingly realising that they can and need to ‘own’ the technology and become more digital. Digital-first banks have been launched that use technology to open contactless banking channels, highlighting redundancy of traditional branch banking models.

Companies across industries use cloud to eliminate expenses incurred on setting up physical IT infrastructure in-house as well as gain nimbleness, scale, elasticity, resilience, and business continuity. Computing has changed and the evidence is overwhelming. For example, smartphones of today wield more compute and storage power than big servers of yesteryears.

New-generation ML and AI applications have become more mainstream. They are being used to run routine business operations – ranging from detecting real-time fraud, checking credit worthiness, and designing shelf spaces in retail shops for better product placement to predicting machine downtime. This changing scenario has led organisations to quickly build digital assets and expand their use, along with creating a more digital-savvy workforce. Organisations are incurring capex and opex to keep pace with digital transformation.²

Old or new conglomerates to ride on cloud

In the past decade, we have witnessed massive influence of big tech on industrial and world GDP. Facebook, Amazon, Apple, Netflix, and Google (FAANG) have been major wealth creators for investors. Some big companies even have trillion dollar valuations, although quantifying the exact impact of these companies on the world economy is difficult. In October 2020, in the middle of the

ongoing pandemic, Apple, Microsoft, Amazon, and Alphabet had each crossed the threshold of \$1 trillion market capitalisation.³ Some of these companies were not present as early as 25 to 30 years ago and yet have become an epitome of digital revolution. Therefore, these are called **digital natives**.

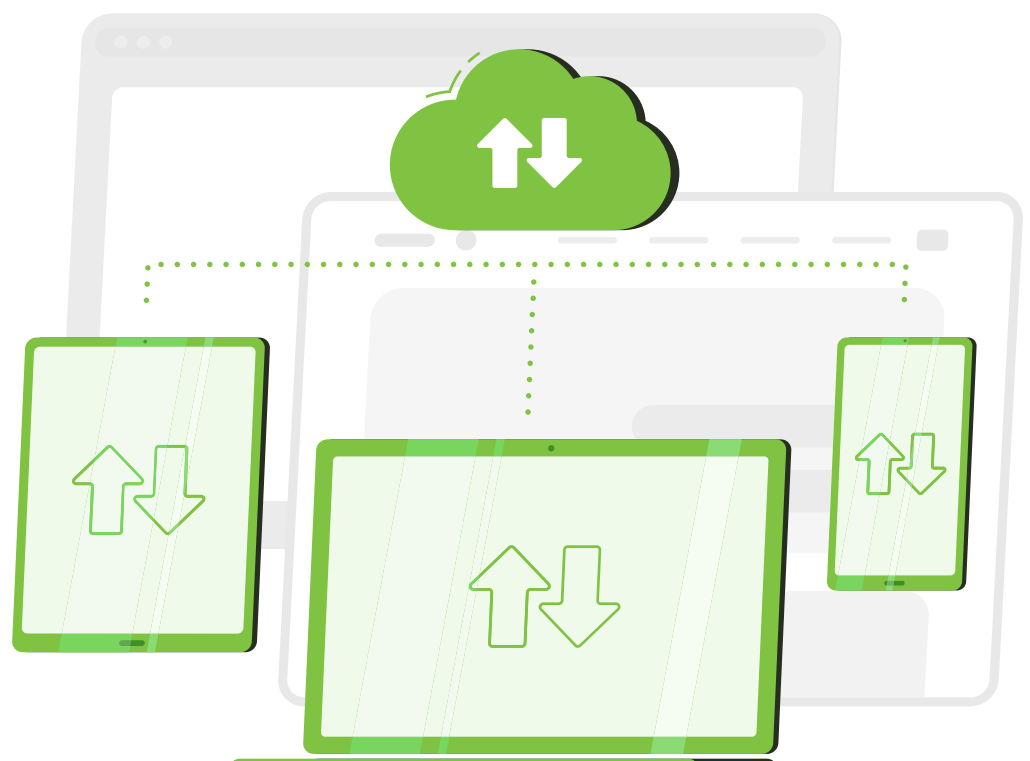
Cloud computing is the megatrend of the next decade with firms such as Shopify, Twilio, Salesforce, and Adobe matching up or even going ahead of FAANG. Old giants, such as Microsoft and IBM, are also evolving and adapting to maintain their leadership in the space of technology with cloud as the fulcrum.

Digital natives' growth is spurred by their ability to use their in-depth technological expertise to solve existing problems in new ways, and forge new business models almost on the fly. This phenomenon has given rise to another coinage of this century – **start-ups** and **unicorns**⁴.

² Satya Nadella coined the term Tech Intensity to denote the growing influence of Technology in Business

³ <https://www.somo.nl/how-big-tech-is-becoming-the-government/>

⁴ In the venture capital industry, the term unicorn refers to any start-up that reaches the valuation of US\$1 billion





Acing cloud adoption to get ahead in the technology transformation game

Although cloud infrastructure enables services such as pay-as-you-go, capacity-on-demand, reduced overhead charges, and business agility, its demand is influenced by various factors. Some of these factors are as follows.

Changes in business models

Business model innovation is a holistic concept requiring a manager to take a step back and apply system-wide or system-level thinking. It looks at

both sides of the coin - an outside-in angle (from a demand perspective) and an inside-out angle (from a supply perspective).

The demand perspective drives a business model innovation from a customer experience, pricing, speed, and competition. The supply perspective changes equation parameters from the way raw material is procured, quality, failure rates, etc.

The silver lining of embracing cloud

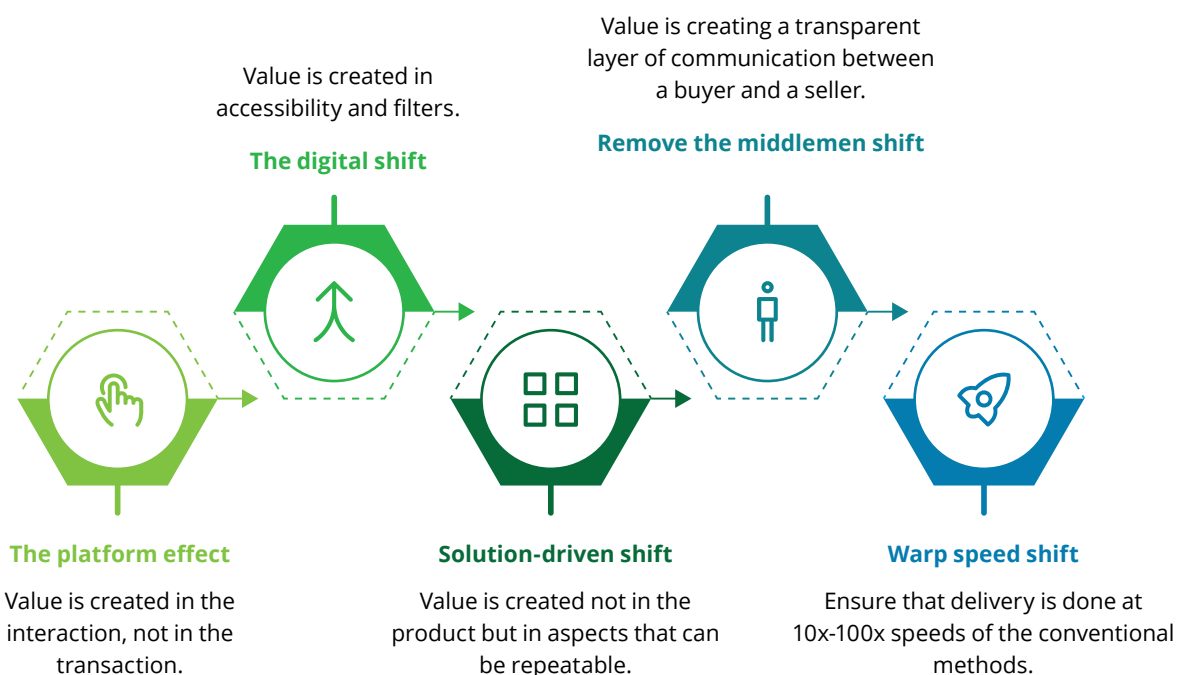
Many Indian companies are re-thinking their models of distribution using technology specifically cloud. For example, a leading Indian digital marketplace for lending products, is driving technology innovation in its offerings. Its cloud capabilities have made loan disbursements and credit card issuance completely digital. A fintech has built digital solutions for KYC verification, income and employment validation, repayment set-up, and consent on loan agreement. A large section of customers will now be able to access credit much quicker from the comfort of their homes through an easy contactless process as each erstwhile physical step in the lending process has now been built digitally. The digital stack has enabled providing unsecured loans within 3-5 hours from an earlier disbursement time of 3 to 7 days. A key feature of the firm's platform enables it to provide customised lending solutions to customers using a predictive algorithm model.



In the Indian context, let us consider the “cloud kitchen” model (adopted by Swiggy, Faaso’s, and others) as an example of business model innovation. Value addition can be driven from multiple perspectives. In a traditional franchise-oriented model, location is important for a restaurant and rent-to-sales ratio is high. However, cloud kitchens do not need a good location, leading to a significant drop in the rent-to-sales ratio. They can offer other

premium brands without worrying about food fatigue from customers. They also have a level of independency that allows cloud kitchens to add other brands and have preferential pricing.

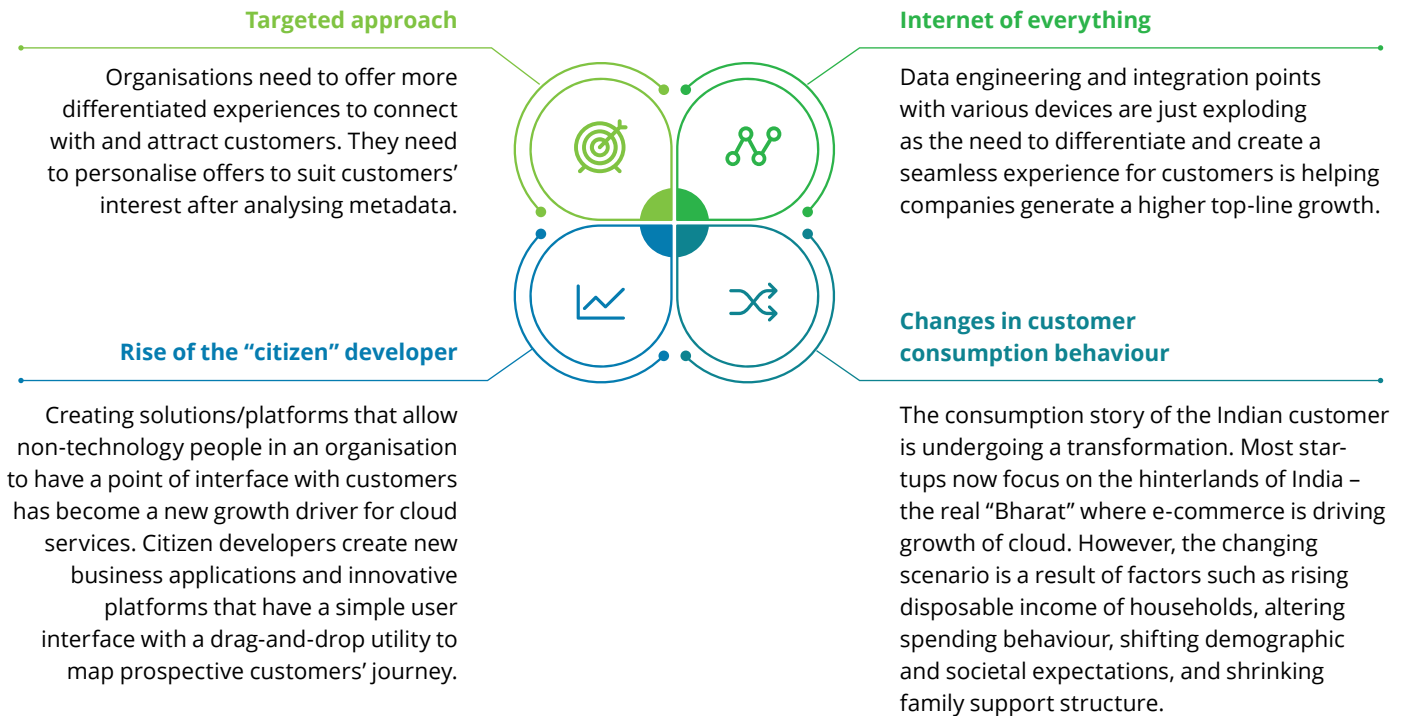
Given below are some trends that we think allow for effecting business model changes (in line with the value proposition that cloud offers).



Changes in customer expectations

Modern customers do not hesitate to throw their weight around and flaunt their power. Organisations need to provide choices to win customer loyalty. When customers do not have the choice with a

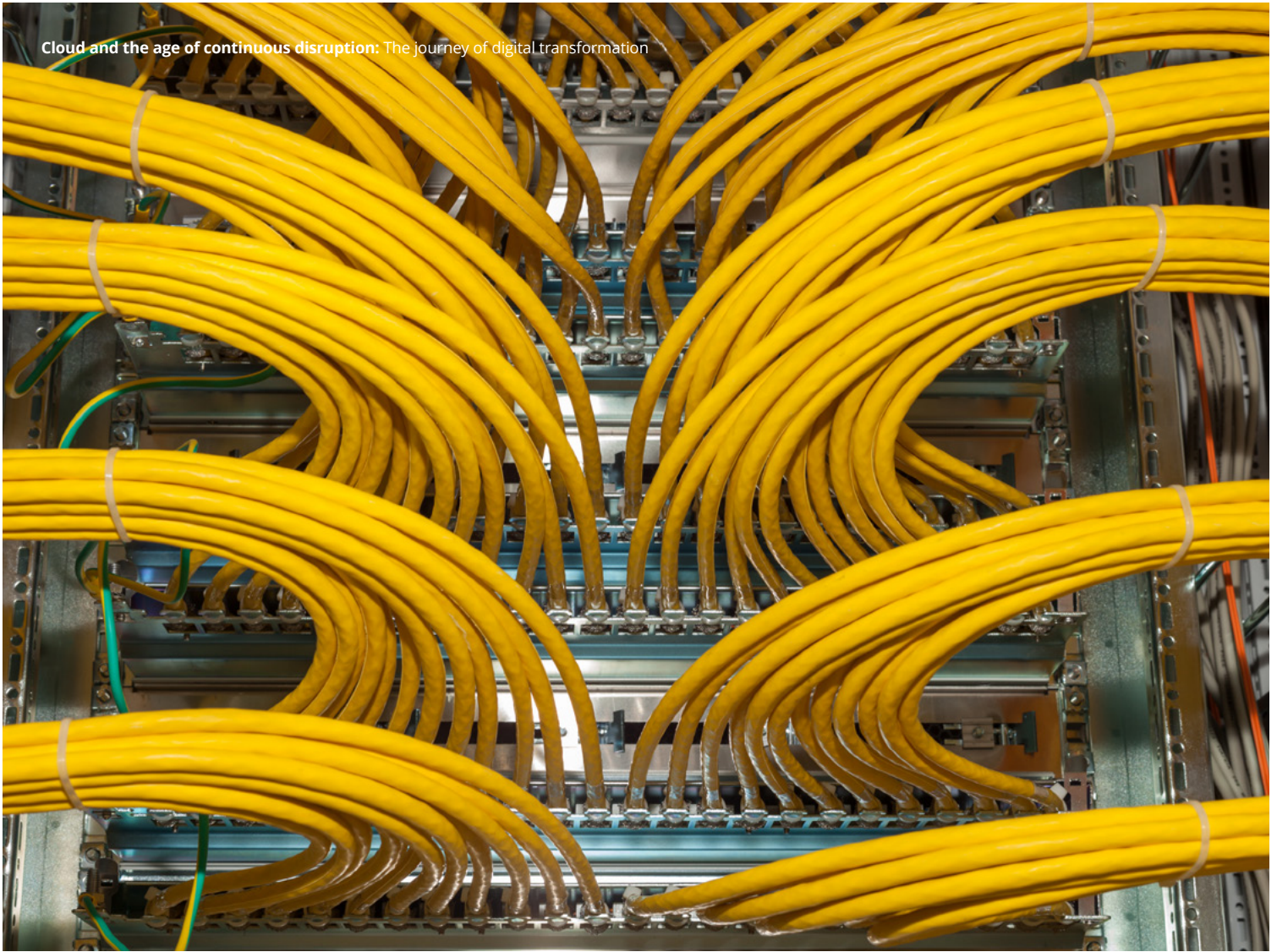
particular organisation, they move on – often after just one bad experience. Moreover, customer expectations are rapidly changing, fueling the growth of cloud-oriented models, as covered in the following points:



The need for innovation

The need for innovation is clear. Businesses today realise the fact that cash is king and operational expense is better than capital expenditure (as it brings more degree of control to investments). Organisational culture and environment, along with cloud technologies, play a key role in enabling innovation. Organisations need to empower developers and create a right environment for them to create software applications that enhance business performance.

This makes cloud a wonderful platform to try out new proofs of concepts, curate experiences for customers, and improve at faster rates.



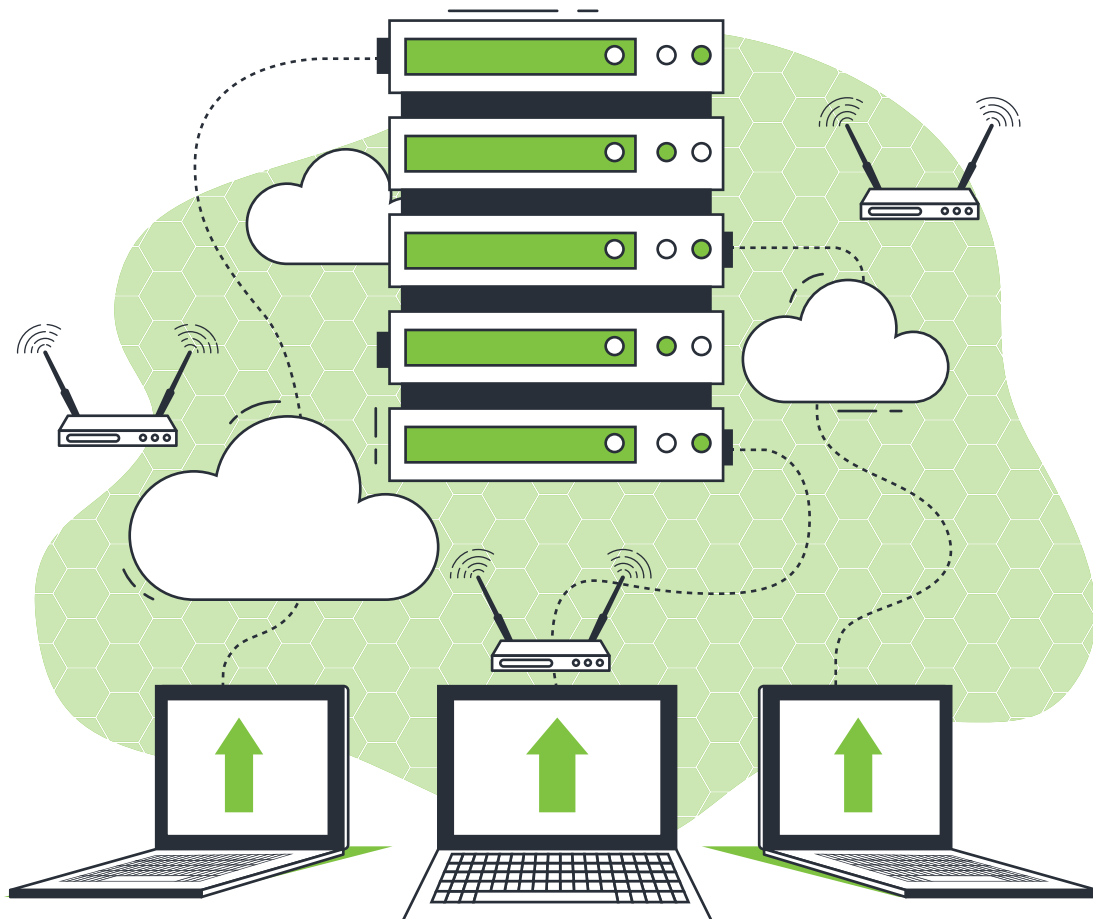
Barriers to cloud adoption

Organisations are not keen on going the cloud way because of a number of challenges. This observation is also shared in a Deloitte report titled “Cloud is here: embrace the transition”,⁵ Some of the factors that prevent organisations from adopting cloud are mentioned below.

- **Integrating cloud platforms used within an organisation:** This process requires overcoming issues related to network connectivity; security; authorisation and authentication; and operations and management. Failure to resolve these issues may lead to running parallel IT operations for cloud-based and legacy platforms, posing challenges to the overall adoption of cloud systems.
- **Data security and privacy:** Public cloud environments require data to be stored on a shared infrastructure managed by Cloud Service Providers (CSPs), representing a fundamental shift from traditional IT practices. Though client IT teams have access to and control of public cloud usage, the fear of being incapable of taking requisite steps in case of a cyberattack leads to some resistance in these teams towards cloud adoption.
- **Multi-tenancy:** It also hinders cloud adoption as CSPs use it to optimise server workloads and reduce costs by sharing workloads across multiple environments. The potential security threat of side-channeling (when an attacker gets information through a shared tenant’s node) can sway a client to decide against adopting cloud.

⁵ The cloud is here: embrace the transition - How organisations can stop worrying and learn to “think cloud?”

- **Compliance and regulatory risks:** Moving to a public cloud platform requires giving some level of compliance controls to a CSP. Many organisations find it a challenging situation as CSPs do not negotiate their standard terms and conditions. Different kinds of clients use public cloud environments, and providers do not customise services to meet unique or specialised requirements.
- **Vendor lock-in:** Entering into a contract with a CSP poses various challenges, such as financial penalties for early termination of a contract, and no flexibility to renegotiate prices (if commercial costs change through the contract period), and migrate to another CSP offering more attractive services. These challenges have played a significant role in dissuading firms from adopting cloud. In addition, lack of coordinated cloud standards across cloud service providers has made it difficult for firms to move workloads between CSPs and/or private clouds.
- **Zero cost savings:** Some organisations do not see any cost savings and some even experience cost escalations. The increase could be because of the lack of:
 - Understanding of workloads suitable for cloud environments and those requiring high resource utilisation; several upstream/downstream integrations may not be ideal candidates for cloud migration and can be heavy on the pocket
 - Forecasting investments related to technology (for example, network redesign, and identity and access management toolset) and staff (new roles, training, etc.) to enable proper fiscal management of a hybrid IT environment
 - Adequate monitoring of cloud service usage that can significantly increase costs billed on a pay per use basis





Rising above the clouds of challenges

Although numerous challenges exist that hinder cloud adoption, some of the steps that organisations can take to address them are mentioned below:

- **Formulating cloud adoption and purchase guidelines:** Put in place guiding principles, as a part of enterprise wide guidelines, for purchasing and adopting cloud solutions. Consider operational performance metrics (not only features and functionalities) in software evaluation and selection decisions.
- **Modernising operating models and enterprise practices:** Invest in upgrading existing enterprise IT architecture and tools such as cloud service expense management to identify and right-size

overprovisioned resources, take advantage of pricing changes, and identify ways to cost effectively use and release IT resources to reduce cloud expenses.

- **Encryption and shielding:** Put in place robust security provisions, such as encryption, keys rotation, and tokenisation. Procure multi-factor authentication and digital certifications to safeguard data in cloud. Deploy web application firewalls preventing cross-scripting or SQL injection attacks, and special shield services preventing DDoS attacks. Align security architecture with CSPs' architectural constraints. Train staff on cloud security provisions and foster a culture of constant vigilance.

- **Cloud vendor landscape evaluations:** Establish fundamental guidelines around compliance and regulatory requirements for cloud services that will serve as a baseline for vendor evaluations. Look for baseline compliance requirements, such as user identity and access management, data protection, incident response, and data residency requirements, while evaluating cloud vendors.
- **Mature vendor management capabilities:** Organisations find it critical to approach cloud service contracts as an ongoing set of relationships—consistent monitoring of the cloud market is imperative for various firms.
- **Cloud vendor agnostic services and containerisation:** Build these services to reduce dependency on a single vendor. Use containerisation technology to increase workload portability across cloud environments.
- **Business case:** Invest in creating business cases justifying workload migration to cloud environments to mitigate risks related to cost management. Revisit the business case after the transition to validate its realisation.
- **Cloud suitability analysis:** Assess workloads in terms of functional (availability, requirements, hardware dependence) and technical fitment (application architecture, integration requirements) for cloud migration. The assessment can yield results related to rationalisation of the application portfolio, thereby reducing application costs.
- **Cloud governance:** Establish adequate governance mechanisms that account for who uses cloud services, how many services can be used, and what approvals are required.





Conclusive remarks

We are roughly a decade from when cloud computing started. And, in such a short time, this technology has become an inevitable part of every organisation's growth strategy. This paper delves into the evolution of technology, force multipliers, and accelerators causing rapid adoption of cloud by businesses and enterprises. It also uncovers challenges preventing organisations (especially in the public and government sectors) from embracing cloud services. From a technology and business perspective, we believe the future of work, skills sets required, and the overall economic and human

impact of technology will continue to evolve at an even faster pace than seen heretofore. New-age technologies, such as blockchain, IoT, and quantum computing will usher in a new era of technology innovation. These technologies are still nascent. But just as with innovations we have seen so far, we are sure to witness faster emergence of these technologies from labs to the business battlegrounds where new-age companies will take over the baton from their legacy counterparts. The time is ripe for the next inflection point.

About CII

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering with the industry, Government, and civil society through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led, and industry-managed organisation, with more than 9,000 members from the private and public sectors, including Small and Medium Enterprises (SMEs) and MNCs. It has an indirect membership of over 300,000 enterprises from 294 national and regional sectoral industry bodies.

For more than 125 years, CII has been engaged in shaping India's development journey and works proactively on transforming the Indian industry's engagement in national development. CII charts change by working closely with the Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness, and business opportunities for the industry through a range of specialised services and strategic global linkages. It also provides a platform for consensus building and networking on key issues.

Extending its agenda beyond business, CII assists the industry to identify and execute corporate citizenship programmes. Partnerships with civil society organisations carry forward corporate initiatives for integrated and inclusive development

across diverse domains, including affirmative action, livelihood, diversity management, skill development, empowerment of women, and sustainable development, to name a few.

As India marches towards its 75th year of independence in 2022, CII, with the theme for 2021-22 as building India for a new world: competitiveness, growth, sustainability, and technology, rededicates itself to meeting citizens' aspirations for a morally, economically, and technologically advanced country, in partnership with the Government, industry, and stakeholders.

With 62 offices, including 10 centres of excellence, in India, and 8 overseas offices in Australia, Egypt, Germany, Indonesia, Singapore, the UAE, the UK, and the US, as well as institutional partnerships with 394 counterpart organisations in 133 countries, CII serves as a reference point for the Indian industry and the international business community.

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