



The Future
Growth Sectors in
Digital Engineering

September 2022

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Foreword



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In the recent years, digital platforms and tools have been recasting relationships between organisations, customers, workers, and employers. 'Digital transformation' has dramatically become a means to boost growth and competitiveness. The pandemic brought forth the need for organisational agility and deeper links with customers. To thrive in a post-COVID-19 world and ensure long-term success, businesses have recognised that their workforce and processes must be robust and adaptive of emerging technologies.

With an optimistic Digital Engineering (DE) revenue¹ growing at a CAGR of ~20 percent, India is leapfrogging into the fourth industrial revolution. The conspicuous upswing in the advancement of the digital backbone of the second-most-populous country and largest democracy is attributable to the transitional years that went by. The country is home to the biggest market for digital consumers with over 500 million internet users. Fostering the third largest startup ecosystem, nurturing one of the world's youngest populations with an enormous science and engineering talent pool, and instituting initiatives to digitally empower the society and businesses at large, India is well positioned to embrace emerging technologies.



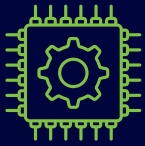
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Our research and discussions with industry leaders define 'DE' as something that builds smart, connected, and intelligent products with the aim to elevate customer centricity and embrace the concept of device-as-a-service by using digital technology as the backbone. Our research in the report indicates the ongoing evolution of DE in India and its deployment specifically in the context of four upcoming sectors: Banking, Financial Services and Insurance (BFSI), Health care, Consumer Packaged Goods (CPG), and retail. Today, the disruptive technologies are fulfilling the promise to transform these sectors and make them stalwarts of tomorrow. This report outlines the indicative drivers, growth themes, and use cases across these sectors, and spotlights the projects of select DE pioneers in India and their model of co-creation and collaboration with startups, universities, and competitors.

We hope that this report becomes an inspiration to all organisations that aspire to adopt/grow in the field of DE. Maintaining this growth arc in India can be done only when there is cross-industry collaboration, partnership, and continuous debate, and highlighting the experience of these sectors is the first step in achieving this.

Executive summary

In the Engineering Research & Development (ER&D) world, Digital Engineering (DE) is slowly becoming the lead player over traditional engineering. For this report, DE has been defined as the following:



DE is platform engineering that is microservices-based and available on cloud. It inherently focuses on driving end-to-end customer experience through a culmination of technologies and better customer insights, and through product and service monetisation.

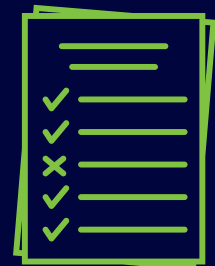


DE is propelled by a technology layer comprising Artificial Intelligence/Machine Learning/Data Learning (AI/ML/DL), big data analytics, Internet of Things (IoT), automation/robotics, cloud computing, cybersecurity, 3D printing, and now 5G.



India has stepped up as a leading destination for DE. The share of DE in overall ER&D revenue in India continues to be in the range 28-30 percent as on FY22.

The Global ER&D Pulse Survey (NASSCOM and Deloitte, 2022) highlights sectors, such as industrial, energy and oil & gas, hardware & electronics, and automotive as the principal sectors in the ER&D space. However, there are other sectors, that have been growing with respect to DE, specifically, Banking, Financial Services and Insurance (BFSI), Consumer Packaged Goods (CPG), retail, and health care. All these sectors have one aspect in common, i.e., they use DE creatively in both their engineering operations and as part of their final products/solutions. The India growth story for these sectors is expected to be significant over the next few years.



There are many enablers for the proliferation of DE in India. Some of these include the following:



Availability of talent – India also offers a large entry-level talent pool of more than 2 million STEM graduates, out of which, there are sizable numbers with AI/ML, cloud, cybersecurity, and 5G skills.

Improving quality of talent – In addition, companies have adopted other strategies to increase and improve the quality of talent pool; some are collaborating with academic institutions to develop digital curricula, whereas others are building alternate talent pools through targeted skilling programmes for people from tier 3/4 cities and marginal groups.



Ecosystem collaboration across startups, fintechs, and academia – The Indian startup ecosystem is the third largest in the world and home to more than 100 unicorns. Across the BFSI, health care, and CPG/retail sectors, there are numerous examples of domestic and global companies tying up with these startups to co-create new products through consortium, co-opetition, and incubator/accelerator programme models.

Support from the government institutions – The central and various state governments have contributed significantly in fostering this external ecosystem via:

- Investing actively in technical skill development programmes (Digital India, Skill India) with private sector companies.
- Setting up country-wide centres of excellence and accelerator programmes (e.g., FinTech Center of Excellence, Bharat Virtual Virtual Accelerator, and COVID-19 initiatives).
- Promoting the development of tech clusters, such as BioValley and Medivalley for the medical devices manufacturing and testing of new technologies, and the Mumbai FinTech Hub.



India is moving in the right direction to promote DE growth, but there are some additional steps that can be taken to further the penetration of India's contribution in DE:



Creating a balance between growing technical capabilities and industry-specific and soft skills – Government-corporations' collaborations are required to design upskilling/reskilling programmes that focus on the DE application in specific industry domains.

Enhancing India's data protection infrastructure and alleviating concerns related to patent laws – Existing data protection regulations can be further enhanced to provide increased confidence to Global Capability Centers and Engineering Service Providers to serve global businesses. In addition, from a global standpoint, concerns around patentability criteria and patent maintenance need to be addressed.



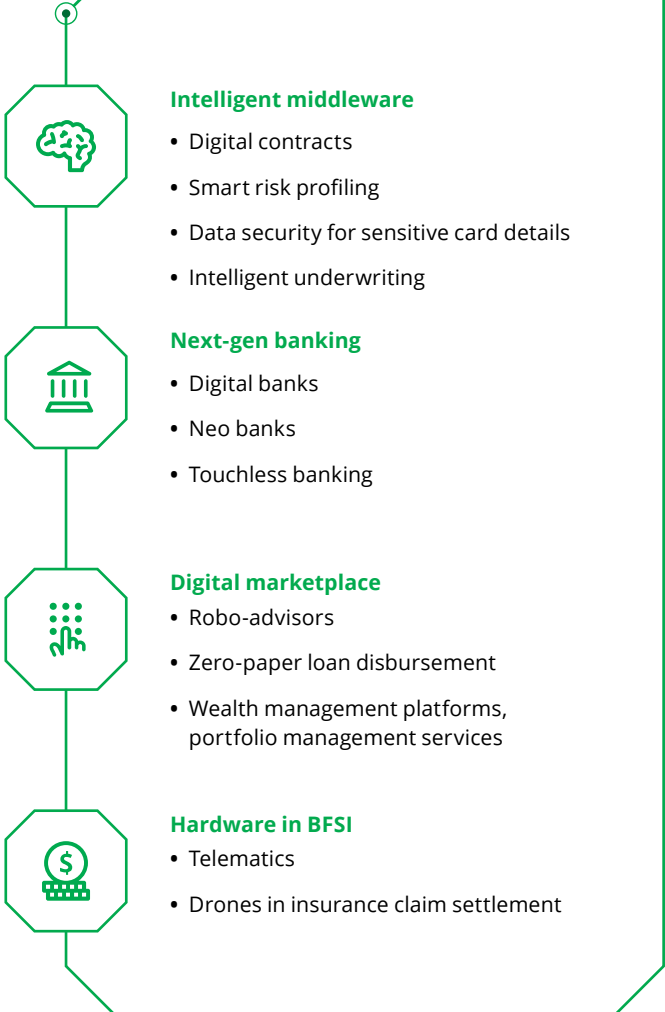
Addressing regulatory gaps to help further India's position as a DE offshoring/outsourcing location. Some of the examples include simplifying the requirements for setting up a foreign company centre in India, revisiting import tariff rates for hardware, and refining certain ease of doing business limits and parameters.

Across sectors, industry leaders observed a consistent increase of investments in the DE endeavours. India has already been able to establish a strong foothold in this space through its booming talent pool, growing ecosystem for collaborations, and encouragement towards this sector from the government institutions. These are additional key elements that will help further strengthen and expand India's prowess in this sector across the globe.

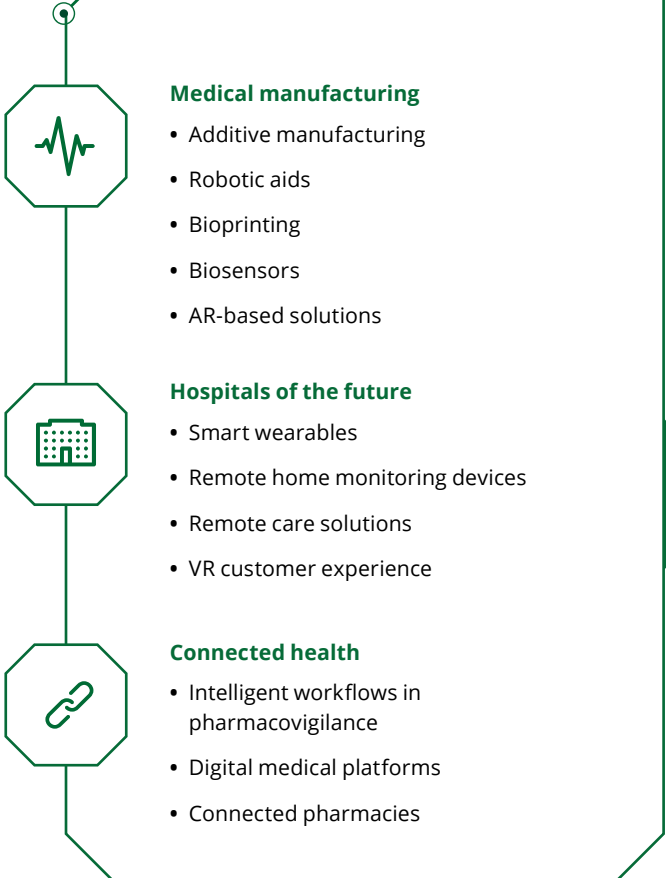
Growth themes and use cases in the focus sectors



BFSI



Health care





CPG

Performance optimisation

- Supply chain control tower
- AI-powered demand forecasting

Industry 4.0

- ML-powered Digital Twin
- Visual inspection AI
- AMRs and cobots
- 3D printing

Customer experience and brand recognition

- AR embedded product packaging
- VR-based instore and factory experience

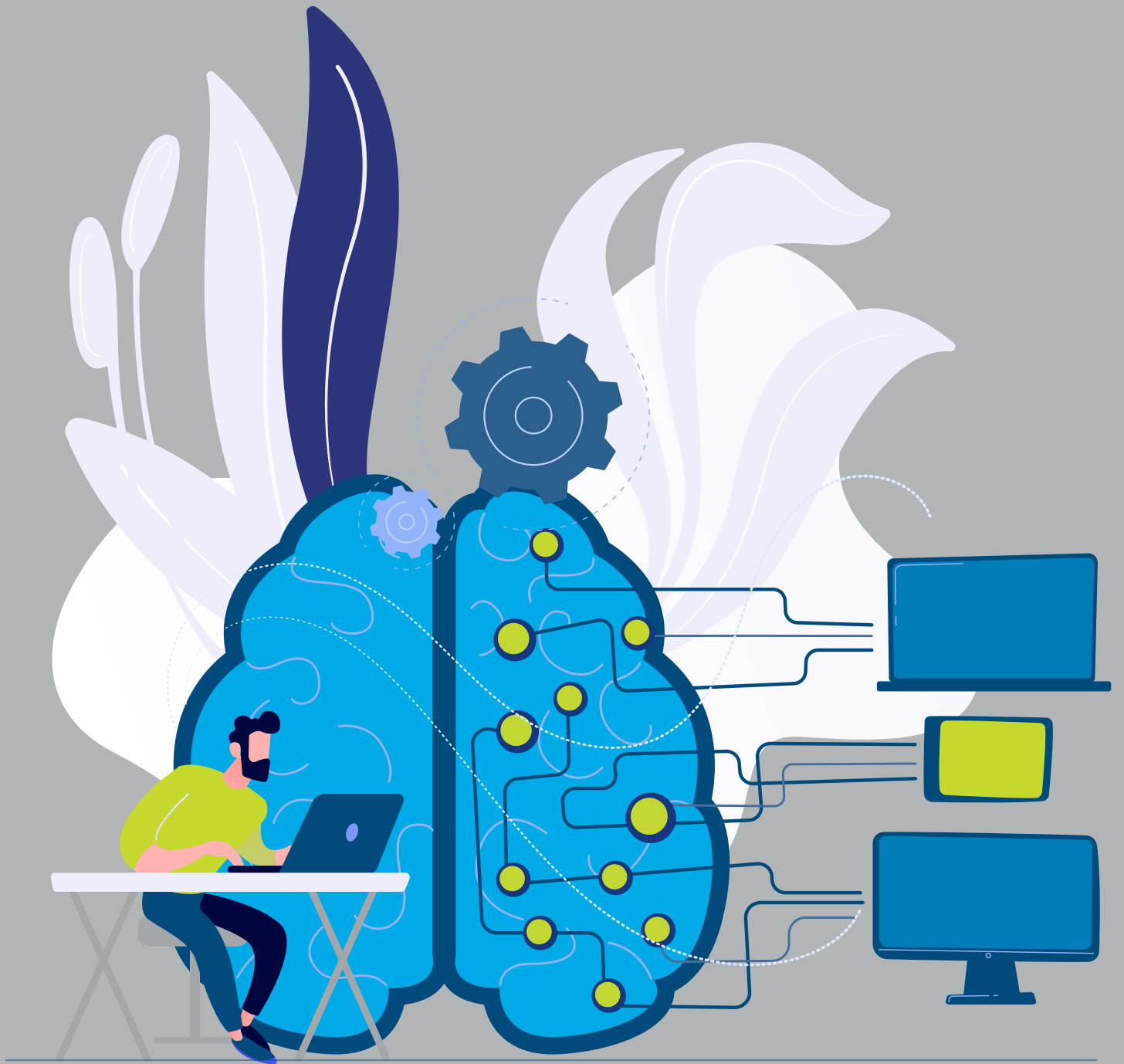
Retail

Smart stores

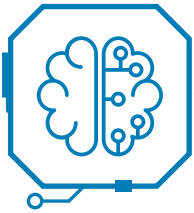
- Robots and sensors for inventory management
- Omnichannel presence
- Virtual fitting rooms and interactive mirrors
- Smart Beacons for customised offerings

Integrated business planning

- End-to-end connected system for better decision making
- AI-based emotion capturing for customer behaviour



Introduction to Digital Engineering



Digital Engineering (DE) has different definitions and connotations depending on the company and the industry. The original definition comes from the U.S. Department of Defense, which defines “digital engineering as an integrated digital approach that uses authoritative sources of system data and models as a continuum across disciplines to support lifecycle activities from concept through disposal”.¹

The intent is to describe it not just as a method/approach but also what it achieves. A revised definition includes the following:

Platform engineering

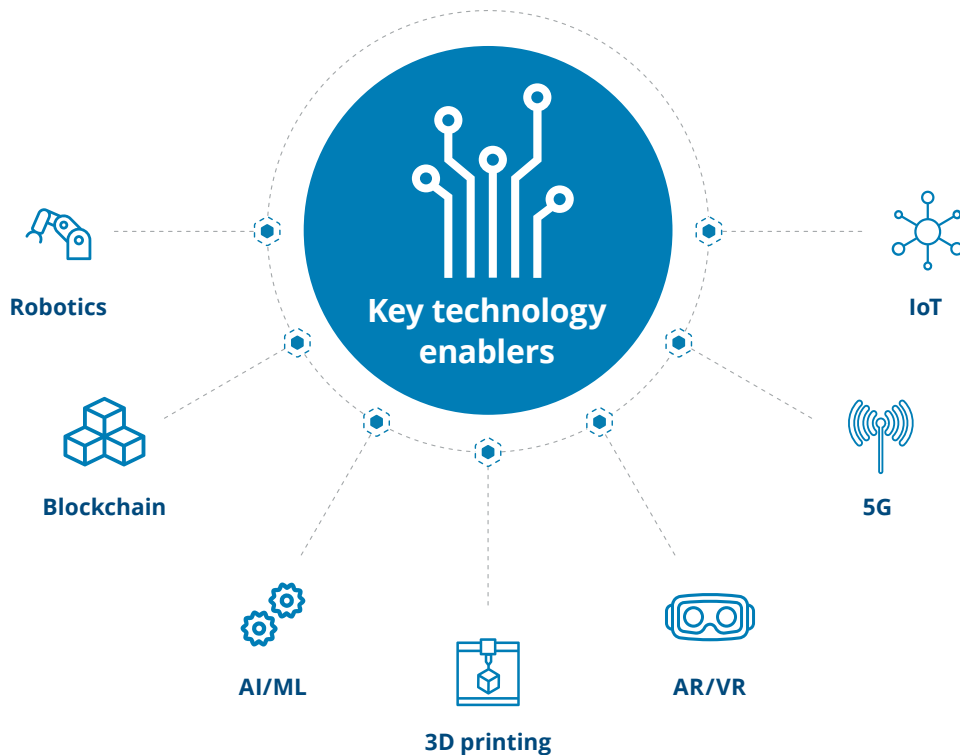
Digital engineering is platform engineering that is microservices-based and available on cloud.

Device-as-a-Service

Digital engineering inherently provides solutions to customers through product and service monetisation.

Customer-focused

Digital engineering is a culmination of technologies to derive better insights and provide customers with a superior end-to-end experience.



¹ <https://onlinelibrary.wiley.com/doi/abs/10.1002/j.2334-5837.2020.00815.x>

Organisations' definitions of Digital Engineering

“
Smart, connected, and intelligent products, for which the design, development, operations, and end-user experience is governed by the insights generated using data from customers which comes under the purview of Digital Engineering
- An Indian technology corporation
”

“
Using data of medical patients from smart devices to drive customer value and better health care outcomes while ensuring continued and superior operations of medical institutions
- A German medical devices company
”

“
We define Digital Engineering as a tripod of 1) design-led customer experience transformation, 2) ensuring significant operational efficiencies and transformation with cloud enablement and hyper automation, and 3) enabling new revenue channels with omnichannel and deep data insights.
- GlobalLogic
”

“
Interconnectivity of all factories to improve manufacturing processes by introducing new technologies and implementing sustainability measures, with a focus on providing connected products for the end consumer
- Reckitt Benckiser
”

“
Any product/service that leverages disruptive technologies to deliver/run digital businesses is Digital Engineering. It is the intersection of the CIOs', CTOs', and COOs' worlds
- An Indian technology service provider
”

Global trends that drive the Digital Engineering’s growth story



Customer centricity

Driving customer success has been one of the biggest catalysts behind DE. To meet customer expectations, companies are leveraging DE to achieve **lower cost-to-serve, ensure higher willingness to spend, increased loyalty and brand advocacy.**



Mutual technology and business operations

Technologies, such as VR/AR, AI, and digital twins have been used primarily in a “single-problem, single-technology solution” manner. While these technologies have enormous potential even as isolated solutions, their **convergence promises even greater possibilities** to develop new tools, methods, and solutions that create process efficiencies, save money, and lead to further innovation.



Time to market

In the time it takes to introduce a new feature, by using legacy testing methods, competitors can conduct market testing and release more complete products. Digital modelling and simulation tools **reduce the time, money, and effort required** to test and iterate on the design of novel technologies.

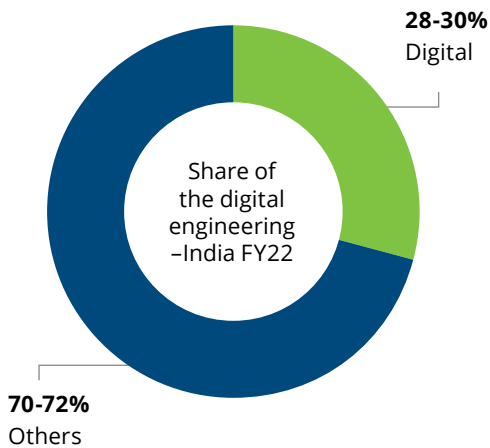


Data-driven ecosystem

Harnessing the unlimited power of data commissions’ valuable insights to make fast and confident decisions and create best-in-class products through efficient production. By integrating multiple partner activities and data, digital thread enables **efficiency of business processes**, such as optimising operations, automating the build and integration of systems.



India ER&D and DE revenue in US\$ billion FY22.



- The share of traditional ER&D in overall ER&D revenue is expected to go down in the near future, with DE taking more of a centre stage.
- The Global ER&D Pulse Survey (NASSCOM and Deloitte, 2022) highlights sectors, such as industrial, energy and oil & gas, hardware & electronics, and automotive as the principal sectors in the ER&D space. These sectors continue to invest in India for software design/engineering, developing Industry 4.0 solutions, and creating customer-centric products/solutions.
- However, other sectors have become prominent in recent years growing in similar areas of DE, specifically, BFSI, retail, CPG, and health care. While BFSI, retail, and CPG sectors comprise a small share of the market, health care consists of a significant share. All these sectors have one aspect in common, i.e., using DE creatively in both their operations and final products/solutions. The India growth story for these sectors is expected to be similarly significant.



The DE landscape in India is heavily correlated with the historical evolution of traditional IT/IT enabled Services (ITeS) industry. Several global companies are using India's ER&D and software prowess to gain the unique advantage of managing the entire product lifecycle from one centre.



The demand for digital engineering professionals has consistently increased over the years, with a sudden surge in demand for digital skills, especially in the areas of AI, data science, cloud computing, information security, and blockchain. This is due to the expediting digitisation and automation of businesses.



Bengaluru, Hyderabad, Mumbai, Pune, Delhi, and Chennai, identified as mature tech hubs, account for over 85 percent of the country's total digital talent.²



Bengaluru and Mumbai have emerged as the leading destinations for digital projects. While Mumbai is the preferred location for global organisations, Bengaluru is the principal choice for companies of Indian origin.



Across sectors, Mumbai, Bengaluru, and Delhi are the most preferred choices. However, Hyderabad and Chennai are gaining traction as BFSI and health care hubs.

² <https://www.thehindu.com/business/indias-demand-supply-gap-for-digital-talent-expected-to-rise-over-35x-by-2026-nasscom/article65056315.ece>

Factors that contribute to India's rise as a Digital Engineering destination

Previously, with the labour arbitrage model becoming a cost-effective solution for multinational firms, India was looked at as a destination for low-cost, outsourced software and support services. However, the evolution of delivery from India has been swift, resulting in it becoming the **technology and innovation hub for various global organisations**.

1 Availability of key technologies

Disruptions, such as AI, cloud technology, blockchain, automation, IoT, have rapidly shaped an ever-evolving blueprint of how businesses are conducted in India. The digital transformation journey of India has been accelerated by the entry of various category-leading global players in the Indian market. These global behemoths are increasingly adopting digital strategies across business functions, and utilising more sustainable and smarter ways to operate in the Indian market.

2 An unrivalled youth population

India ranks as one of the highest in the world in terms of the number of students graduating in science and engineering fields². The increased pool of graduates coupled with a maturing talent ecosystem is helping the growth of digital talent pool in the country despite the talent churn.³

3 Encouraging regulatory environment

The Indian Government provides a three-year tax holiday in a block of seven years to encourage entrepreneurship. In addition, financial support for startups through schemes, such as Credit Linked Capital Subsidy for Technology Upgradation (CLCSS), which provides interest subsidy of 15 percent for a technology investment of up to 10 million⁴, is also provided. Other tax breaks and benefits for micro and small enterprises have also been introduced.

4 Startup and R&D ecosystem

India is recognised for fostering a progressive startup environment. The innovation, entrepreneurship, and technology ecosystem has significantly matured in the country, with India gaining the distinction of being the third largest startup ecosystem with over 25000-26000 total Indian tech startups founded between 2011-21 and one of the fastest growing unicorn ecosystems. This has created a diverse product-centric and technology-focused ecosystem.⁵

³ <https://www.weforum.org/agenda/2019/10/india-technology-development-silicon-valley/>

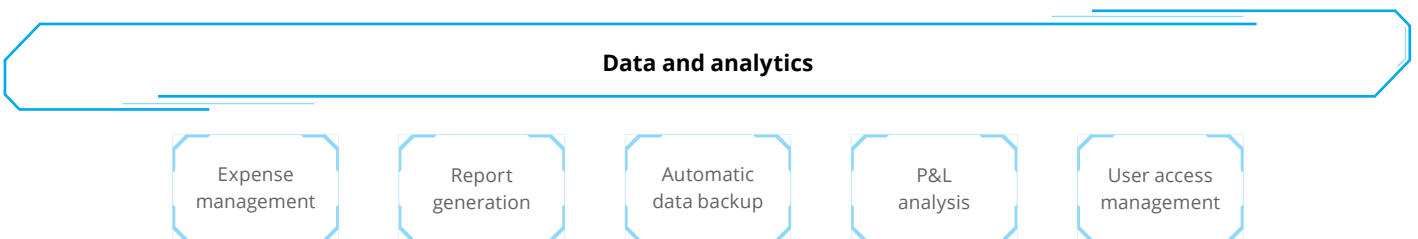
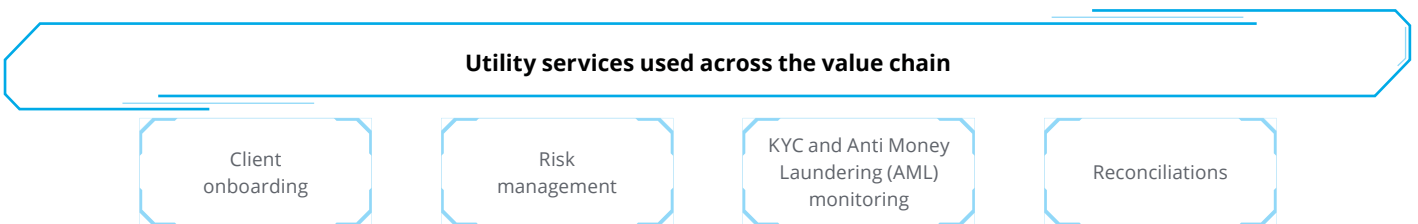
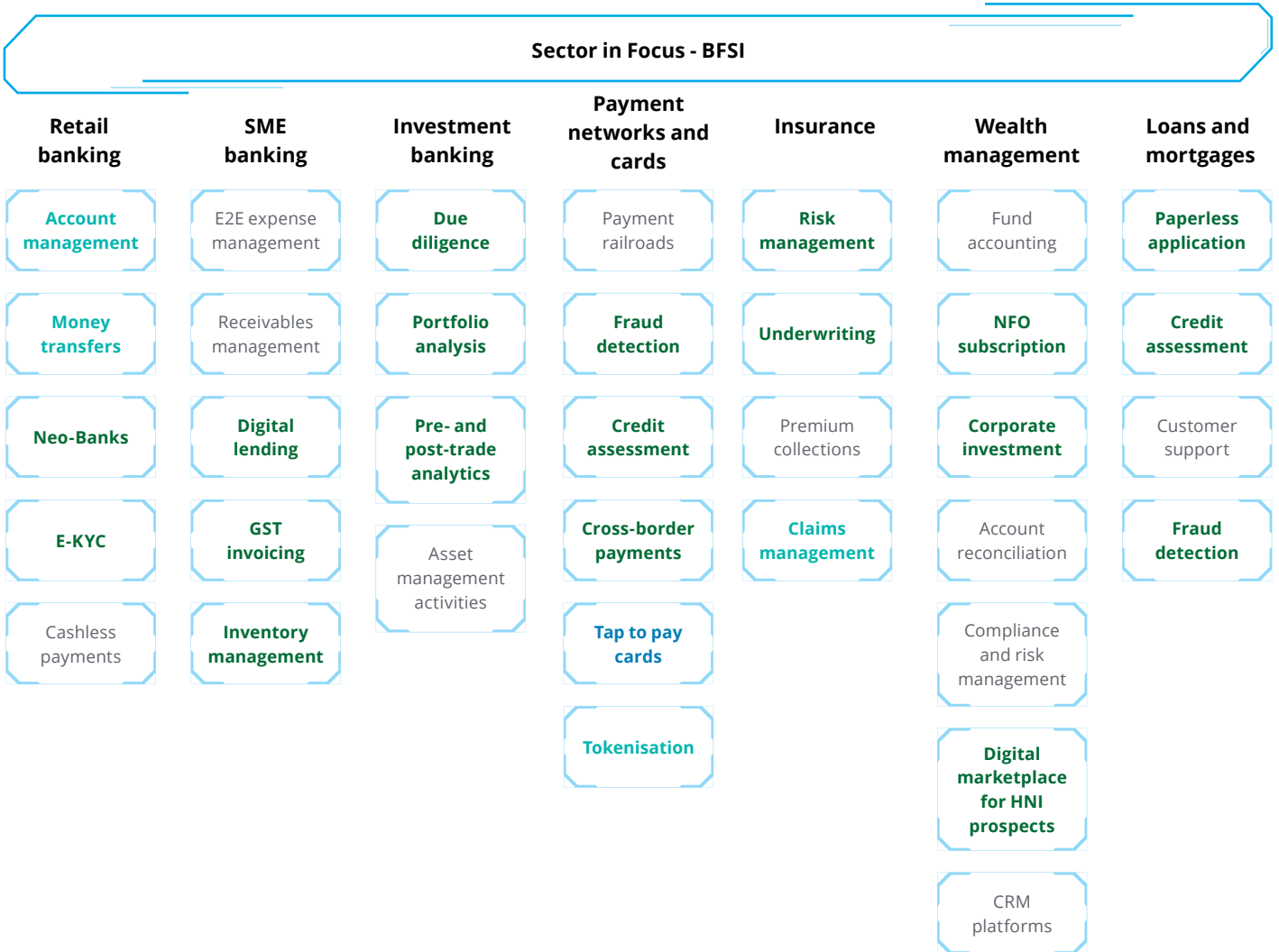
⁴ <https://www.indiaonlinepages.com/population/india-current-population.html>

⁵ NASSCOM Indian Tech Startup Ecosystem - Year of the Titans (2021)



Sector in Focus: Banking,
Financial Services and
Insurance sector

Digital engineering footprint is observed across the BFSI value chain



Examples of DE

■ Hardware engineering
 ■ Software engineering
 ■ Hybrid engineering

■ Activities listed in black either do not have evidence of Digital Engineering, or are outside the purview of this report

Growth in the sector can be seen across four unique themes

Growth themes		
	Description	Indicative application areas/use cases
 <p>Intelligent middleware</p> <p>01</p>	<p>Smart algorithms and new-age technologies are being used by companies to provide intelligent middle- and back-office services, such as risk management and secured payments.</p>	<ul style="list-style-type: none"> • Processing Letters of Credit (LCs) and cross-border payments by using blockchain • Assessing credit scores and likely default rates in insurance using AI-based algorithms • Modelling complex customer profiles for enhanced pricing accuracy by using predictive analysis
 <p>Next-gen banking</p> <p>02</p>	<p>Traditional banking operations are being augmented with online financial services for retail and SME customers.</p>	<ul style="list-style-type: none"> • Banking services through mobile apps by digital banks • Financial services, such as digital lending, receivables management, and traditional banking by neobanks • Touchless banking using AI, speech, and image recognition in bank branches (for loan applications, assessing credit card options or getting the latest rates on various deposits)
 <p>Digital marketplace</p> <p>03</p>	<p>Digital marketplaces provide a one-stop platform with aggregated offerings, including wealth management and insurance services, and are witnessing greater demand due to availability of better choices and better matching of customer needs.</p>	<ul style="list-style-type: none"> • Financial planning services to consumers through robo-advisors • Zero-paper loan disbursement process through platforms • Wealth management platforms, portfolio management services provide New Fund Offer (NFO) subscriptions for High Net-worth Individuals (HNI) investors and aggregating investment options for easy comparisons
 <p>Hardware in BFSI</p> <p>04</p>	<p>Smart devices are gaining popularity in the BFSI sector for relaying continuous and high-quality data to enable faster and accurate decisions.</p>	<ul style="list-style-type: none"> • Tracking telemetry data to aid in insurance claims decisions by using IoT devices • Remote property estimations and analysis by using drones and advanced imaging technology

Smart algorithms and new-age technology to provide intelligent middle- and back-office services

Use cases

01



Intelligent middleware





End users

Banking institutions, insurance providers

	Description
Digital contracts	Blockchain technology helps set up a secure environment in cross-border payments and issuance of LC. The blockchain network is an incorruptible digital ledger with a shared database, including digital signatures from designated parties in the transaction with transparency that helps in binding contracts.
Smart risk profiling for insurance	Insurance companies are using smart algorithms powered by AI to predict default rates for customers by tracking historical transactions of the client to predict future outcomes.
Data security for sensitive card details	Data pseudonymisation provides additional security to Personal Identifiable Information (PII) of customers by masking sensitive information, such as card details. Storage of such information has also been centralised/ limited to a few payment network providers.
Intelligent underwriting	Intelligent underwriting workflows ingest complex documents, summarise profiles, and provide recommendations on risk profiles to enable more strategic decision making in underwriting loans.






A Closer Look: Intelligent Middleware

Use cases	Description	Benefits	Core technologies
<p>SBI</p> <p>Kotak Mahindra Bank</p> <p>AXIS Bank</p> <p>ICICI Bank</p>	<p>Indian Banks' Blockchain Infrastructure Company Private Limited⁶ is a consortium of 15 banks including SBI, ICICI, Kotak Mahindra, Axis Bank. The consortium aims to use blockchain technology to solve multiple issues that exist with the issuance of LC.</p> <ul style="list-style-type: none"> • Issues range from data entry errors, transaction authentication errors, to fraud • Blockchain technology will reduce errors in capturing data by creating a LC request through the data fed in by the requestor, making it tamper-proof. • The time involved in credit appraisal reduces due to the digital transfer of the LC request from the beneficiary to the advising bank. The advising bank receives and advises the LC to the beneficiary. • On acceptance, the beneficiary sets up a digital contract between the two parties. 	<ul style="list-style-type: none"> • Error-free transaction • Fraud prevention • Increased speed of operation 	 Blockchain
<p>MasterCard</p> <p>VISA</p> <p>RuPay</p>	<p>Based on a recent directive by the Reserve Bank of India, payment aggregators, online merchants, and wallets have removed sensitive card-related customer information, including full card details from cloud storage. Card networks, such as Visa, Mastercard, American Express, and RuPay will store these card details on their platforms using a pseudonymisation technique⁷ that masks user card details as random numbers.⁸ This provides protection of PII data of the customer. Furthermore, the consolidation of the data to a few payment aggregators provides additional protection against fraudulent websites capturing this information.</p>	<ul style="list-style-type: none"> • Enhanced data security 	 Pseudonymisation

⁶ [https://bfsi.economictimes.indiatimes.com/news/banking/how-indian-banks-are-leveraging-blockchain-technology/88027231#:~:text=%22State%20Bank%20of%20India%20\(SBI,for%20providing%20various%20financial%20services.](https://bfsi.economictimes.indiatimes.com/news/banking/how-indian-banks-are-leveraging-blockchain-technology/88027231#:~:text=%22State%20Bank%20of%20India%20(SBI,for%20providing%20various%20financial%20services.)

⁷ grcworldforums.com/data-management/data-masking-anonymisation-or-pseudonymisation/12.article

⁸ <https://www.thehansindia.com/business/payment-aggregators-gateways-merchants-not-allowed-to-store-customer-data-from-july-1-743910>


Use cases	Description	Benefits	Core technologies
TransUnion CIBIL	TransUnion CIBIL has a credit scoring model ⁹ that provides predictive insights into customer risk behaviour enabling loan providers to take strategic decisions. The CIBIL score predicts whether a potential borrower is likely to default based on borrower’s history.	<ul style="list-style-type: none"> Better decision making 	 AI
Cognizant	Intelligent underwriting tools provide use case summaries to allow quick and easy review of insurance applications. ¹⁰ OCR technology reads complex documents and assembles them into consistently formatted files.	<ul style="list-style-type: none"> Increased speed of operation 	 AI
ARTIVATIC	Natural language processing aids in organising and extracting data from the source documents and ML models interpret and assign scores to identify promising cases.	<ul style="list-style-type: none"> Provided strategic insights into underwriting use cases 	 Image processing

Source: Deloitte analysis, company websites, secondary public sources

Banks move beyond brick-and-mortar establishments to provide online services

Use cases

02  **Next-gen banking**




 **End users**
Retail customers, small and medium enterprise

	Description
Digital banks	With smartphones and internet penetration becoming ubiquitous, all major banks in India have a mobile app catering to digital banking services, providing value added services in addition to traditional banking services. Services include multi-lingual support, automation of recurring payments, controls on spend, and remote blocking & unblocking of cards.
Neobanks	Neobanks are a mobile app for digital banking, providing value-added services to retail customers and small and medium enterprises. These offerings go beyond traditional services and include innovative products and services, such as three-in-one cards, receivables management, and transaction analysis.
People-less banking	Banks use AI-powered devices in branch operations to support customers in this form of new-age banking. Services are provided without human intervention through the help of virtual customer care executives that provide tailored solutions based on customer needs.

⁹ <https://www.transunioncibil.com/product/cibil-score#:~:text=India's%20first%20credit%20scoring%20model,in%20the%20next%2012%20months.>

¹⁰ <https://artivatic.ai/>

A Closer Look: Next-gen banking

Use cases	Description	Benefits	Core technologies
<p>HDFC Bank</p> <p>ICICI Bank</p> <p>AXIS Bank</p>	<p>Banking mobile applications have digitised and automated traditional banking services. Apart from regular services, some of the other features provided are as follows:</p> <ul style="list-style-type: none"> HDFC’s app provides a customisable quick access menu where users can avail their most frequently used services.¹¹ The app is also available in Hindi. iMobile by ICICI allows users to locate ICICI Bank ATMs, check loan eligibility, and avail instant personal loans against their credit cards.¹² Axis Bank’s app allows users to schedule credit card payments, convert credit card payments to EMIs, block and replace cards, and set limits on debit card usage.¹³ Users can also set up directly, and request auto payments of utility bills through the app, send emails and tweet feedback directly and request calls from a support executive. 	<ul style="list-style-type: none"> Heightened customer convenience through a completely digital experience Elevated customer experience through value added services 	 Digital platforms
<p>Payzello</p> <p>Khatabook</p>	<p>Neobanks provide financial services to both retail customers and small and medium enterprises. Innovative offerings include the following examples:</p> <ul style="list-style-type: none"> Payzello offers smart banking cards that come with security features that allow users to lock and unlock the card in scenarios where they misplace the physical asset.¹⁴ The three-in-one card is a combination of debit, credit, and forex capabilities that allows users to switch between them based on requirements. Khatabook provides financial services to merchants and the app is available in more than 10 languages.¹⁵ Merchants can generate debit and credit reports, set up automatic payment reminders, and receive 24*7 multilingual support. It also provides a QR code that allows merchants to send payment links and receive timely payments with 0 percent transaction fees. 	<ul style="list-style-type: none"> Additional security and convenience to customers through new innovative offerings Ease of adoption through multilingual support Value added services easing SME operations 	 IoT  Digital platforms


¹¹ <https://www.hdfcbank.com/personal/ways-to-bank/mobilebanking/hdfc-bank-mobilebanking-app>

¹² <https://www.icicibank.com/imobilecampaign/index.html>


¹³ <https://www.axisbank.com/make-payments/credit-card-bill-payments/pay-your-credit-card-bills>


¹⁴ <https://www.fintechfutures.com/2020/11/indian-start-up-payzello-combines-debit-credit-and-forex-into-one-card/>


¹⁵ <https://khatabook.com/blog/khatabook-app-features/>


Use cases	Description	Benefits	Core technologies
RBL Bank	<p>RBL makes use of smart screens to greet and serve customers on services, such as loan application and credit card assessments.</p> <ul style="list-style-type: none"> Through hand gestures, a customer can navigate the smart screen and select required services using this self-service model. A camera mounted on the smart screen uses image processing technology, studies facial expressions to gauge interest levels, and recommends offerings based on reactions provided by users.¹⁶ 	<ul style="list-style-type: none"> Elevated user experience through AI-driven services 	 AI


Source: Deloitte analysis, company websites, secondary public sources




Spotlight¹⁷







Customer challenge

The client wanted to automate the manual regression testing of ATMs/kiosks, which requires significant time and effort.

Solution

TCS created **intelligent AI operations** to read, understand, decode the test cases and create an actionable plan in which every step could be executed through the robots.

It **automated regression testing** by using Cognitive Test Automation Framework (CTAF), which enables the physical robot with a vision to view and recognise the device under test.

Impact

- Reduced the overall cost by 85 percent compared with manual testing
- Six times increase in throughput
- 50 percent reduction in testing cycle time
- Achieved ROI within 1.5 years

¹⁶ <https://indiaai.gov.in/case-study/rbl-bank-uses-ai>

¹⁷ Spotlight company challenges and solutions are based on primary discussions

Digital marketplaces witness greater demand due to availability of aggregated offerings and customised plans

Use cases

03



Digital marketplace




End users



Retail customers, small and medium enterprise

	Description
Robo-advisors	Robo-advisors are software products that assist in managing investments without the input of a financial manager. The software uses an algorithm that drives financial planning services with almost zero human supervision. Users can access this digital wealth management platform through web-connected devices.
Zero-paper loan disbursement process	Digital platforms have enabled online loan disbursement through a zero-paper process. Using e-verification procedures and online application submissions, loans are processed and disbursed through online banking and financial service providers.
Wealth management platforms, portfolio management services	Wealth management platforms provide NFO subscriptions HNI investors and aggregate investment options for easy comparisons, thus providing analysis across investment portfolio, enabling HNI investors to take informed decisions.

A Closer Look: Digital Marketplace

Use cases	Description	Benefits	Core technologies
Scripbox	<p>Robo-advisors such as Scripbox offer risk profiling and goal-based insights to their customers based on personal investment targets.¹⁸</p> <ul style="list-style-type: none"> • Scripbox provides portfolio analysis of user holdings to gauge portfolio health and provides recommendations to optimise the portfolio. • It also offers thematic portfolios designed according to sectors or investment philosophies. 	<ul style="list-style-type: none"> • Better decision-making enabled by AI-powered recommendations • Comprehensive view of funds in a single place 	 AI

¹⁸ <https://scripbox.com/blog/algorithmic-or-human-based-advice-what-works/>

Use cases	Description	Benefits	Core technologies
Fullerton India	<p>Fullerton India is one of the many lenders who provide a zero-paper loan disbursement process.¹⁹</p> <ul style="list-style-type: none"> • The requestor can determine the maximum loan amount they are eligible for using a personal loan eligibility calculator. • The requestor then files an online loan application and submits documents for e-verification to close the process. 	<ul style="list-style-type: none"> • Increased speed of operations • Reduced error due to a completely digital process 	 Connected systems
Paytm Money	<p>Paytm Money has launched PMS Marketplace for HNI Investors in partnership with PMS Bazaar, a Portfolio Management Services (PMS) advisory startup.²⁰</p> <ul style="list-style-type: none"> • The marketplace offers key parameters for each scheme, such as total assets, inception date, benchmark and fund manager details, performance across history, and against benchmarks. • HNI investors can reach out to fund managers available through the platform for investment advice. • The marketplace uses data to provide a 360-degree view under one roof. 	<ul style="list-style-type: none"> • Better decision-making enabled by fund analysis • Comprehensive view of funds in a single place 	 Digital platforms

Source: Deloitte analysis, company websites, secondary public sources

¹⁹ <https://www.fullertonindia.com/personal-loan-disbursement.aspx>

²⁰ <https://www.thehindubusinessline.com/markets/stock-markets/paytm-money-launches-portfolio-management-services-marketplace-for-hni-investors/article37820096.ece>

Spotlight²¹



Customer challenge

The client wanted an omnichannel money transfer platform.



Solution

HCL developed a **digital platform** to provide an omnichannel, cross-border, cross-currency money movement experience. HCL implemented DevOps with open-source tools for reduction in time-to-production. The platform integrates with mobile, web and retail partners and third-party digital platforms (wallets) to enable external payment across geographies.



Impact

- Highly rated app
- Reduced time-to-market, three times frequency of global roll outs (40+ roll outs)
- Reduction in cost, 28 percent increase in customer registrations and more than 5 million new app downloads

Smart devices in the sector enable faster and accurate decisions

Use cases

04

Hardware in BFSI






End users
Insurance providers

Description	
Telematics	Usage-based Insurance (UBI) adjusts the payable premium for a policy based on the usage of the insured product or service. In auto insurance, UBI is referred to as telematics, which is an amalgamation of telecommunication and informatics. Telematics tracks, stores, and transfers driving related data to understand the driving behaviour and model customised pricing based on driver profiles.
Drones in insurance claim settlement	Usage of imaging technology, high-quality images enable accurate assessments and help in fraud mitigation. Drones can also access locations affected by natural disasters where human access is difficult, thus reducing travel time to affected sites and overall risk for the insurer.

²¹ Spotlight company challenges and solutions are based on primary discussions

A Closer Look: Hardware in BFSI

Use cases	Description	Benefits	Core technologies
Leading Insurance Company	<p>Leading insurance company provides 'Drive Smart' that fixes vehicle insurance price during policy renewals based on usage details.²²</p> <ul style="list-style-type: none"> A 'DriveSmart' device installed in the vehicle transmits driving summary and driving patterns, including over speeding, changing gears incorrectly, and rash driving. Statistics provided will include time spent in driving, distance travelled, likely fuel consumption, and amount saved through good driving practices. A one-touch call feature allows users to call for support in the event of an emergency or a breakdown. 	<ul style="list-style-type: none"> Promoted safe driving practices Lowered premium for risk-averse drivers as compared with risk-taking drivers 	 IoT  Drones
Agricultural Insurance Company of India Limited	<p>Technology integration in crop insurance is being strongly promoted by the Government of India.</p> <ul style="list-style-type: none"> According to the Union Budget of 2022, Kisan Drones will be used to provide crop assessments, which are already deployed to serve other agricultural needs. The Agricultural Insurance Company of India Limited is exploring this option.²³ Agricultural insurance sectors use drones for efficient and trustworthy data. They capture the damages that have occurred for the right estimation of monetary payback to the farmers in a shorter time span. Imaging technology in drones enhances the accuracy of claims in calamity situations where human intervention is not possible. 	<ul style="list-style-type: none"> Increased speed of claims settlement Increased accuracy in claims settlement 	 Image processing

Source: Deloitte analysis, company websites, secondary public sources

²² Company website

²³ <https://timesofindia.indiatimes.com/business/india-business/farming-gets-hi-tech-sauce-kisan-drones-set-for-takeoff/articleshow/89284749.cms>



Spotlight²⁴



Customer challenge

AXA was looking to reduce the manual effort in authentication and estimation of settlement claims.



Solution

Insurance products are becoming increasingly modular, covering specific risks that the customer is exposed to. Aside from automating the claims processing activity, AXA uses drone technology and computer vision to determine the authenticity of claims in large risk/calamity situations. The India GCC is working on training the model through image labelling and maintaining the algorithms in production.



Impact

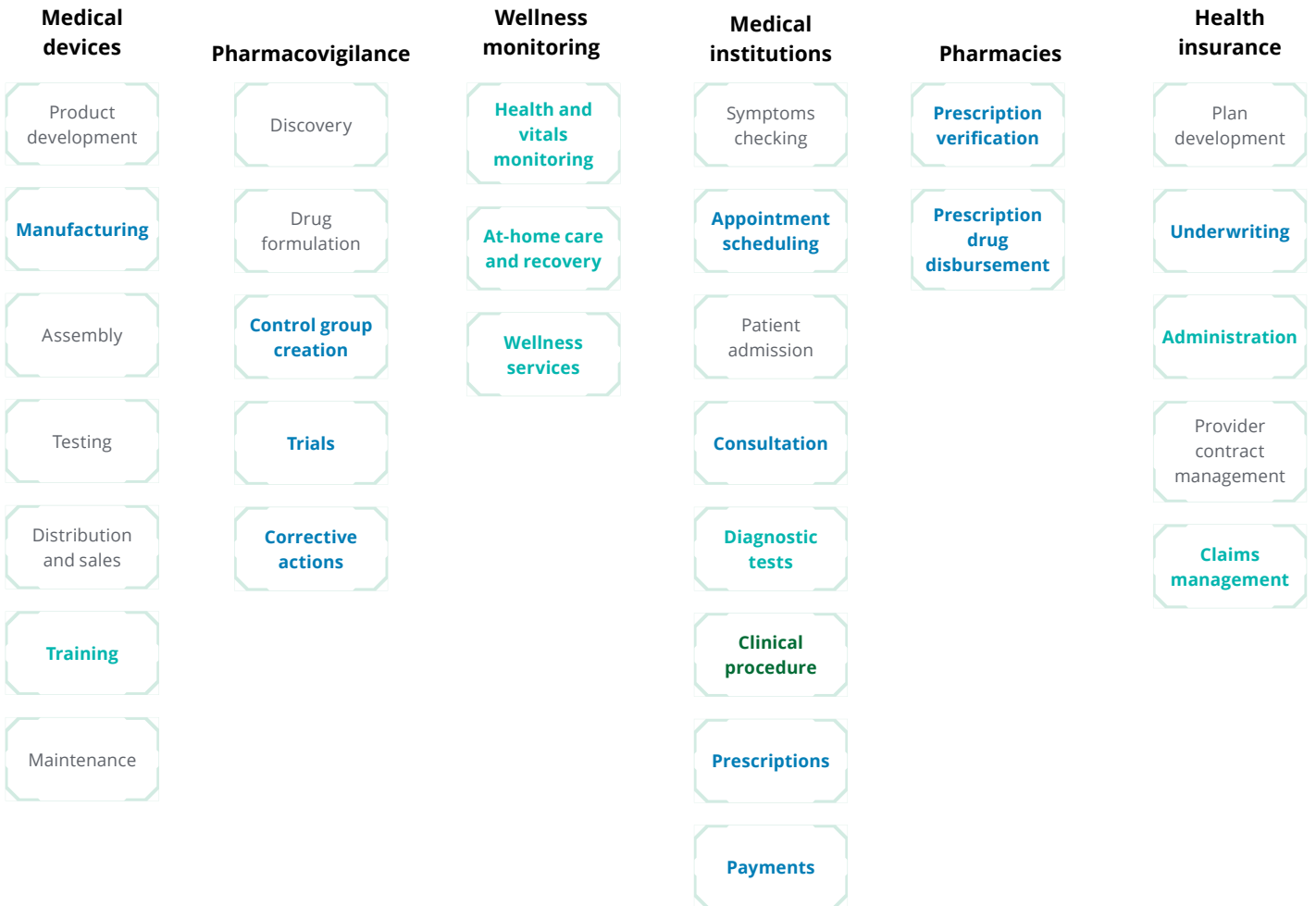
- Improved internal processes by automating time-consuming tasks
- Increased speed and accuracy of claims' settlement

²⁴ Spotlight company challenges and solutions are based on primary discussions



Sector in Focus: Health care

Health care is expected to continue to be one of the top segments driving growth in DE



Data and analytics



Examples of DE

- Hardware engineering
- Software engineering
- Hybrid engineering

■ Activities listed in black either do not have evidence of Digital Engineering, or are outside the purview of this report

Growth in the sector can be seen across three unique themes



Growth themes



Medical manufacturing

01

Growth themes

Description

Medical manufacturers are utilising additive manufacturing and robotics to build medical devices that assist in surgical procedures and bio-print human organs.

Indicative application areas/use cases

- Additive manufacturing of **surgical devices, surgical guides, and custom aids**
- **Personalised surgical planning based on patient anatomy** by using robotic arms for surgeries
- **Bioprinted organs**, tissues, surgical implants
- Training workers involved in medical device manufacturing using AR-based solutions



Hospitals of the future

02

Growth themes

Medical institutions use IoT and AI/ML to deliver remote care and monitoring services.

- **Tracking health indicators** using smart wearables
- **Tracking vitals** through remote home monitoring devices
- Remote care solutions in hospitals that **trigger alarms during critical readings**
- **Medical diagnosis, decision making, and administrative activities** using AI-based solutions
- **Health insurance plan selection** in a VR environment



Connected health

03

Growth themes

Connected health has become ubiquitous with a gamut of offerings across the entire patient lifecycle.

- **Bridging the gap between health care providers and patients** through teleconsultation and e-diagnostic services on digital medical platforms
- **Error-free and verified medicine disbursements** through digital prescriptions
- **Delivery of prescription drugs to a patient's doorstep** through connected pharmacies

Medical manufacturers use additive manufacturing and robotics to build medical devices for assistance in surgical procedures and bioprinting human organs

Use cases

01



Medical manufacturing






End users

Surgeons, medical researchers, testing

Description

Additive manufacturing	3D printing of surgical devices, surgical guides, and custom aids provide surgeons a superior operating experience with heightened performance and better patient outcomes. Surgical guides based on individual patient anatomy help in performing precise incisions. 3D printed models assist surgeons in pre-operative planning by allowing them to simulate the procedure before operating on the patient.
Robotic aids	Smart robotics capture 3D visualisations of Computed Tomography (CT) scans of a patient's anatomy to aid surgeons in creating a customised operating plan. A guidance system using haptic technology directs surgeons on drillings per requirements, such as preserving soft tissues or saving healthy bones.
Bioprinting	Bioprinting is an additive manufacturing process that uses a digital file as a design to print an object layer by layer using cells and biomaterials. Digital files are based on CT and Magnetic Resonance Imaging (MRI) scans that act as an input to the printer. The bioprinter has a cell-laden bio-ink cartridge that prints the structure based on the design. Post printing, the structure is treated with UV or ionic solutions to stabilise them. Organs, tissues, and implants bioprinted using 3D printing technologies aid in regenerative operations.
Biosensors	Biosensors are the most important component in most of the point-of-contact diagnostic devices. The biosensor detects and analyses with the help of a detector based on physicochemical reactions that are recognised by a biorecognition element and transformed into a readable signal.
AR-based solutions	Augmented Reality (AR) finds relevance in the shop floor to train workers. The technology is being used in cross-training shop floor workers to help them manufacture medical devices that demand specialised skillsets and greater precision. Design steps are captured digitally and relayed through hardware, which provides an immersive training and guidance experience to new employees at a lower cost. Virtual simulations help in achieving faster training completion rates as they can be repeated multiple times in a shorter time.



A Closer Look: Medical Manufacturing

Use cases	Description	Benefits	Core technologies
Next big innovation labs	<ul style="list-style-type: none"> Trevima is a customisable 3D bioprinter that allows the use of a variety of biomaterials and cell types due to the customisation feature of the product such as nozzle diameters, speed of printing, and automation. Innoskin HE, a 3D bioprinted human epidermis developed by NBIL is used for pharmaceutical, cosmetic, and chemical testing purposes. The product is expected to provide alternatives in testing material in chemical and cosmetic formulations, reduce operational costs of gathering testing material and ensure integrity in the structure of the testing material.²⁵ 	<ul style="list-style-type: none"> Reduced testing material costs 	 3D printing
Stryker	<p>The SmartRobotics™ system, MAKO, developed by Stryker, provides CT-based 3D modeling pre-operative planning features. These features allow surgeons to preplan a patient's implant position while considering the patient's individual anatomy. Surgeons can visualise the bone, joints, tissues, and component relationship to detect the risk of potential impingement. A robotic arm powered by haptic technology uses this customised plan to guide surgeons to perform precision drillings.²⁶</p>	<ul style="list-style-type: none"> Customised solutions for patients through precise planning and accurate drilling leads to better outcomes 	 3D printing
Roche	<p>Point-of-Care (POC) diagnostic devices developed by Roche Diagnostics India have aided in the early detection of coronary heart disease and checking cholesterol levels. These portable point of care systems support spot diagnosis, assessment and monitoring of a patient's condition through biosensing. A cassette with a patient's blood sample is fed into the device, which analyses the data and provides a near instant diagnosis.²⁷</p>	<ul style="list-style-type: none"> Low-cost diagnosis Rapid turnaround of test results 	 Biosensors

²⁵ <https://nextbiglab.com/innoskin/>

²⁶ https://www.stryker.com/us/en/joint-replacement/systems/Mako_SmartRobotics_Overview.html

²⁷ https://diagnostics.roche.com/in/en_gb/about/about-roche-diagnostics-india.html

Use cases	Description	Benefits	Core technologies
US-based software company	<p>Vuforia Expert Capture AR technology alongside Leading cloud computing company's product presents crucial assembly steps and processes involved in building Rapidly Manufactured Ventilator Systems (RMVS). This is transferred, edited, and relayed through wearable equipment to the shop floor workers and not the traditional medical device manufacturers. This reduces training lead times and avoids potential transmission of COVID-19 by placing 'virtual' smiths on the shop floor.²⁸</p>	<ul style="list-style-type: none"> • Reduced training costs • Expedited training • Ensures higher employee safety 	 AR/VR
ANATOMIZ 3D	<p>Predesigned surgical guides based onto the patient's anatomy and 3D printed for surgery help surgeons perform precise incisions and bone drillings at pre-defined locations and angles.²⁹</p>	<ul style="list-style-type: none"> • Reduced operating time • Reduced cost of surgeries • Better patient outcomes 	 3D printing

Source: Deloitte analysis, company websites, secondary public sources

²⁸ <https://businesscloud.co.uk/news/augmented-reality-vital-role-in-ventilator-production-push/>

²⁹ <https://anatomiz3d.com/>

Spotlight³⁰



Customer challenge

More comprehensive information can lead to better patient outcomes. However, accessing siloed patient data across health care enterprises is a challenge, and the cost of integrating the data increases as enterprises grow. Also, while radiologists are overwhelmed by the growing number of patients, the increasing demand for imaging, and explosion in the volume of imaging data, their time is consumed by complicated routine reading tasks and manual workflow steps combined with complex navigation across tools with inconsistent user experience. Further, to generate reports, radiologists need to manually extract and aggregate data from multiple tools, which is time consuming, inefficient, and error prone. **Reducing effort is key** to optimise radiology service delivery.



Solution

Siemens Healthineers developed an **Outcome-Driven Imaging and Information System**, which is a future-proof, data-driven imaging and IT system that drives the best possible outcomes for patients. The system provides one place where data can be turned into knowledge to enable better patient outcomes by managing data around patients, not departments. In typical clinical pathways, patients have several touch points with different clinical departments. To make the correct diagnosis and therapy decision, it is essential that the patient data remains open and always accessible from one spot.



Impact

- **Clinicians:** Simplified workflows make data more manageable, so clinicians benefit from more knowledge without the fear of more data.
- **IT:** Lower total cost of ownership by reducing the complexity of the IT landscape with fewer servers and no translation tools.
- **Patients:** Get the most transparent and comprehensive treatment available.

³⁰ Spotlight company challenges and solutions are based on primary discussions



Spotlight³¹



Customer challenge

The customer wanted to improve bio-vaccine production efficiency and throughput.



Solution

Tech Mahindra built a plant process digital twin to monitor real-time status of the vaccine production across three stages and predict quality deviation so that timely corrective action is taken.



Impact

- Reduce batch rejection and improve throughput from 30 percent originally to 80 percent.



³¹ Spotlight company challenges and solutions are based on primary discussions

Medical institutions make use of Internet of Things and Artificial Intelligence/ Machine Learning to deliver remote care and monitoring services

Use cases

02



Hospitals of the future



End users

Fitness enthusiasts, medical institutions, patients, insurance seekers

Description

Smart wearables

Smart devices have gained traction in the fitness and wellness verticals, with applications ranging from vital monitoring, personal care to recreational activities, such as sports. Smart wearables track vitals, sleep cycles, physical activity, and relay data to a mobile application. The applications interpret the input data using ML algorithms to recommend changes to regular activities for improved performance and health.

Remote home monitoring devices

Remote monitoring devices **for at-home patient care** have seen rising growth in a post-pandemic world. Coupled with AI, these IoT devices track vitals, relay them on a platform that is monitored remotely, and alert care providers on adverse symptoms.




Remote care solutions

Remote care solutions **at medical institutions provide ICU-like care** through light-weight portable devices that track vitals of patients round the clock, feed data to a platform monitored by doctors, and alerts in cases of adverse health patterns. Moreover, predictive analytics can alert doctors of the potential health complications when vitals replicate patterns of historical illnesses.

VR customer experience

VR platforms of health insurance providers deliver an immersive experience to customers allowing them to navigate through offerings and select customised solutions.

A Closer Look: Hospitals of the Future


Use cases	Description	Benefits	Core technologies
Leading Medical Device Manufacturer	Leading medical device manufacturer specialises in remote at-home care. With a partnership with American Megatrends India Pvt. Ltd, the company makes use of B.O.L.T. – a portable health monitoring device to collect health statistics ranging from blood pressure to temperature from at-home patients. The data is used to design customised treatment plans and alert the care provider during scenarios of spikes in vitals. The care provider monitors this data over an app on a real-time basis and proactively intervenes in case of deteriorating health signs. ³²	<ul style="list-style-type: none"> Monitors real-time vitals Provides preventive health care Provides at-home care 	 IoT
India-based health care service provider	The Remote Monitoring System, an IoT vitals monitoring platform , empowers doctors to continuously monitor a patient’s vital signs, such as the seven-lead ECG, heart rate, respiratory rate, pulse rate, SpO2, non-invasive blood pressure, and posture. Working in the Chest Sensor, Bedside Monitor, and Central Station Monitor provide ICU-like care to the patient in a non-ICU setup. Through the continuous monitoring of vitals, the device increases patient safety by sending an alert to doctors and nurses about changes in a patient physiological status even in the absence of the clinical team in the patient’s room. ³³	<ul style="list-style-type: none"> Real-time vitals monitoring Provides preventive health care 	 IoT
PNB MetLife	With the help of a VR Headset, customers can use conVRse, an experiential VR platform , to enter a 3D simulated room. In this virtual setup the customer interacts with a virtual insurance manager called ‘Khushi’ assisting clients to browse, assess, customise, and select insurance plans, manage claims, and provide other services in the spectrum of insurance. The platform is built in collaboration between MetLife’s Singapore based incubation hub and PNB MetLife in India. ³⁴	<ul style="list-style-type: none"> Enables superior customer experience 	 AR/VR

Source: Deloitte analysis, company websites, secondary public sources

³² Company website

³³ Company website

³⁴ <https://cio.economictimes.indiatimes.com/news/corporate-news/how-pnb-metlife-leverages-virtual-reality-based-convrse-platform-to-improve-customer-services/57042367>

Use cases	Description	Benefits	Core technologies
Leading Smart Wearable Manufacturing Company"	Smart wearables are growing in popularity, especially with fitness enthusiasts. Smart watches help stay connected through texts, calls, reminders, and alarms. These devices are also equipped with gender-specific functionalities, such as a menstrual tracker for women taking personal care beyond regular workouts. ³⁵	<ul style="list-style-type: none"> Monitors real-time health Connected devices provide value added services 	 IoT

Source: Deloitte analysis, company websites, secondary public sources




Spotlight³⁶



Customer challenge

The client lacked a vendor-agnostic, connected device platform for the ease of capturing and aggregating patient data. They also faced higher clinical trial subjects dropouts due to lack of remote patient monitoring infrastructure, leading to the inability to scale and onboard larger clinical trial participation.



Solution

TCS developed a scalable clinical trials platform driven by **IoT, wearable devices, and cloud-powered data analytics**. The platform delivers a patient-centric experience while lowering trial costs, and helps in capturing and managing data seamlessly across any clinical environment. The core functionality of the platform is to meet the demands of digital site connectivity and virtual trial engagements.



Impact

- Cost reduction by 60 percent per subject compared with current practice of onsite clinical trial methods
- Integrated 10,000 device units and 500+ providers in the clinical trial ecosystem
- Increased recruitment rate and diversification by making trial participation more convenient
- Redistributable apps and functions enable quick onboarding with infinite scalability

³⁵ Company website

³⁶ Spotlight company challenges and solutions are based on primary discussions



Spotlight³⁷



Customer challenge

A health care client intended to provide clinicians with remote access to data from hemodynamic monitors to improve clinical workflow and response time for critical care.



Solution

Wipro developed a cloud-based remote access platform with centralised secure data exchange to provide end-to-end patient monitoring and insights for critical care. By enabling remote access to non-invasive data from connected hemodynamic data monitors, the platform serves as a supportive visual aid to clinicians and provides visibility across the patient care activities, thus improving communication with peers.



Impact

- Continuous access to patient insights
- Multi-patient view
- Tracking patient's progress through a smartphone

³⁷ Spotlight company challenges and solutions are based on primary discussions

Connected health has become ubiquitous with a gamut of offerings across the patient lifecycle

Use cases

03



Connected health



End users

Safety authorities, health care providers, patients

Description

Intelligent workflows in pharmacovigilance

In pharmacovigilance, case processing is a fundamental activity. It provides data to analyse the adverse effects that allow detection of new safety concerns and periodical assessment of the benefit-to-risk ratio associated with the use of a pharmaceutical product. Intelligent workflows work well in case of management use cases. They ingest hard-copy documents using Optical Character Recognition (OCR), automate routine steps and manual checks to improve accuracy and reduce the processing time.



Digital medical platforms

During the pandemic, telemedicine and wellness apps have risen in popularity, and generated substantial subscription to these services. Telemedicine apps provide scheduling, consultation, and diagnostic services. Wellness apps range from fitness sessions, dietary recommendations, dietician consultations, and food delivery.




Connected pharmacies

E-pharmacies made use of the e-commerce wave to provide verification, sourcing, and delivery services of over-the-counter drugs, prescription medication, and health drinks and supplements. Moreover, value added services, such as prescription verification, alternative suggestions for medicines in cases of stockouts, and diagnostic test bookings are also available through these apps.

A Closer Look: Connected Health

Use cases	Description	Benefits	Core technologies
Oracle	Safety One Intake solution aids safety case management use cases. Designed by Oracle, the platform automatically structures and ingests safety source documents, easing the time taken to create new cases. A smart user interface and algorithm in the platform enables signal evaluators to take more accurate decisions by curtailing false positives. Finally, the case management workflow uses built-in features to automate routine steps and reduce manual work, cutting down processing time. ³⁸	<ul style="list-style-type: none"> • Reduced case ingestion time • Reduced processing time • Evaluation of accurate signals 	 AI  Connected systems

³⁸ <https://www.oracle.com/a/ocom/docs/industries/life-sciences/safety-one-intake-solution-brief.pdf>

Use cases	Description	Benefits	Core technologies
Leading Health and Fitness Company	Digital platforms are bringing the spectrum of personal health and wellbeing to the customer’s living room. From providing workouts, meditation, dietician sessions to delivering healthy meals and selling fitness gear, the “super app” is garnering subscribers post-pandemic. On-app analytics tracks progress, provides performance reports, and establishes badges for milestones achieved, gamifying the fitness journey. Motion technology tracks body movements to calculate the calorie burn and performance during workout sessions. ³⁹	<ul style="list-style-type: none"> • At-home wellness service • Personalised fitness reports 	 Digital platforms
Practo	Teleconsultation is bridging the distance between health care providers and patients through appointment scheduling, teleconsultation, and e-diagnostic services. The Practo app provides diverse teleconsultation services, such as on-call doctors, specialised treatments, general consultations to the booking of lab tests and surgeries, and patients now do not need to visit caregivers. Moreover, with the help of insurance provider partners, the app also allows users to browse and select through multiple health insurance offerings. ⁴⁰	<ul style="list-style-type: none"> • At-home consultation and diagnostics • On-demand caretakers • Digital prescriptions prevent errors in communication 	 Digital platforms
PharmEasy	Through its telemedicine model, PharmEasy has set up connected pharmacies. The app provides on-demand, home delivery access to a wide range of prescription, over-the-counter drugs, and other health care products. Moreover, the app provides prescription consultations with on-call doctors, on dosage, alternative medicines, and verification of prescription legitimacy and services, such as remote lab test bookings. ⁴¹	<ul style="list-style-type: none"> • Prescription verification • At-home medicine delivery 	 Digital platforms

Source: Deloitte analysis, company websites, secondary public sources

³⁹ Company website

⁴⁰ <https://www.practo.com/healthfeed/teleconsult-its-importance-in-daily-life-40994/post>

⁴¹ <https://pharmeasy.in/about-us>



Spotlight⁴²



Customer challenge

The client is a hospital chain situated in an urban location that wanted to increase its reach to rural regions with minimum capital investment on infra.



Solution

Tech Mahindra developed a telehealth platform for teleconsulting and diagnostics:

- Patient portal to search for doctors, book appointments, pay fees, upload medical records, video consultation, and prescription
- Doctor portal to manage schedules, see records, remote consultation, prescribe and refer
- Paramedic portal to support clinical care management process



Impact

- Improve hospital outreach to remote and rural locations
- Improved data accessibility and diagnostics

⁴² Spotlight company challenges and solutions are based on primary discussions



Spotlight⁴³



Customer challenge

The customer wanted a medical data platform.



Solution

CARE is a powerful software framework that has the necessary foundation for building the next-gen medical multi-tenant software/services faster. It can be used to build both edge/gateway applications as well as scalable cloud application. HCL's CARE was the platform of choice for building the medical data platform for the customer. It provides several pre-built functionalities for medical software, rapid development of microservices, and enables cloud automation using softwares, such as Jenkins, Terraform, ARM, and Ansible.



Impact

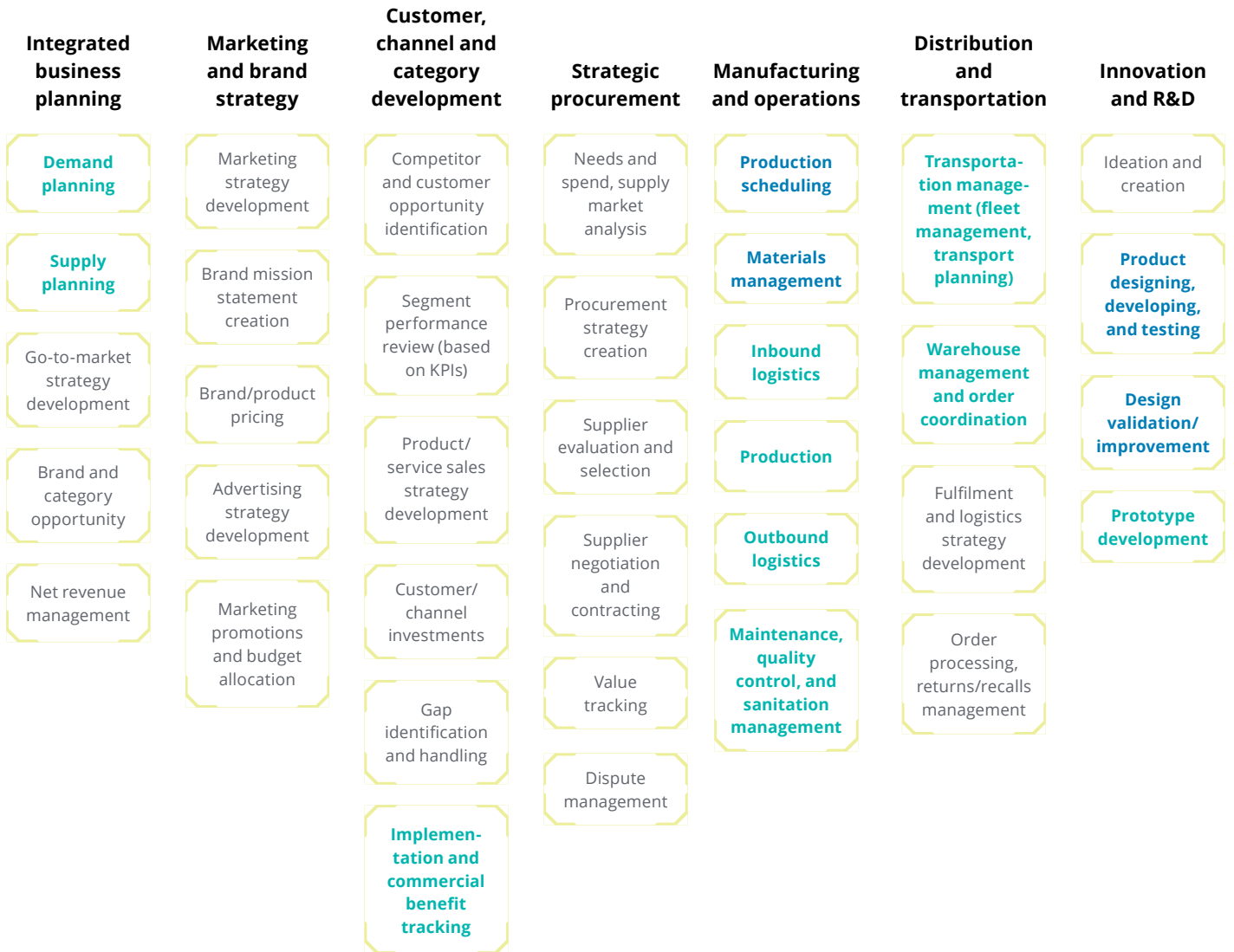
- Resulted in 10 repositories, 60+ microservices, secured vaults, 40-60+ build/release pipelines, and 5 builds per microservices per day
- Reduced Kubernetes management efforts by more than 40 percent; Helm charts increased deployment rate to two times
- Reduced cloud infrastructure cost of pre-production environments by US\$2,500 per month

⁴³ Spotlight company challenges and solutions are based on primary discussions

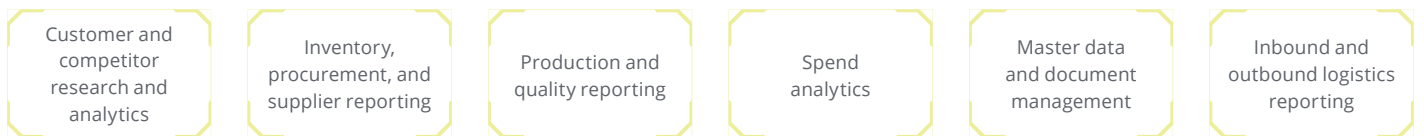


Sector in Focus: Consumer
Packaged Goods/Retail sector

Growing Consumer Packaged Goods and Retail segments in Digital Engineering space



Data and analytics



Examples of digital engineering

- Hardware engineering
- Software engineering
- Hybrid engineering
- Activities listed in black either do not have evidence of Digital Engineering, or are outside the purview of this report

Growth in the sector can be seen across three unique themes



Growth themes



Performance optimisation

01

Description

Companies are increasingly taking advantage of **AI/ML-driven applications**, which brings together data from all parts of the value chain to enable better decision-making using data analytics.

Indicative application areas/use cases

- **Supply chain control tower** – A centralised hub for shipment tracking, inventory visibility, monitoring process compliance
- **Demand prediction** across product segments to ensure smooth procurement and prevent shortages
- **Route planning and order prioritisation** using analytics and AI



Industry 4.0

02

Companies are building smart factories that use connected equipment to optimise efficiency and productivity.

- **Monitoring machine performance** through data collected by IoT sensors and digital twins
- **Predicting and monitoring error patterns by use of big data analytics** to undertake predictive maintenance
- **Producing and material handling** by use of robots
- **Simulations to identify best operational conditions** and optimise materials management
- Adopting additive manufacturing/3D printing to **reduce material wastage and efficiency**



Customer experience and brand recognition

03

Companies are utilising AR and VR to personalise the marketing and sales experience, and also to connect better with customers.

- **Offering more product information** by equipping product packaging with AR features. This also supports a companies' ethical and sustainability initiatives
- **Allowing consumers to virtually experience deeper parts of a brand's identity** through virtual tours by employing VR technology

Harnessing insights from customer behaviour and production helps in advancing end-to-end performance

Use cases

01  **Performance optimisation**  **End users**
Supply chain executives, suppliers, distributors



Description	
Supply Chain Control Tower	<p>Supply chain control towers are designed to provide deeper end-to-end visibility across supply chain starting from procurement of raw materials, logistics, manufacturing, distribution, and finally sales. They often include a central dashboard of data with views into key business metrics and events. Typical examples of supply chain control tower include:</p> <ul style="list-style-type: none"> • Logistics/transportation control towers • Fulfilment control towers • Inventory control towers • Supply assurance control towers • End-to-end supply chain towers

Use cases


01  **Performance optimisation**  **End users**
Strategy and planning teams


Description	
AI-powered demand forecasting	<p>Demand forecasting is traditionally a type of predictive analytics in which the process of projecting client demand is examined using historical data. Using AI, businesses can make use of ML algorithms to predict changes in consumer demand as accurately as possible. These algorithms can recognise patterns, discover complex relationships in massive datasets, and detect demand fluctuations automatically.</p>


A Closer Look: Performance Optimization


Use cases	Description	Benefits	Core technologies
SmartLinks	SmartLinks is a definitive Software as a Service (SaaS) platform for logistics and inventory planning. Acting as a centralised hub, it provides services, such as digitalised documentation, vehicle management, real-time tracking, and financial reconciliation using ML models. It also has provisions for 360-degree dashboard to track relevant business KPIs, which enables informed decision-making process. ⁴⁴	<ul style="list-style-type: none"> • End-to-end visibility across supply chain partners • Early warning alerts and exception management • Predictive and prescriptive decision support 	 AI/ML  IoT


Source: Deloitte analysis, company websites, secondary public sources




Spotlight⁴⁵







Customer challenge

The client was looking for a robust digital data governance system for ensuring data quality and completeness for net-zero emissions management.

Solution

TCS built an end-to-end **carbon management solution** for net-zero pledge from multiple departments– procurement, logistics, processing, packaging, and distribution. The custom solution leveraged components and frameworks of **TCS ENVIROZONE™** with a robust governance system for ensuring data quality and completeness.

Impact

- 10-20 percent reduced carbon footprint and offset costs
- Substantial long-term savings (>US\$100 million)
- Industry-first auditable carbon management system to drive visibility
- GHG data disclosure for geo/suppliers/brands

⁴⁴ <https://www.smartlinkstech.com/saas-platform/>

⁴⁵ Spotlight company challenges and solutions are based on primary discussions



Spotlight⁴⁶



Customer challenge

The client wanted to improve field service operations of geographically distributed beverage dispensers through real-time remote monitoring solution.



Solution

Tech Mahindra enabled beverage dispenser sensorisation (embedding different sensors within a device) and designed cloud-based application to remotely monitor status and diagnose the health of geographically-distributed beverage dispensers. This connected dispenser model additionally monitors the quality and quantity of drink served.



Impact

- Reduced equipment maintenance cost by four times
- Improved the consistency across all dispensers
- Enhanced customer experience



⁴⁶ Spotlight company challenges and solutions are based on primary discussions

Industry 4.0 initiatives lead the innovation charge through applications of new-age technology

Use cases



Industry 4.0






End users

Manufacturing and production teams, shop floor employees, end customer

	Description
ML-powered digital twin	IoT sensors send real-time data about machine run-time, productivity, etc., to a cloud database that feeds a digital twin, a computer-generated model that mirrors the physical operation of each machine. This model is then provided as an input to subsequent AI/ML models which, based on all the above parameters, predict the likelihood of machine breakdown.
Visual inspection AI	Automated Visual Inspection (AVI) solutions are used to detect defects and other irregularities in manufactured products. Deep learning networks are trained with labeled examples of specific types of data to extract common patterns in manufacturing and then leveraged across the supply chain for segregating products that do not follow this theme.
AMRs and Cobots	Autonomous Mobile Robots (AMRs) use IoT sensors to track, interpret, and co-deliver the inventory across the warehouse. The data from IoT sensors regarding inventory levels of various items across the warehouse are fed into AI/ML algorithms, resulting in better demand and supply planning.
3D printing/additive manufacturing for creating rapid prototypes	<p>3D Computer Aided Design (CAD) enables precise and fast fabrication of a physical part, model, or assembly process. This entire process consists of the following two steps:</p> <ul style="list-style-type: none"> • The objects are digitally defined by CAD software, which slices the 3D object into thin layers for precise printing and manufacturing process. • Additive manufacturing uses this smaller slice to direct hardware to deposit material, layer upon layer, in precise geometrical shapes.


A Closer Look: Industry 4.0 - Retail

Use cases	Description	Benefits	Core technologies
IBM	IBM Maximo Visual Inspection and the Maximo Application Suite is used to detect and correct defects in product quality in manufacturing contexts at the edge. It provides intelligent asset management, monitoring, maintenance, and reliability on a single platform. ⁴⁷	<ul style="list-style-type: none"> • Reduced cognitive load for operators, less slippage in defects monitoring • Low effort in starting up • Adapts to product changes • Runs autonomously on-premises 	 AI
IT service provider	IT service provider builds AI-enabled warehouse automation robots for businesses. Its AI-enabled software called GreyMatter integrated into the robots to communicate with other robots, and with the central system, creates continuous feedback between the algorithms in the software and the real-time operations on the floor. The company offers two products - Butler, a fleet of mobile robots for moving materials in the warehouse, and Sorter - a fully automated sortation system to sort and divert outbound packets. ⁴⁸	<ul style="list-style-type: none"> • Increased order accuracy • Increased productivity • Reduced labour cost • Improved employee experience 	 Robotics
Imaginarium	Imaginarium, a Mumbai-based startup , is amongst India's largest rapid prototyping and rapid manufacturing centres, catering to industries such as jewelry, architecture, and consumer goods. It offers complete solutions from 3D-printed prototypes to customised mannequins, tooling, molds, and even low series production of fully functional parts. ⁴⁹	<ul style="list-style-type: none"> • Flexible design • On-demand printing • Reduced labour cost • Minimised waste and time to market 	 3D printing


⁴⁷ <https://www.ibm.com/cloud/architecture/architectures/use-maximo-visual-inspection-to-detect-mfg-defects/>


⁴⁸ Company website


⁴⁹ <https://imaginarium.io/about-us/>


Use cases	Description	Benefits	Core technologies
Leading Cloud Computing Company	The company's Digital Twins IoT platform enables users to create a digital representation of real-world things, places, business processes, and people. By taking advantage of AI/ML and data analytics, end users can gain insights about the various bottlenecks in production process, areas where the process can be optimised, and the maximum capacity at which machines can be operated to prevent breakdowns. ⁵⁰	<ul style="list-style-type: none"> • Reduced risk of accidents • Helped businesses predict uncertainties • Incorporated AI/ML and IoT to speed up the production process • Cost-effective and helped plan better products through stimulations 	 Digital twins


Source: Deloitte analysis, company websites, secondary public sources




Spotlight⁵¹







Customer challenge

The client wanted to improve the productivity of the babycare line by optimising the FTE count and automate the existing manual process to eliminate errors due to manual handling of raw materials.

Solution

TCS in partnership with TEAL (Titan Engineering and Automation Ltd), designed, developed, manufactured, tested, and deployed a smart machine with an **automated cobot** for pick and place system, rotary folding, vacuum folding and controlled drop system to automate the existing process.

Impact

- Cost savings of 21 FTE/day across shifts
- Improved operational efficiency resulting in no manual interventions
- Achieved target quality and performance level

⁵⁰ Company website

⁵¹ Spotlight company challenges and solutions are based on primary discussions



Spotlight⁵²



Customer challenge

A multinational food manufacturing company was looking for a user-centric digital engagement and dynamic decision-making platform.



Solution

Wipro's **S.M.A.R.T.** (Sustainable, Monitored & Managed, Automated & Autonomous, Reliable & Resilient, and Turnkey) manufacturing framework provided intelligent physical automation, seamless orchestration of operational technology and IT, digitalisation of operations, and dynamic decision-making enabled by real-time data analytics.



Impact

- On-time supply increased to 98 percent
- Yield improved by 5 percent
- Equipment efficiency improved by 5 percent
- Product quality improved by 3 percent

⁵² Spotlight company challenges and solutions are based on primary discussions

Customer centricity has become a strategic priority in guiding innovation in the Consumer Packaging Goods sector

Use cases

03



Customer experience and brand recognition



End users
End customer

Description

AR embedded product packaging




AR packaging helps brands in relaying information quickly and clearly through 3D content, which in turn leads to a better customer experience.

VR-based instore and factory experience

Companies use AR/VR apps for better customer experience by giving them virtual tours of the entire manufacturing process of their products. This makes the customer feel more connected with the brand, which leads to higher product purchases.



A Closer Look: Customer Experience and Brand Recognition

Use cases	Description	Benefits	Core technologies
Leading Packaging Company	Leading packaging company provides augmented reality-based innovative packaging solution. It offers a wide range of packaging solutions from its specialised plants, such as cartoon-based (barcodes are printed on the packaging material and scanning them provides details of the product explained by cartoon characters) and flexi material-based packaging solutions. ⁵³	<ul style="list-style-type: none"> • Increased customer engagement • Flexibility and adaptability to change • Virtual space for communication and information sharing • Cost effective 	 AR/VR  IoT
Avataar	Avataar provides a 3D-based AR/VR platform for personalised product visualisation. Its online platform helps companies convert 2D image of any product into 3D model, which can be used by end customer to visualise the product in their environment. ⁵⁴	<ul style="list-style-type: none"> • Increased customer brand loyalty • Unique shopping experience through innovation • Virtual space for communication and information sharing 	 AR/VR

Source: Deloitte analysis, company websites, secondary public sources

⁵³ Company website

⁵⁴ <https://www.avataar.me/>



Spotlight⁵⁵



Customer challenge

The client wanted to centralise the new websites on a cloud-based platform for higher flexibility.



Solution

HCL developed a self-sustaining digital transformation platform for supporting the client’s legacy and new websites on a modern cloud-native solution to provide flexibility to the business. The platform enabled centralised solutions for 500+ brands and their internal websites across multiple business functions and geographies. It provided standardisation and control on the content and UI/UX of the websites.



Impact

- Faster onboarding on new brand website
- Improved customer engagement
- Reduced cost of development and support
- Standardisation across websites/application landscape

⁵⁵ Spotlight company challenges and solutions are based on primary discussions

Growth in the Retail sector is witnessed across two unique themes

 Growth themes



Smart stores

01

Description

Retailers use robots, sensors for inventory management, and in-store logistics operations. There is greater focus on enhancing the overall customer experience using AR/VR and smart mobile applications.

Indicative application areas/use cases

- **Tracks out-of-stock merchandise** using retail robots, which clicks pictures of shelves and available products, digitise the information, and convert them into metrics
- **Alerts for product replenishment** through sensors installed below product shelves
- Platforms for **customers to place their orders through multiple channels, track shipments on a real-time basis**, and scroll through product catalogs through digital kiosks
- Assists in **customer profiling** through in-store smart beacons and **offers customised discounts** on products
- **Directs customers towards products** of their choice through recommendation engines
- **Provides customers 'virtual' trials on clothing** through virtual trial rooms and interactive mirrors



Integrated business planning

02

Companies have built interconnected networks using data from multiple systems to generate insights about customer behaviour patterns and increase sales.

- **Tracks online and offline transactions for stores, sales data, and connect** with customers (email marketing, loyalty programmes) by synchronisation of retail point of service systems
- **Better demand-supply planning and product segmentation** through customer behaviour analysis across stores using IoT sensors and emotion AI





Use cases

01 Smart stores

End users Store executives, end customers

Description	
Robots and sensors for inventory management	<ul style="list-style-type: none"> • Retail robots track out-of-stock merchandise by clicking pictures of shelves and available products, digitising and converting the information into measurable metrics for better inventory planning. • IoT sensors are installed below product shelves and generate alerts for product replenishment.
Omnichannel presence	<ul style="list-style-type: none"> • Smart applications/virtual stores provide platforms for customers to place their orders through multiple channels, track shipments on a real-time basis, and scroll through product catalogues. • Digital kiosks help the customer scroll through available list of products, the shelf location, and payment mechanism in a particular store.
Virtual fitting rooms and interactive mirrors	<ul style="list-style-type: none"> • A virtual fitting room allows shoppers to try on items without touching them. It works by overlaying an item on a live video feed of a customer that allows them to see the size, style, and fit of any item before making the purchase.
Smart beacons for customised offerings	<ul style="list-style-type: none"> • Smart beacons in stores detect customers through their smartphone and store app, assists in profiling them, offers customised discounts. Customers are also supported with recommendations on products of their choice in specific aisles through recommendation engines.

A closer look at smart stores


Use cases	Description	Benefits	Core technologies
Ace Turtle	Ace Turtle is a provider of a mobile-commerce-as-a-service platform for businesses. It offers an omnichannel platform with modules to monitor online orders, payments, rewards, and loyalty programmes. It also has an integrated business intelligence module to provide regular insights and reports on sales and customers based on geography, product categories, etc. ⁵⁶	<ul style="list-style-type: none"> • Low customer acquisition cost • Increase in operational efficiency • Improvement in inventory turnover • Increase in sales 	 Automation  AI/ML
DATAMATICS	Datamatics enables retailers to cross-sell and up-sell products through strategically aligned beacon systems throughout retail stores as well as telecom-enabled SMS-alerts in ring-fenced geographically dispersed areas. Using purchasing history along with pattern mining, advanced analytics, and AI / ML algorithms, Datamatics also enables retail and ecommerce clients to position bundled offers to their customers. ⁵⁷	<ul style="list-style-type: none"> • Increase in order accuracy • Increase in productivity • Reduction in labour cost • Improvement in ecosystem experience 	 RFID sensors
India-based IT consulting & services company	India-based IT consulting & services company has developed smart shelves, which are wireless inventory control systems installed with weight sensors. The weight sensors can be built on or installed under shelves and consistently notify the back-end system about the existing quantity of items on the shelves. These wireless devices use RFID tags and readers to scan the products in display and stock shelves and alert store associates when product levels are running low. ⁵⁸	<ul style="list-style-type: none"> • Reduction of 'out-of-stock' products • Locate products easily • Better utilisation of in-store human resources • Control and monitor the usage of high value items 	 IoT

Source: Deloitte analysis, company websites, secondary public sources


⁵⁶ <https://www.aceturtle.com/solutions/>


⁵⁷ <https://www.datamatics.com/industries/retail>


⁵⁸ Company website


Use cases	Description	Benefits	Core technologies
TRUPIK	Trupik provides cloud-based fitting solutions to brands and retailers. Its software, Trupik Connect, is a mobile application where the customers can virtually drape clothes on 3D replicas of themselves by feeding in specifications. ⁵⁵	<ul style="list-style-type: none"> • Convenient and faster shopping experience for customers • Lower product return rate • Greater inventory turnover • Increase in customer satisfaction 	 AR/VR


Source: Deloitte analysis, company websites, secondary public sources




Spotlight⁶⁰







Customer challenge

The client wanted to provide its customers with best in-class shopping experience through AR/VR solutions.

Solution

Tech Mahindra developed an AR-based virtual showroom application for end customers to experience the product’s presence in their own kitchen. The following features made it more customer centric:

- Product presentation at real scale to check the better fitment in space
- User can configure the colour, check key features, and different models

Impact

- Reduced sales cycle time up to 30 percent
- Enhanced customer buying experience

⁵⁹ <https://www.india.com/technology/hyderabad-based-startups-trupik-connect-app-lets-you-try-clothes-in-3d-before-buying-1894720/>

⁶⁰ Spotlight company challenges and solutions are based on primary discussions



Spotlight⁶¹



Customer challenge

The client wanted to digitise the touchpoints with their customers, increase their sales, and provide a better customer experience.



Solution

GlobalLogic developed an omnichannel strategy addressing touchpoints between customers and store associates. The solution enabled digitisation of the store experience by creating an end-to-end design, development, testing, and rollout of a customer facing mobile app, iPad-based store kiosks, mobile payment, digital wallet, and loyalty platform.



Impact

- Increase In digital channel revenue (app revenue) by 860 percent
- Increased order conversion rate to 3 percent
- Improved user experience and engagement



⁶¹ Spotlight company challenges and solutions are based on primary discussions

Use cases

02  **Integrated business planning**





End users
Store executives, strategy and planning teams




Retail growth theme: Integrated business planning

Description	
End-to-end connected system for better decision making	Companies are building interconnected networks using data from multiple Point of Sale (POS) systems – this includes data from sales, customer’s touch points during product purchase, interactions across multiple distribution channels, and overall service quality. This helps in better decision making and increased revenue.
AI-based emotion capturing for customer behaviour	IoT sensors and AI-based transistors collect data related to customer reactions when they purchase different products, which in turn helps with better demand-supply planning and product segmentation.

A closer look : Integrated Business Planning

Use cases	Description	Benefits	Core technologies
GOFRUGAL	GOFRUGAL’s POS software is a cloud-based POS designed for retailers. Its cloud-based integration platform helps in collating sales, in-store service experience, and product purchasing behaviour data from multiple ERP systems. It also provides inbuilt AI/ML and big data analytics functionalities for end users to generate valuable insights from the data. ⁶²	<ul style="list-style-type: none"> • Increase in operational efficiency • Increase in inventory turnover • Better customer experience • Increase in overall revenue 	 AR/VR  IoT

⁶² <https://www.gofrugal.com/retail/features/>

Use cases	Description	Benefits	Core technologies
ENTROPIK TECH	Entropik’s emotion AI technology captures a user’s facial expressions and tracks their eye movement to provide insights to brands and retailers as to how a buyer is responding to a certain packaging or product placement in a retail environment. The solution enables retailers to get aggregated responses from consumers in a self-service dashboard on a real-time basis. ⁶³	<ul style="list-style-type: none"> • Better customer experience • Better demand forecasting • Customised products, marketing offers leading to increase in customer’s brand loyalty 	 AI/ML  IoT
Leading Software & Technology Company	Leading software & technology company specialises in automotive AI and advertising research. With the customer’s consent, it uses emotion AI technology to capture macro and micro facial reactions to an advertisement. This allows a company to know what people think of their advertisements and to know their purchase intent after watching an advertising video. ⁶⁴	<ul style="list-style-type: none"> • Better assessment of consumer behaviour 	 AI/ML

Source: Deloitte analysis, company websites, secondary public sources

⁶³ <https://www.techcircle.in/2021/06/16/how-entropik-s-emotion-ai-platform-is-helping-offline-retailers-woo-shoppers/>

⁶⁴ Company website



 **Spotlight⁶⁵**



Customer challenge

A global personal care and cosmetics company wanted to improve customer experience and develop products based on consumer preferences/choices.



Solution

As a strategic partner to the client, Wipro's solution aimed to achieve three major objectives – comprehensive platform development, industrialisation of IoT, and real-time data analysis. Their solution ensured integration of data from multiple ERP systems, which helped in customisation of products based on customer choices and various other factors including geographical, demographical, and behavioural factors. It created a provision of supply chain control towers, which increased the visibility of the supply chain as well.



Impact

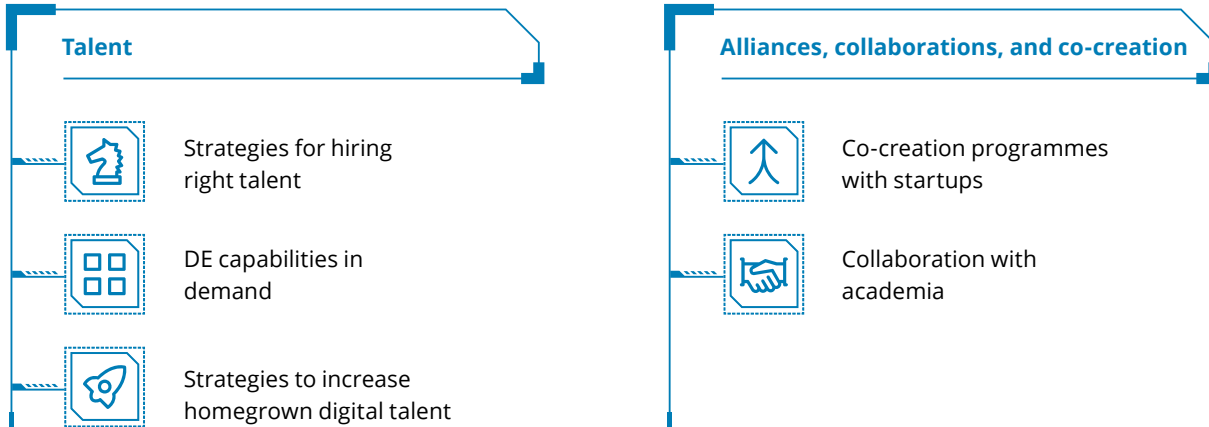
- Reduced time to market
- Customised products on demand
- Reduced the number of KPIs to be monitored from more than 200 to less than 40

⁶⁵ Spotlight company challenges and solutions are based on primary discussions



Go-to-market strategies
for Digital Engineering for
ER&D companies

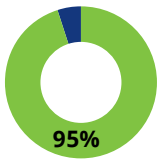
In this Volatile, Uncertain, Complex, and Ambiguous (VUCA) world, ER&D companies are adopting various strategies to digitally transform their organisations, boost growth, and stay competitive. Two key aspects to achieve are having the right talent and collaborating and co-creating with various entities.



Businesses have adopted a slew of strategies to address their requirements for relevant talent



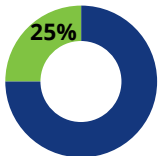
“Siemens Healthineers has adopted a ‘Build-Buy-Borrow’ model. ‘Build’ refers to the approach of hiring digital talent from universities and training them on the domain and specific technologies. ‘Buy’ refers to the hiring of experienced professionals with specialised tech skillsets and domain know-how. ‘Borrow’ refers to ramping up quickly by utilising ESPs’ ability to scale through their wide reach to vast talent pools. Based on the criticality, competencies, and capacity, we take a decision to build, buy, or borrow.”



of the surveyed workforce⁶⁶ in India has said that they need more digital skills. This echoes the sentiments of industry leaders.^{66 67}



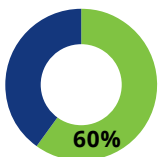
"While not having explored partnering with academic institutions, **GlobalLogic** focuses on lateral hiring and collaborating with more channel partners to build its digital talent"



of the business leaders in India say they are outsourcing their digital technology management^{66 67}

A leading global conglomerate

With new hires, the most challenging aspect is translating technology skills into domain knowledge and industry-specific application areas. Upskilling and reskilling have become paramount if companies want to build the right talent pool in their organisations.



of the surveyed workforce would require re-skilling on continual basis, as has been re-inforced by organisations globally^{66 67}

⁶⁶ Source – Draup - India’s Tech Industry Talent: Demand Supply Analysis; STEM graduates include Science (Chemistry, Biochemistry, Medicine, etc.), Technology and Engineering, and Mathematics

⁶⁷ Source – Wheelbox – India Skills Report & Deloitte analysis

Companies' DE hiring needs comprise a varied combination of technical capabilities, including knowledge of programming languages and platforms.



*Based on Deloitte's analysis of the current demand market

Strategies aimed at increasing homegrown digital talent at entry level



The New Education Policy of 2021 (NEP) has the potential to be transformational for the Indian education system. With infrastructure support for vocational learning, emphasis on native language, innovative education centres to bring dropouts into the mainstream, and tracking of students and their learning levels, NEP facilitates a pathway to professional learning involving both formal and non-formal education modes.⁶⁸



Most organisations highlight the lack of digital talent while undertaking digital transformation activities. To help fill this void, enterprises are increasingly turning to **collaborating with colleges and universities** through innovation labs aimed at solving real-world problems and internship programmes aimed at developing digital skills.⁶⁹

Cisco Networking Academy and the National Skill Development Corporation have partnered to enable free access to an industry-relevant digital curriculum. Future Ready Talent is a virtual internship platform for students with an opportunity to learn the in-demand technology skills and work towards solving real-world problems.⁷⁰



Building alternate talent pools – Other means of acquiring digital expertise, especially in smaller towns and amongst more women should be encouraged to join the workstream with hybrid work norms. For this, corporate social spending should be used.⁷¹

Government initiatives, such as Digital India, FutureSkills Prime and Skills India have been undertaken to create a digitally empowered economy. To enable small businesses access digital skilling resources and online training assets, organisations such as leading cloud computing company and Google have launched their respective programmes.⁷²

⁶⁸ Based on the AWS APJ Digital skills survey of over 1,000 India workers

⁶⁹ <https://www.livemint.com/opinion/online-views/the-war-for-digital-talent-india-can-emerge-as-a-global-hub-for-it-11632847335532.html>

⁷⁰ <https://blogs.cisco.com/csr/cisco-networking-academy-launches-free-it-education-to-empower-all-people-with-career-possibilities>

⁷¹ <https://futureskillsprime.in/blog/staying-relevant-in-the-new-normal>

⁷² <https://futureskillsprime.in/blog/how-indias-demographic-dividend-can-add-2-percent-to-its-gdp-every-year>

External ecosystem alliances for Digital Engineering have grown exponentially with the startup boom in India



Co-creation models and incubator/accelerator programmes

In the DE space, organisations are rapidly embracing consortium and co-competition approaches to address industry challenges, innovate, and generate new revenue streams. Many companies are collaborating with their competitors to combine their core capabilities with those of a partners’ technology/expertise.

In addition, the growth in digitalisation over the past few years has driven the need to innovate, putting even more of a spotlight on corporate-startup engagement. India has witnessed a steady increase in startup accelerator and incubator programmes, with companies realising the need to innovate to stay ahead of competitors and disruption. Through such collaborations, startups also benefit from corporate fundings, resources, and data and customer access.

Recent achievements of Indian startups⁷³



70 unicorns

Active in India in 2021, the third largest in the world with a cumulative valuation of startup ecosystem being US\$320-330 bn



42 unicorns

Tech startup ecosystem received a major boost with the addition of 42 unicorns in 2021



+US\$24.1 bn

Total equity investments raised by Indian startups in 2021



61%

Of total investments raised by unicorns in 2021

⁷³ NASSCOM-Zinnov Indian Tech Startup Ecosystem – Year of the Titans – Edition 2021

Examples of collaboration and incubator/accelerator programmes in India

Multinational investment bank

The accelerator programme launched by multinational investment bank is **Catalyst**. Catalyst is a 12-week programme for innovation experts, technology startups, fintechs, funds, and academic institutions to co-create Minimum Viable Products (MVPs) with in-house design experts. The chosen MVPs get converted into contracts after the acceleration period. Catalyst has completed 6 editions, accelerated 69 startups, and addressed 72 business challenges identified across the bank. Currently, the bank is focusing on new startup locations such as Pune, Cochin, Trichy, and Coimbatore. The upcoming challenge areas revolve around cybersecurity, open banking automation, payment, and risk platforms.⁷⁴

Siemens Healthineers

Siemens Healthineers involves physicians and technicians in the product development lifecycle through early engagement. This is done during concept building and performing product trials to use their domain expertise.⁷⁵

Multinational IT consulting & service company

Multinational IT consulting & service company invests in early to mid-stage enterprise software startups across US, Israel, and India (currently has investments across 16 startups). The focus is on investing in cybersecurity, app development, data, cloud infrastructure, and automation with specific emphasis on health care, BFSI, and IT domains.⁷⁶

India Post Payments Bank (IPPB)

IPPB launched **Fincluvation**, a joint initiative to collaborate with the fintech startup community to co-create and innovate solutions for financial inclusion. The platform works with startups to develop solutions aligned to tracks, such as creditisation, digitisation, and any market-led solution that can help solve problems relevant to IPPB in serving its underserved customer.⁷⁷

Multinational med-device and health care solutions company

India Edison Accelerator programme creates strategic partners to co-develop health care solutions. The company's focus is on technology solutions for streamlining health care delivery across verticals including advanced imaging and visualisation, remote patient monitoring, virtual hospitals, and point-of-care diagnostics.⁷⁸

NATHEALTH, TiE Mumbai and IQVIA

'**Reimagining Health Care: Industry-Startup Interface Series**', aims to strengthen co-innovation between health care startups and industry members and accelerate the process of establishing an accessible and technologically advanced health care infrastructure in India.⁷⁹

⁷⁴ Company website

⁷⁵ <https://www.siemens-healthineers.com/en-in/medical-imaging/asset-lifecycle-development/clinical-performance-companion>

⁷⁶ <https://m.economictimes.com/tech/software/wipro-announces-150-million-second-venture-fund/articleshow/73305149.cms>

⁷⁷ <https://pib.gov.in/PressReleasePage.aspx?PRID=1818635>

⁷⁸ Company website

⁷⁹ <http://www.pharmabiz.com/NewsDetails.aspx?aid=140702&sid=2>

Leading Cloud Computing Company

Under the **AI Innovate initiative**, startups get to partner closely with engineering and product teams to build their core AI models. Selected startups receive access to industry and technology deep-dive sessions, AI masterclasses by experts, and mentoring by startup founders and industry leaders.⁸⁰

TCS

TCS launched its **CO-Innovation Network (COIN)**, which brings together experts from startups, research, academics, and corporate worlds to work on collaborative innovations for TCS. The network provides startups an access to TCS' accounts and affiliated investors, such as VCs, angel investors, and corporate venture capital.⁸¹

Target

The **Target Accelerator Program (TAP)** is a four-month-long programme that focuses on creating transformative solutions for retail sector. Since it was launched, 30 startups have graduated from the programme. In the past five years, the programme's core focus has been using cutting-edge innovations, such as AI, 3D, and AR, and to act as a testing ground for startups to develop, scale, and test their products in a live retail environment, and has played a key role in contributing to the growth of the startup ecosystem in India.⁸²

US-based retail company

US-based retail company Innovation Labs' programme **CONSTRUCT**, is collaborating with deep technology companies of all sizes and at all stages. Seven Indian startups, representing diverse interests including AI-driven trend forecasting and automated content generation, have joined.⁸³

HDFC

HDFC partnered with IvyCamp to host Finnovation, a startup engagement programme for innovative tech startups to test and scale solutions targeting property assessment and customer servicing. Startups have an opportunity to access knowledge, infrastructure, and support from HDFC and undertake business transformation projects through technology.⁸⁴

Kotak

Kotak Payment Co-creation programme collaborates with startups in the digital payments sector. Selected mature fintech startups received access to mentorship, co-create payment products with Kotak's Innovation Lab and an opportunity for a pilot launch.⁸⁵

India-based life insurance company

India-based life insurance company Innovation Labs 2.0 selected four partner startups to capitalise on emerging technologies and co-develop solutions in the areas of non-invasive medical tests, digital twins, intelligent data acquisition, and health and wellness through targeted programmes.⁸⁶

⁸⁰ Company website

⁸¹ <https://www.tcs.com/tcs-cointm#:~:text=To%20identify%20such%20opportunities%20for,for%20TCS'%20Fortune%201%20C000%20customers>

⁸² <https://targetaccelerators.com/>

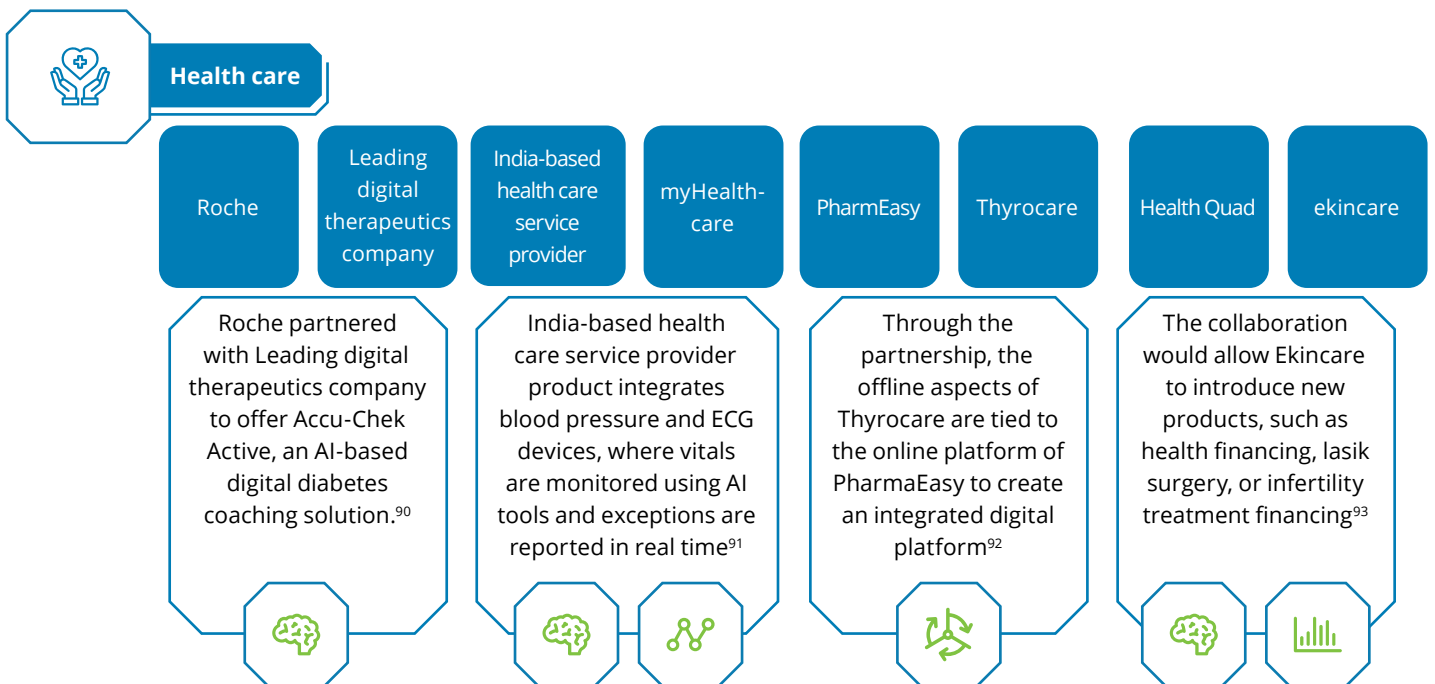
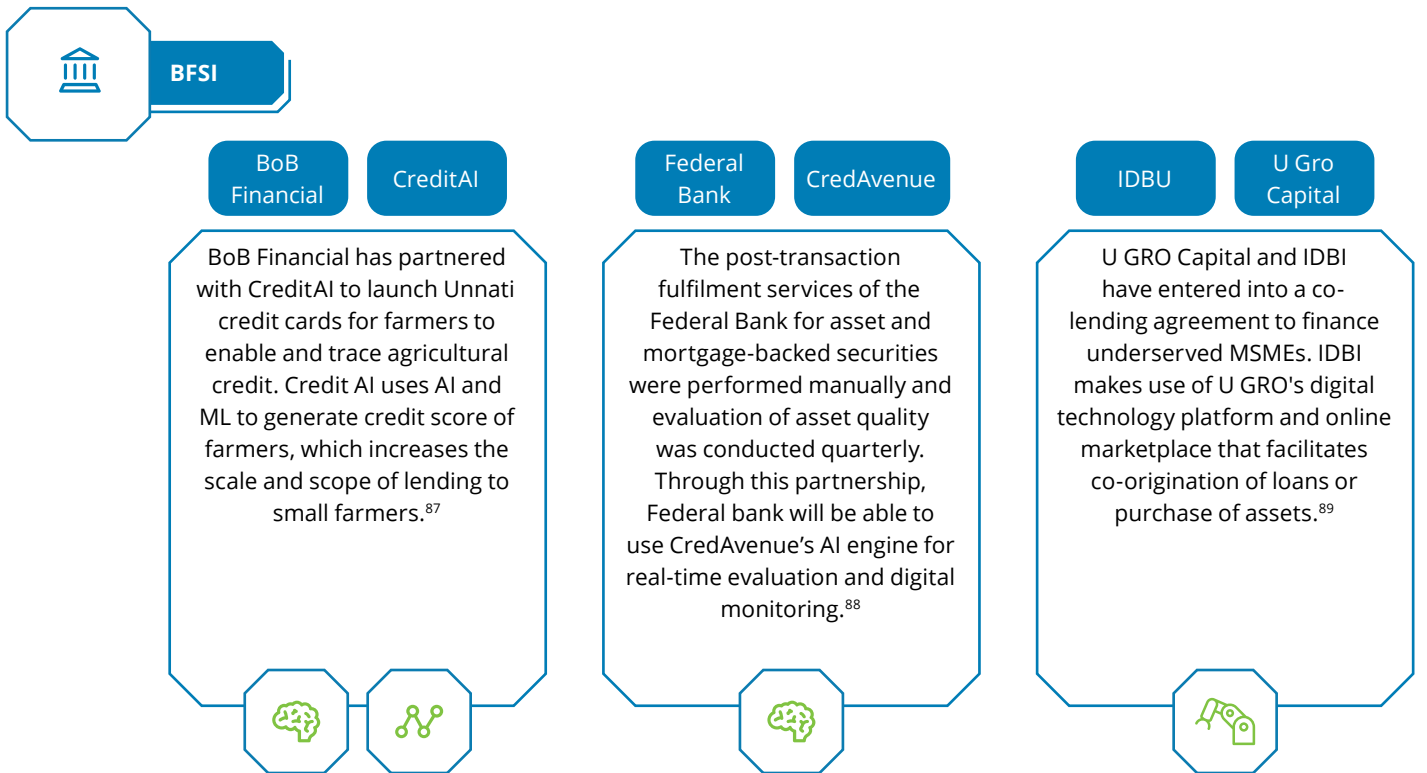
⁸³ Company website

⁸⁴ <https://ivycamp.in/finnovation>

⁸⁵ <https://inc42.com/buzz/kotak-mahindra-nasscom-fintech-startups/>

⁸⁶ Company website

Examples of select startup partnerships



⁸⁷ <https://bfsi.eletsonline.com/bob-financial-and-creditai-launch-co-branded-credit-card-for-farmers/>

⁸⁸ <https://bfsi.eletsonline.com/federal-bank-credavenue-partner-to-offer-portfolio-management-of-its-securitization-book/>

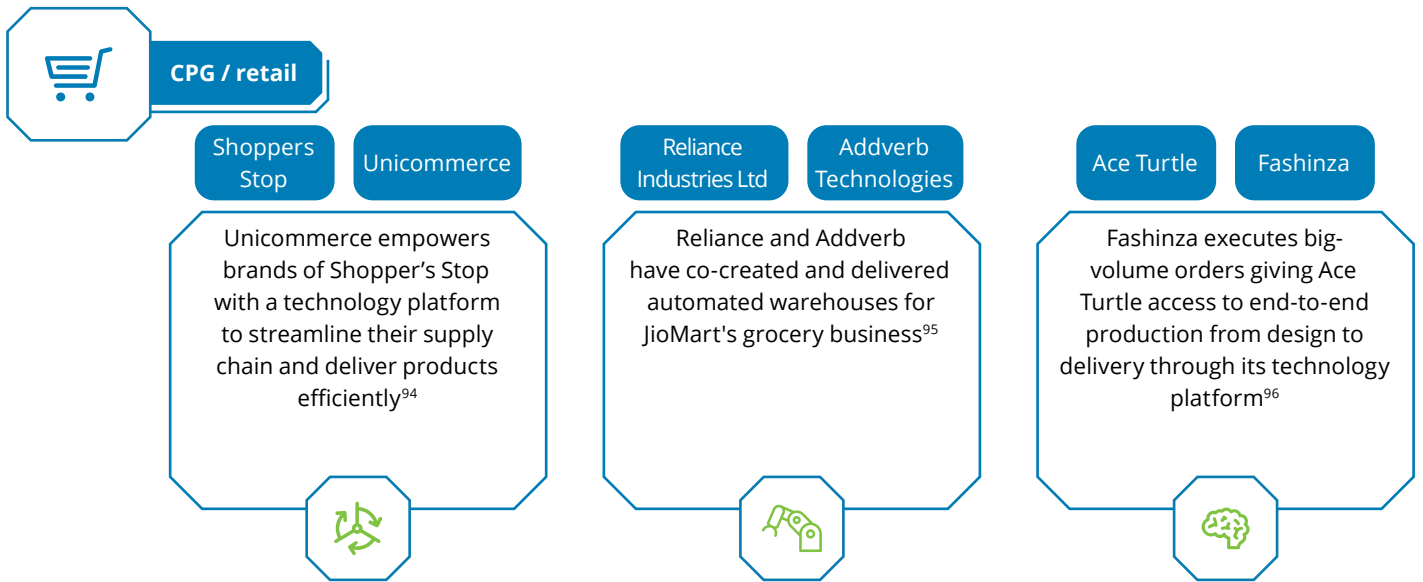
⁸⁹ <https://economictimes.indiatimes.com/small-biz/sme-sector/idbi-bank-u-gro-capital-ink-a-co-lending-agreement/articleshow/86675778.cms?from=mdr>

⁹⁰ Company website

⁹¹ Company website

⁹² <https://economictimes.indiatimes.com/tech/startups/pharmeasy-to-acquire-66-stake-in-thyrocare-in-rs-4500-crore-deal/articleshow/83842616.cms?from=mdr>

⁹³ https://www.peoplesmatters.in/site/interstitial?return_to=%2Fnews%2Ffunding-investment%2Fekincare-raises-15-million-in-funding-led-by-healthquad-sabre-partners-33227



Core enabling technology



⁹⁴ <https://www.cxooutlook.com/unicommerce-and-shoppers-stop-join-hands-to-streamline-post-purchase-journey/>

⁹⁵ <https://timesofindia.indiatimes.com/business/india-business/reliance-retail-buys-54-stake-in-addverb-tech-for-132-million/articleshow/88971287.cms>

⁹⁶ <https://bwdisrupt.businessworld.in/article/Fashinza-Announces-first-ever-fashion-collaboration-with-Ace-Turtle/31-08-2021-402507/>

Digital Engineering companies play a valued role in co-creating digital-specific education programmes and running innovation challenges



Multinational IT consulting & service company

Indian Institute of Science⁹⁷

- Wipro and IISc developed a research centre called **Multinational IT consulting & service company IISc Research and Innovation Network (WIRIN)**. The aim is to conduct advanced applied research in areas of autonomous systems, robotics, and 5G. Professors and research teams from IISc and engineers, developers, architects, and researchers from the autonomous systems, robotics and 5G domains at Multinational IT consulting & service company constitute the team at WIRIN
- **Focus is on R&D of technologies in AI, ML, visual computing, Human Computer Interaction (HCI), etc.**

HCL

IIT Kanpur⁹⁸

- **HCL is collaborating with C3i Hub at IIT Kanpur, a specialised cybersecurity research centre.** The teams will develop a security framework and solutions for cybersecurity challenges in the current and future operational technologies and for managing cyber threats, vulnerabilities, and risks for critical infrastructure.
- HCL will also collaborate with IIT Kanpur to identify selective research projects to bring them to scale. These projects will be tested using international benchmarks for potential commercialisation.

Philips

Manipal University⁹⁹

- **Philips & Manipal Academy of Higher Education (MAHE) are collaborating to improve patient care in India.** Projects include a non-contact health screening kiosk, assessing the vital parameters of patients in a safe and contactless manner, **AR/VR Virtual Lab to serve as knowledge hub**, and a platform to facilitate seamless interaction between partner teams.
- The team will also collaborate on IntelliSpace Precision Medicine Oncology Platform to enable patient-centred precision care in oncology.

⁹⁷ <https://www.wipro.com/newsroom/press-releases/2019/wipro-collaborates-with-iisc-for-advanced-research-and-innovation-in-autonomous-systems-robotics-and-5g/>

⁹⁸ <https://www.hcltech.com/newsfeed/hcl-signs-mou-iit-kanpur-strengthen-capabilities-fields-cybersecurity>

⁹⁹ <https://medical.thehighereducationreview.com/news/manipal-academy-of-higher-education-mahe-strengthens-collaboration-with-philips-nid-1629.html>

Multinational investment bank

NMIMS¹⁰⁰

- Multinational investment bank & NMIMS collaborated on research for impact-based finance solutions.
- As a part of a PhD research sponsorship programme, scholars from NMIMS' School of Business Management (SBM) will receive support from Multinational investment bank to conduct research on developing blended finance (strategic use of development finance for the mobilisation of additional finance towards sustainable development) as a tool to support various social enterprises.
- The focus will be research on value chains providing access to health care, water, energy, to develop long-term revenue-generating solutions to help the country achieve the UN's Sustainable Development Goals.

TATA Consultancy Services

GITAM (DEEMED TO BE UNIVERSITY)¹⁰¹

- This collaboration between TCS and GITAM is focused on co-developing academic programmes/degrees in the university. The degrees are BSc in Computer Sciences (Cognitive Systems) and BCom in Business Process Management.
- The intent is to bridge the gap between academia and industry, and thereby enhance the employability of the emerging workforce.
- The programmes concentrate on the latest digital technologies and cloud skills. Remote internship opportunities were offered to provide students with practical knowledge and hands-on experience.

Source: Secondary research and company websites

¹⁰⁰ Company website

¹⁰¹ [https://telanganatoday.com/gitam-collabs-with-tcs-lvpei-to-launch-industry-oriented-courses-~:text=GITAM%20collabs%20with%20TCS%2C%20LVPEI%20to%20launch%20industry%2Doriented%20courses,-By%20Telangana%20Today&text=BSc%20Computer%20Sciences%20\(Cognitive%20Systems,with%20LV%20Prasad%20Eye%20Institute.](https://telanganatoday.com/gitam-collabs-with-tcs-lvpei-to-launch-industry-oriented-courses-~:text=GITAM%20collabs%20with%20TCS%2C%20LVPEI%20to%20launch%20industry%2Doriented%20courses,-By%20Telangana%20Today&text=BSc%20Computer%20Sciences%20(Cognitive%20Systems,with%20LV%20Prasad%20Eye%20Institute.)



Challenges to future
growth of Digital
Engineering in India

DE is expected to form a substantial part of ER&D enterprises. It is expected to play a crucial role in government and industry alike, whether it is used for planning or decision making, accelerating solution development, discovering new trends or new product creation. India is on the verge of becoming a DE leader; however, some hurdles remain to be overcome to ensure faster and better adoption of technological changes for DE.



Finding the right talent



- India’s demand for digital talent jobs is ~8X larger than its entry-level talent pool, at present. By 2024, this demand is expected to grow to 20X. While technology talent is expected to grow at a CAGR of 18% over the same period, the demand for digital skilled talent is increasing at a CAGR of 35%. This demand supply gap is already driving higher cost to find talent for ER&D enterprises
- Other concerns include high attrition (a global concern), low quality of talent, and the lack of domain knowledge.
 - High attrition forced companies to mitigate the issue by increasing salaries and offering hiring bonuses. As organisations move up the value chain, this poses a conundrum in terms of **running the business cost effectively, while retaining and investing in high quality talent.**
 - On average, employability rate ranges from 30-40 percent of the entry-level talent. This differs on the skillsets that companies are looking for. The World Economic Forum report (2020) also mentions that “skills imparted to our youth during college education become obsolete by the time they enter the industry.”
 - While various national level skill development programmes (e.g., Skill India, NSDC) offer courses and content in emerging technologies, there is still a **need for initiatives focusing on domain/industry-specific knowledge** and application of technical skills. While the state and central governments are trying to address this gap along with businesses, employers continue to spend significant time and resources on reskilling and upskilling programmes to make fresh hires future- and industry-ready.

Data protection and privacy



- Data sharing is complicated as it has multiple limitations due to privacy concerns by the database owners and end-user corporations. Businesses undergoing digital transformation collect, store, and transmit huge volumes of personal data electronically. Business users worry about storing sensitive data, such as invoices, bills, and client documents, on technology platforms without adequate protection, which poses multiple risk implications for data breach and privacy violations.
- This creates challenges for India to operate as a DE destination¹⁰² given that it globally ranks third in terms of the number of data breaches, with an estimated total of 86.63 million breaches until November 2021.
- The government has tried to address some of these challenges pertaining to cybersecurity attacks leading to increasing costs of complying with these regulations for businesses.
 - The Data Protection Bill of India that is in the works is one such example. The bill is premised on a centralised Data Protection Authority having a wide discretionary remit to formulate regulations. The bill imposes restrictions on data transfer (particularly, 'critical' data transfer with the authority defining the definition of 'critical'), which might hinder India's abilities to serve global businesses. The bill may need to be revised to comply with international data protection practices.
 - A new regulation was announced in May 2022, wherein the government has the right to ask VPN companies to maintain personal data of VPN users for five or more years. This could render VPN services illegal in India if service providers don't comply, hampering business users in the process.

Patents and IP protection



- While there have been significant improvements in patent laws and regulations in India, more initiatives are still needed by enterprises.
 - The potential threat of patent revocations, lack of presumption of patent validity, and the narrow patentability criteria under the India Patents Act pose problems for companies across different sectors.
 - The share of Indian residents' total patents filed in the country stands at 36 percent, whereas the average in other largest economies stands at 62 percent; most of the patent applications are done by non-residents in India.
- India is on the **United States Trade Representative's (USTR's) 'Priority Watch List' for lack of adequate protection of the rights of American companies.**
 - Some of the concerns include innovators not being able to receive, maintain, and enforce patents in the health care/ pharmaceutical sector, concerns over copyright laws not incentivising the creation and commercialisation of content, and somewhat archaic trade secrets frameworks.
 - Other concerns are regarding difficult patentability criteria for pharmaceutical patents, effective system for protecting against the commercial use/disclosure of data to obtain marketing approvals for pharma products.

¹⁰² <https://www.businesstoday.in/latest/trends/story/india-ranks-third-in-global-data-breaches-in-2021-report-315750-2021-12-15>



Digital infrastructure

- To fuel the digital movement in India, the physical infrastructure needs to be developed:
 - Power distribution remains a challenge due to concerns in cost-reflective tariffs, complexity of tariff determination, and delays in payment of subsidy amounts, and dues by state governments.
 - Spectrum availability in Indian metros is about a tenth of the same in cities in developed countries. This has led to concerns regarding provisions for high-speed data services.
 - Public Wi-Fi penetration can be improved. Globally, there is one Wi-Fi hotspot for every 150 citizens. For India to reach that level of penetration, over 8 million hotspots are required, of which only about 31,000 hotspots are currently available.
- The government has announced many new initiatives, including Digital India, Make in India, Startup India, and innovative applications of Aadhaar, such as JAM (Jan-Dhan Yojana-Aadhaar-Mobile trinity) and digital lockers; efforts towards their implementation need to accelerate.
- To emerge as a leading innovation hub, India needs to increase its R&D expenditure. Currently, it is 0.7 percent of GDP, which is lower than the 1.5-3 percent of GDP spent by the top 10 economies. Support from domestic enterprises in increasing their R&D investments needs to be intensified in addition to the central government's higher contribution to GERD (Gross Domestic Expenditure on R&D)



Policies and regulatory gaps

- India has complex and multi-layered requirements for establishment and incorporation of companies. For example, requirements regarding presence of a local director, legalisation of foreign documents (where a foreign company intends to incorporate in India) and prior government approval (if investment is from a restricted country) make the overall process complex. This makes it difficult to get the necessary clearances for setting up a DE centre.
- The World Bank's Ease of Doing Business¹⁰³ report highlights some of the other challenges, which needs to be worked on to establish the country as a leading destination for DE:
 - India ranks 115th amongst 190 countries on the 'paying taxes' parameter in Ease of Doing Business Index affecting investments.
 - Simplification of contract enforcement needs to be addressed. The average time to enforce a contract is 1445 days, ranking India 163rd on the 'enforcing contracts' indicator.
 - It takes ~4 years to resolve a commercial dispute in India, which needs to be expedited for organisations undergoing rapid technological advancements.^{104, 105}
- Simplifying legal processes for hiring foreign labour will enable global companies to set up more delivery centres in India, thus prompting greater growth of and collaboration with global corporations. High import tariff rates specifically for electronic components and Information and Communications Technology (ICT) goods, amongst other hardware components need to be addressed. Currently, flexibility in hanging tariff rates between bound and applied rates introduces uncertainty in importing goods.

¹⁰³ World Bank Ease of Doing Business report (2020)

¹⁰⁴ <https://documents1.worldbank.org/curated/en/688761571934946384/pdf/Doing-Business-2020-Comparing-Business-Regulation-in-190-Economies.pdf>

¹⁰⁵ World Economic Forum Report (2020) as reported in a FutureSkills blog in association with NASSCOM (<https://futureskillsprime.in/blog/India-2030-vision-of-assessments-in-creating-a-skilled-nation>)

Conclusion

Best practices that can be adopted by the industry

Consistently, industry leaders have observed a theme of increasing investment in DE endeavours and the need for developing the talent base to match the growing demand. However, there are key elements that have helped centres in India – both GCCs and service providers – in developing their value proposition globally, thereby traversing the journey of becoming global business partners and leaders in the DE space.

To grow in the DE space, companies can consider the following:



Connect both hardware and software to take a product to market - It is no longer possible for DE companies to be purely software- or hardware-driven. Every software product is eventually consumed through multiple form factors/hardware devices, whether it is smart phones, laptops, or smart TVs. Similarly, hardware products now generate many gigabytes of data, which is the cornerstone of DE. Companies need to build their value proposition similarly, i.e., understand the UI/UX aspect on the software side and the form-factor issues on the hardware side and combine them to offer a robust solution.



Utilise technical skills considering functional/industry knowledge - Industry know-how in the DE workforce along with the right technical skills is becoming increasingly important to develop DE applications from a customer experience lens. While there is a need to develop competencies end-to-end in the DE lifecycle, i.e., from concept to manufacture, it is imperative to develop a varied workforce across subject matter and industry/domain experts, product/project managers, and technology experts.



Develop workforce as well as the physical work environment - There is a need to further expand the building of innovation labs in India for the purpose of design, testing, simulations, environment compliance, etc. Collaborations between the central and state governments with industry players to set up such labs will help in solving problems in real-world complex systems.



Make use of domain fungibility when developing solutions - There are significant domain overlaps across sectors in DE. For instance, imaging algorithms for medical purposes can also be used in cars for ensuring passenger safety and both originated from innovations in defense equipment. Companies need to share their expertise from the product world into the engineering space; and for many successful DE companies, this collaborative approach has long been part of their value proposition.

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